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A Comprehension into Target Binding and Spatial Fingerprints of Noscapinoid Analogues as Inhibitors of Tubulin

Seema Mandavi [1], Sant Kumar Verma [2], Laxmi Banjare [2], Amit Dubey [3], Renu Bhatt [1], Suresh Thareja [2], Akhilesh Kumar Jain [2]

Affiliations
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Abstract

Background: Owing to its potential to interfere in microtubule dynamics in the mitotic phase of cell cycle and selectively induce apoptosis in cancer cells without affecting normal cells, noscapine and its synthetic analogues have been investigated by other research groups in different cell lines for their capability to be used as anti-cancer agents.

Objective: The present study is focused on the investigation of the mode of binding of noscapinoids with tubulin, prediction of target binding affinities and mapping of their spatial fingerprints (shape and electrostatic).

Methods: Molecular docking assisted alignment based 3D-QSAR was used on a dataset (43 molecules) having an inhibitory activity (IC_{50} = 1.2-250 μM) against human lymphoblast (CEM) cell line.

Results and conclusion: Key amino acid residues of target tubulin were mapped for the binding of most potent noscapine analogue (Compound 11) and were compared with noscapine. Spatial fingerprints of noscapinoids for favorable tubulin inhibitory activity were generated and are proposed herewith for further pharmacophoric amendments of noscapine analogues to design and develop novel potent noscapine based anti-cancer agents that may enter into drug development pipeline.

Keywords: 3D-QSAR; Anticancer agents; molecular docking; noscapine analogues; spatial fingerprints; tubulin inhibitors.

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General Review Article

Polymeric Nanoparticles of Aromatase Inhibitors: A Comprehensive Review

Author(s): Keerti Mishra (http://orcid.org/0000-0003-1525-0267), Pooja Ratre (http://orcid.org/0000-0003-3542-2943), Suresh Thareja, Akhlesh K. Jain* (http://orcid.org/0000-0002-6420-9773)

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Liposomes: An Emerging Approach for the Treatment of Cancer

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Affiliations
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Abstract

Background: Conventional drug delivery agents for a life-threatening disease, i.e., cancer, lack specificity towards cancer cells, producing a greater degree of side effects in the normal cells with a poor therapeutic index. These toxic side effects often limit dose escalation of anti-cancer drugs, leading to incomplete tumor suppression/ cancer eradication, early disease relapse, and ultimately, the development of drug resistance. Accordingly, targeting the tumor vasculatures is essential for the treatment of cancer.

Objective: To search and describe a safer drug delivery carrier for the treatment of cancer with reduced systemic toxicities.

Method: Data were collected from Medline, PubMed, Google Scholar, Science Direct using the following keywords: 'liposomes', 'nanocarriers', 'targeted drug delivery', 'ligands', 'liposome for anti-cancerous drugs', 'treatment for cancer' and 'receptor targeting.'

Results: Liposomes have provided a safe platform for the targeted delivery of encapsulated anti-cancer drugs for the treatment of cancer, which results in the reduction of the cytotoxic side effects of anti-cancer drugs on normal cells.

Conclusion: Liposomal targeting is a better emerging approach as an advanced drug delivery carrier with targeting ligands for anti-cancer agents.

Keywords: Cancer; anti-cancer drugs; drug delivery; ligands; liposomes; nanocarriers; targeted therapy..

Related information

MedGen
PubChem Compound (MeSH Keyword)

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(41)

ORIGINAL ARTICLE

Colon Targeting of 5-fluorouracil Loaded Dual Cross-linked Multiparticulate System: *In vitro* and *in vivo* Characterizations

Sandeep Kumar Sonkar[1], N. Ganeshan[2], M. Mathur[2], S. K. Lanjhiyana[1]

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Abstract

Objective: The present study aimed to develop sustained released 5-fluorouracil loaded chitosan-pectin blended dual cross-linked gel beads system. **Materials and Methods:** Dual cross-linked beads were evaluated for drug content, particle size, swelling degree, scanning electron microscopy, differential scanning calorimetry, X-ray diffraction, etc., for its suitability for colon targeting. **Results:** The developed systems were appreciably performed during *in vitro* drug releases in simulated gastric (simulated gastric fluid) at pH 1.2, intestinal (simulated intestinal fluid) at pH 6.8, and colonic fluids at pH 7.4 (simulated colonic fluid [SCF]) with and without rat cecal content medium for up to 24 h. Batch formulations were shown lesser releases in acidic dissolution medium, whereas augmented releases in alkaline medium at the end of 24 h studies. It was found with significant drug releases ($P > 0.05$) in SCF containing 2 and 4% w/v rat cecal as compared to control studies. During curve fittings using several models, the R^2 value of Higuchi matrix model confirmed for drug release was followed with anomalous non-Fickian transport mechanisms. Those dual cross-linked gel beads confirmed for its improved mechanical core strength, controlled, and sustained release potentials during the experimental. Gamma scintigraphic imaging during *in vivo* studies confirms for targeting potential of optimized formulations for colon-specific region. It was evident that the ionic gelation based dual cross-linked chitosan-pectin beads with divalents Ca^{2+} and SO_4^{-2} ions exhibited better delayed drug release pattern than single cross-linked beads for colon targeting. **Conclusion:** The prepared dual ionic cross-linked optimized formulations may be potential system for targeting drug to colon for colorectal cancer.

Key words: pH sensitive polymers, ionic cross linking, colon targeting, gamma scintigraphy, rat cecal content, kinetic modeling

INTRODUCTION

Multiparticulates system containing natural polymers were found consisting of biodegradable, biocompatible, and pH sensitive properties. These have met with considerable attention since past few decades for development of novel, controlled, and sustained release dosage forms. Multiparticulates based dual cross-linked microbeads are reported for superior reproducible pharmacokinetic behavior for colon-specific drug targeting as compared to conventional formulations. This system lowers intra and inters individual variability in plasma levels and bioavailability. The colon has longer retention time and appears highly responsive to agents that enhance the absorption of poorly absorbed drugs. With the help of those systems based on combined usage of chitosan and pectin, the drug releases or absorption in the upper stomach and small intestine can be minimized until it reaches up to colonic region. Ionic gelation based inter penetrating polymeric network or polyelectrolyte complexes has combined unique physicochemical and improved biocompatibility properties that have been focused for intensive fundamental and applied research.

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Development and Optimization of TPGS based Stealth Liposome of Doxorubicin Using Box-Behnken Design: Characterization, Hemocompatibility and Cytotoxicity Evaluation in Breast Cancer Cells

Balak Das Kurmi & Shivani Rai Paliwal

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RESEARCH ARTICLE

JOURNAL OF BIOCHEMICAL AND MOLECULAR TOXICOLOGY WILEY

Role of the renin–angiotensin system in the development of cataract formation in angiotensin-II-induced experimental rats

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Abstract

Previously, we established several facts regarding hypertension-associated cataractogenesis. As a follow-on study, we evaluated the role of the renin–angiotensin system (RAS) in angiotensin-II (Ang-II)-induced cataract formation in experimental hypertensive rats. Sprague–Dawley male albino rats (150–180 g) were used for the present experiment. The animals were divided into four groups, with six animals in each group. During the 12 weeks of the experimental protocol, the normal group received sterile water (1 ml/kg/day, subcutaneously (sc), and the Ang-II control group received angiotensin (1 mg/kg/day) subcutaneously. The ARB (O) group received olmesartan (2 mg/kg/day) orally, and the ARB (T) group received two drops of olmesartan (5 mM) topically on the cornea; concurrently, both groups were treated with Ang-II (1 mg/kg/day, sc) to induce hypertension. Biweekly, the systolic and the diastolic blood pressures were recorded, and the eyes were examined; moreover, cataractogenic parameters, such as oxidative stress markers and protein contents in the lenses, were evaluated after completion of the experimental protocol. Twelve weeks of olmesartan administered, orally or topically, significantly reduced the progression of cataract formation and restored antioxidants, lipid peroxidation, nitrite content, and protein contents in the lenses of the mice in groups O and T, respectively, as compared with those in the Ang-II control group. On the basis of our results, we conclude that the ocular RAS exacerbates the lenticular oxidative stress that may lead to cataract formation. The results showed that the RAS has an independent and important role in cataract formation under hypertensive conditions.

KEYWORDS

angiotensin II, cataract, hypertension, ocular renin–angiotensin system, olmesartan, oxidative stress

1 | INTRODUCTION

Cataracts, which are induced by several risk factors, including diabetes and hypertension, are major causes of ocular blindness,[1,2] and various case studies have confirmed that hypertension is a prominent risk factor for cataract development.[3–5] In this study, we established that a variety of factors affected hypertension-associated cataractogenesis. Specifically, untreated hypertension increases lenticular oxidative stress, which may cause changes in the proteins, as well as the ion transport system, within the lens, resulting in the development of cataracts. Thus, oxidative/

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RJPT

REVIEW ARTICLE

Lepadigathis cristata Wild. Traditional Plant of Chhattisgarh Tribes: An Alternative Cure

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ABSTRACT:
Documentation and assessment of the rich traditional medicinal knowledge are very important for human beings. Scientist around the world has been actively working to collect information and document of the indigenous medicinal plants. Therefore, the aim of the present review is to gather information on *Lepidagathis cristata* for Medicinal values for the treatment of various disorders.

KEYWORDS: *Lepidagathis Cristata*, Traditional Medicine, Medicinal Plant.

INTRODUCTION:

Lepidagathis cristata Wild family Acanthaceae is a perennial herb mostly found in dry places and waste lands. Plant is a stiff herb with almost no stem. Branches (20cm long) procumbently arise out from a hard central globose rootstock head on the ground and spread out. Leaves (3-6 x 0.5-1cm) are stalk less, alternate, elliptic, serrate and usually lineolate, velvet-hairy, pointed at both ends, margin entire to toot head. Flowers are sessile, capitates, pale pink, 2-lipped the upper lip is notched, and the lower lip is divided into 3 lobes. The heads terminal or axillary densely crowed at the base of the stem, bracts elliptic, spinesent, bracteolate. Calyx is with 5 lobes hairy and corolla white with brown color or purple spots, didynamous anther two celled and exerted 4 stamens, fruits capsule oblong with seeds. Flowering seasons is January–March[1-3]. Other species of *Lepidagathis* are *Lepidagathis cuspidate* is an erect under shrub, *Lepidagathis fasciculate* is a softly villous herb, *Lepidagathis hamiltoniana* is a stiff under shrub, *Lepidagathis incurve* is a small perennial herb, *Lepidagathis mitis* is a stiff under shrub, *Lepidagathis subramatai* is a stiff under shrub[4]. This medicinal herb has been exploited tremendously by common people in many ways for various curative purposes.

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The roots, leaves and inflorescence of this plant are medicinally useful. The roots are used in stomachic and dyspepsia, leaves are used for fevers and the inflorescence ash is used for itchy affections of skin and burns[5]. Therefore the aim of the present review is to document all relevant formation on *Lepidagathis cristata* for Medicinal values to treat various disorders scientific evaluation for researchers.

TRADITIONAL USES:

In Bastar region of Chhattisgarh, tribal peoples used leaf extract of *L. cristata* for malarial and during rainy season leaf extract is used to clean the cattle, and it is also used for skin disorders and wounds haling. Spikes of this plant is used to treat piles is more popular in Chhattisgarh. Root powder of *L. cristata* is mixed with seed powder of *Abrus precatorius* and make paste with karanj oil is applied for leucoderma. The root powder is also used as antidysenteric and reduces heat in stomach. Fumes and smoke of flower head and whole plant is used to treat mouth ulcer and epilepsy. Water extract of leaves mixed with tulsi juice in 10:1 ratio is used to cure fever in Andhra Pradesh by Yanadi tribal. The inflorescence ash is mixed with coconut oil is applied to treat inflammation, skin abscess, tumors, and black batches on face. The tuberous flower ash mixed with coconut oil is used to treat burns and wounds. Plant powder mixed with honey and administered two spoonfuls twice a day for twenty days to treat asthma. Whole plant powder is mixed with coconut oil to treat itchy infections and ash of whole plant is boiled with coconut oil and applied for wound healing of pet animals twice a day[6-11].

(45)

PLOS ONE

RESEARCH ARTICLE

A fraction of *Pueraria tuberosa* extract, rich in antioxidant compounds, alleviates ovariectomized-induced osteoporosis in rats and inhibits growth of breast and ovarian cancer cells

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Abstract

Pueraria tuberosa (Roxb. ex Willd.) DC., known as Indian Kudzu belongs to family Fabaceae and it is solicited as "Rasayana" drugs in Ayurveda. In the present study, we analyzed the efficacy of an ethyl acetate fraction from the tuber extract of *Pueraria tuberosa* (fraction rich in antioxidant compounds, FRAC) against menopausal osteoporosis, and breast and ovarian cancer cells. The FRAC from *Pueraria tuberosa* was characterized for its phenolic composition (total phenolic and flavonoid amount). Antioxidant property (*in vitro* assays) of the FRAC was also carried out followed by the analysis of the FRAC for its antiosteoporotic and anticancer potentials. The antiosteoporotic activity of FRAC was investigated in ovariectomy-induced osteoporosis in rats. The cytotoxicity effect was determined in breast and ovarian cancer cells. Gas chromatography/mass spectrometry (GC/MS) analysis of the FRAC was performed to determine its various phytoconstituents. Docking analysis was performed to verify the interaction of bioactive molecules with estrogen receptors (ERs). The FRAC significantly improved various biomechanical and biochemical parameters in a dose-dependent manner in the ovariectomized rats. FRAC also controlled the increased body weight and decreased uterus weight following ovariectomy in rats. Histopathology of the femur demonstrated the restoration of typical bone structure and trabecular width in ovariectomized animals after treatment with FRAC and raloxifene. The FRAC also exhibited *in vitro* cytotoxicity in the breast (MCF-7 and MDA-MB-231) and ovarian (SKOV-3) cancer cells. Furthermore, genistein and daidzein exhibited a high affinity towards both estrogen receptors (α and β) in the docking study revealing the probable mechanism of the antiosteoporotic activity. GC/MS analysis confirmed the presence of other bioactive molecules such as stigmasterol, β-sitosterol, and stigmasta-3,5-dien-7-one. The FRAC from *Pueraria tuberosa*

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Research Article

Cationic Polyelectrolyte Nanocapsules of Moxifloxacin for Microbial Keratitis Therapy: Development, Characterization, and Pharmacodynamic Study

Parasuraman Mohan[1] and Karthikeyan Kesavan[1,2]

Received 12 February 2021; accepted 6 May 2021

Abstract. Microbial keratitis (MK) is a vision-threatening disease and the fourth leading cause of blindness worldwide. In this work, we aim to develop moxifloxacin (MXN)-loaded chitosan-based cationic mucoadhesive polyelectrolyte nanocapsules (PENs) for the effective treatment of MK. PENs were formulated by polyelectrolyte complex coacervation method and characterized for their particle size, surface charge, morphology, mucoadhesive property, *in-vitro* and *ex-vivo* release, ocular tolerance, and antimicrobial efficacy studies. The pharmacodynamic study was conducted on rabbit eye model of induced keratitis and it is compared with marketed formulation (MF). Developed PENs showed the size range from 230.7 ± 0.64 to 249.0 ± 0.49 nm and positive surface charge, spherical shape along with appropriate physico-chemical parameters. Both *in-vitro* and *ex-vivo* examination concludes that PENs having more efficiency in sustained release of MXN compared to MF. Ocular irritation studies demonstrated that no corneal damage or ocular irritation. The *in-vivo* study proved that the anti-bacterial efficacy of PENs was improved when compared with MF. These results suggested that PENs are a feasible choice for MK therapy because of their ability to enhance ocular retention of loaded MXN through interaction with the corneal surface of the mucous membrane.

KEY WORDS: Polyelectrolyte nanocapsules; Microbial keratitis; Chitosan; Mucoadhesive; Moxifloxacin; Gellan.

INTRODUCTION

The prevalence of microbial keratitis (MK) is widespread in developing countries with approximately 1.5–2 million cases of corneal ulcers. Bacterial keratitis is one of the prominent categories of contagious keratitis (1) and mostly 80% of patients are particularly affected by ulcerative keratitis. The inflammation is caused by *Pseudomonas aeruginosa* and *Staphylococcus aureus*, primarily the corneal inflammation as rupture of epithelial linearity along with subsequent penetration of the stromal layer and finally tissue necrosis (2). The commercially existing moxifloxacin (0.5%) ophthalmic eye drop is a better option for the management of hourly administration into the ocular surface into the first three days of therapy (3). Conversely, topical drug delivery has numerous restrictions such as difficulty to the penetration of drug moiety into a precise distinct layer of the cornea, defensive mechanisms, with frequent reflex blinking, quickly drainage of solutions and lachrymation leads to a very fraction of precorneal retention time, which permit approximately 10% of topically applied medicament to be absorbed efficiently (4).

Moxifloxacin (MXN) is an 8-methoxy fluoroquinolone derivative chemically termed as [1-cyclopropyl-6-fluoro-1, 4-dihydro-8- methoxy-7-{(4aS, 7aS–octa-hydro-6H-pyrrolol (3,4b) pyridin- 6-yl)}-4-oxo-3-quinoline carboxylic acid, mono hydrochloride] and well known hydrophilic moiety (log P oct/wat = 0.6), frequently used to treat ocular disease like as conjunctivitis, keratitis, and keratoconjunctivitis (5). MXN act as a broad-spectrum antibiotic and specifically superior activity on gram-positive microorganisms like *staphylococci*, *streptococci*, *enterococci*, anaerobes, and atypical bacteria (6). The mechanism of bactericidal potential is based on fluoroquinolone mediate by preventing DNA multiplication through the inhibitory action of DNA gyrase and bacterial topoisomerase IV, the exact target enzymes implicated in bacterial DNA replication, repair, transcription, and recombination process for protein synthesis (7).

Polyelectrolyte nanocapsules (PENs) formed by complex coacervation, when a polymer-rich phase of coacervate liquid is in equilibrium with polymer deficient supernatant phases (8). It has gained importance among the researchers and become a better choice for nanocarrier preparation. PENs can be prepared by spontaneously produced by mixing two or more oppositely charged linear or nonlinear polymeric material. PENs formation is generally stabilized by interaction among oppositely charged polymeric material which includes reversible electrostatic interaction, dipole-dipole association, and formation of hydrogen or hydrophobic bond formation (9). The formed coacervate stability is affected by

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Phase Transition Microemulsion of Brimonidine Tartrate for Glaucoma Therapy: Preparation, Characterization and Pharmacodynamic Study

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ABSTRACT

Purpose: The aim of this study was to formulate brimonidine tartrate loaded phase transition microemulsions (PMEs), which undergo phase transition from water in oil (W/O) microemulsions to liquid crystalline (LC) and then oil in water (O/W) microemulsions after instilled into the eye and prolong the precorneal residence time and ocular bioavailability for the effective treatment of glaucoma.

Methods: The pseudo-ternary phase diagram was developed and various PMEs were prepared using Tween 80 and Span 80 with isopropyl myristate and water. Globule size and shape, physicochemical parameters, *in vitro* and *ex vivo* drug release of PMEs were studied. The *in vivo* anti-glaucoma efficacy of optimized PMEs was studied in an experimental rabbit eyes model and compared with marketed formulation (MF).

Results: Globule size of PMEs was found less than 200 nm, which was confirmed by both dynamic light scattering technique and Transmission Electron Microscopy. Physicochemical properties such as pH, refractive index, percentage transparency, viscosity and conductivity were also found in the acceptable ranges. *In vitro* release studies of PMEs exhibited sustained release property. *Ex vivo* permeation study also supported the enhanced drug flux through cornea from PMEs as compared with MF. In pharmacodynamic study, a greater reduction in intraocular pressure was seen in PMEs as compared to MF.

Conclusion: PMEs as ocular drug delivery system offer a promising approach to enhance the corneal contact, higher permeation and prolonged precorneal retention time in the eye leading to sustained drug release, enhanced bioavailability and patient compliance.

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Glaucoma; phase transition microemulsions; precorneal residence time; brimonidine tartrate; Tween 80; Span 80

Introduction

Drug delivery in ocular is most interesting and challenging field due to the complex anatomical and physiological barriers of human eye. The unique eye structure restricts the transport of drug moiety to the required area of action. Approximately 90% of marketed ophthalmic preparations are topical conventional dosage forms include solutions (62.4%), suspensions (8.7%), and ointments (17.4%), to deliver drug into the anterior segment of the eye.[1] Conventional dosage forms are convenient in use but have a major problem of low drug bioavailability due to tightness of the corneal barrier, tear dilution, rapid drainage from corneal surface through nasolachrymal duct.[2,3] These limitations necessitates repeated instillation of eye drops so as to maintain desired level of drug into the eye which eventually leads to nasolacrimal drainage and undesirable systemic side effects due to subsequent absorption into the systemic circulation[4]

Worldwide, glaucoma is the second foremost cause of blindness.[5] It is an age related optic neuropathy defined by a slow progressive degeneration of optic nerves which leads to vision loss and blindness. Elevated intraocular pressure (IOP) is the main risk factor for development of the glaucoma which causes damage to the optic nerves.[6] In addition, glaucoma is characterized by apoptosis of the ganglion cell and trabecular meshwork (TM) cells. Indeed, the IOP enhances just because of the malfunctioning of TM cells.[7] Broadly this disorder can be classified as "open-angle" and "closed-angle" glaucoma, in which open-angle glaucoma being the most common.[8] Available drug therapies for treating glaucoma include conventional dosage forms which are associated with low bioavailability and undesirable systemic side effects.

Microemulsions (MEs) were very firstly introduced by Hoar and Schulmanin in 1943. Since that time many researchers have experimentally concluded MEs as potential nanocarrier for designing new drug delivery systems and it has got tremendous beneficial advantages over conventional dosage forms in the field of ocular drug delivery systems.[9] These are isotropic, transparent and thermodynamically stable nanosized (<200 nm) dispersion of aqueous and oily phase whose interfacial area stabilized by surfactants.[10] Presence of aqueous and oily phase in MEs facilitates incorporation of both hydrophilic and lipophilic drugs. The existence of surfactant and nanosized structure of MEs plays vital role in drug permeability enhancement across the cornea and promotes good spreadibility on ocular surface and dilution with tears.[11,12] Phase transition microemulsions (PMEs) have the property of phase transition from water in oil (W/O) microemulsions to bicontinous phase/ liquid crystals (LC) and then coarse emulsion (CE) upon dilution with tears after instilled into the eye, which extend the precorneal residence time and bioavailability for the effective treatment of glaucoma.[13,14]

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Stimulation of dorsal hippocampal histaminergic transmission mitigates the expression of ethanol withdrawal-induced despair in mice

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ABSTRACT

Garnered literature points toward the role of the dorsal hippocampus (CA1) in ethanol withdrawal-induced responses, wherein a strong presence of the histaminergic system is also reported. Therefore, the present study investigated the effect of an enhanced CA1 histaminergic transmission on the expression of chronic ethanol withdrawal-induced despair in mice on the tail suspension test (TST). The results revealed that mice who were on an ethanol-fed diet (5.96%, v/v) for 8 days exhibited maximum immobility time on the TST, and decreased locomotion at 24 h post-ethanol withdrawal (10th day), indicating ethanol withdrawal-induced despair. Enhancement of CA1 histaminergic activity achieved by the treatment of intra-CA1 microinjection of histaminergic agents such as histamine (0.1, 10 μg/mouse, bilateral), the histamine precursor L-histidine (1, 10 μg/mouse, bilateral), the histamine neuronal releaser/H_3 receptor antagonist thioperamide (2, 10 μg/mouse, bilateral), the histamine H_1 receptor agonist FMPH (2, 6.5 μg/mouse, bilateral), or the H_2 receptor agonist amthamine (0.1, 0.5 μg/mouse, bilateral) to ethanol-withdrawn mice, 10 min before the 24-h post-ethanol withdrawal time point, significantly alleviated the expression of ethanol withdrawal-induced despair in mice on the TST. On the other hand, only the pre-treatment of the histamine H_1 receptor agonist FMPH (2, 6.5 μg/mouse, intra-CA1 bilateral) reversed the reduction in locomotor activity induced in ethanol-withdrawn mice, whereas other employed histaminergic agents were devoid of any effect on this behavior. Therefore, our findings indicate that an enhanced CA1 histaminergic transmission, probably via stimulation of CA1 postsynaptic histamine H_1 or H_2 receptor, could preclude the behavioral despair, while H_1 stimulation affects motor deficit expressed after ethanol withdrawal.

Introduction

A growing body of clinical evidence has suggested that comorbidity with alcoholism and depression are at a very alarming rate (Brière, Rohde, Seeley, Klein, & Lewinsohn, 2014; Greenfield et al., 1998; Lynskey, 1998), and the presence of comorbid psychiatric conditions results in poorer treatment outcomes with an enhanced likelihood of relapse (Pelc et al., 2002). However, the causal relationship between alcoholism-associated withdrawal symptoms and depression at the molecular level has not yet been elucidated. The acute antidepressant-like effect of ethanol in rodents has been well documented by a plethora of reports using various behavioral paradigms (Ciccocioppo et al., 1999; Fernandez-Pardal & Hilakivi, 1989; Hirani, Khisti, & Chopde, 2002; Kampov-Polevoy, Dubtchenko, Crosby, & Halikas, 1993; McHugh & Kelly, 2018), and its chronic consumption precipitates withdrawal-associated neuroadaptive changes that might be responsible for the reinforcing effects of ethanol and could lead to the gradual increase in withdrawal-induced behavioral despair-related measures (Feighner, 1999; Ferguson, 2001; Hirani et al., 2002).

Incidentally, apart from the contemporary monoaminergic theory underlying pathophysiology of depression and its involvement in ethanol-induced effects (Besheer, Lepoutre, & Hodge, 2009; Hirani et al., 2002; Imperato & Di Chiara, 1986; Littleton,

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Research report

Central histaminergic transmission modulates the expression of chronic nicotine withdrawal induced anxiety-like and somatic behavior in mice

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ABSTRACT

The present study investigated the plausible modulatory role of central histaminergic transmission on the expression of nicotine withdrawal induced anxiety and somatic behavior in mice. Abrupt cessation of chronic nicotine (2 mg/kg, i.p. × 3/day) treatment for 12 days to mice, expressed increased anxiety in light & dark test and total abstinence (somatic) score at 24 h post nicotine withdrawal time. The somatic signs includes a composite score of all behaviors such as grooming, rearing, jumping, body shakes, forelimb tremors, head shakes, abdominal constrictions, scratching, empty mouth chewing or teeth chattering, genital licking, tail licking. Mice exhibited higher expression to nicotine withdrawal induced anxiety in light & dark test at 24 h post-nicotine withdrawal time on pre-treatment centrally (i.c.v) with histaminergic agents like histamine (0.1, 50 μg/mouse), histamine H_3 receptor inverse agonist, thioperamide (2, 10 μg/mouse), histamine H_3 receptor agonist, FMPH (2, 6.5 μg/mouse) or H_2 receptor agonist amthamine (0.1, 0.5 μg/mouse) or intraperitoneally (i.p.) with histamine precursor, L-histidine (250, 500 mg/kg) as compared to control nicotine withdrawn animals. Furthermore, mice pre-treated with all these histaminergic agents except histamine H_3 receptor agonist, FMPH shows exacerbated expression to post-nicotine withdrawal induced total abstinence (somatic) score in mice. On the other hand, central injection of selective histamine H_3 receptor antagonist, cetirizine (0.1 μg/mouse, i.c.v.) or H_2 receptor antagonist, ranitidine (50 μg/mouse, i.c.v) to mice 10 min before 24 h post-nicotine withdrawal time completely alleviated the expression of nicotine withdrawal induced anxiety and somatic behavior. Thus, it can be contemplated that the blockade of central histamine H_3 or H_2 receptor during the nicotine withdrawal phase could be a novel approach to mitigate the nicotine withdrawal associated anxiety-like manifestations. Contribution of endogenous histamine via H_3 or H_2 receptor stimulation in the nicotine withdrawal induced anxiety and somatic behavior is proposed.

1. Introduction

Nicotine is an active alkaloid phytoconstituent present in tobacco leaves and considered cardinal for inducing plethora of behvioral effects contributing to tobacco addiction. The most notable actions of nicotine consumption are related to modulation of anxiety measures in humans as well as in rodents, wherein acute administration of nicotine is purported to elicit both anxiolytic [1–3] and anxiogenic effects [4–6]. On the other hand, tolerance to the effect of nicotine on anxiety is reported on chronic consumption [7] and subsequent withdrawal leads to increased anxiety measures in rodents [8,9]. These anxiety related withdrawal effects of nicotine are considered cardinal for tobacco abuse leading to relapse [10] and progressively contribute to the maintenance of the nicotine-containing product consumption habit [11–14]. Similarly, it is reported that the affective aspects of the nicotine withdrawal syndrome are also characterized by increased anxiety in humans [15,16] and as well as somatic signs as described by Malin et al., 1992 [17], which were found to be selectively elevated during the withdrawal phase. These somatic behavioral signs include body shakes, grooming, abdominal posture, ptosis (slackening of the jaw) empty mouth chewing, chattering, eye blinks and diarrhea. However, the exact neurobiological mechanisms underlying the nicotine abstinence induced anxiety or somatic symptoms are still under scrutiny.

At the molecular level, nicotine binds to its specific molecular protein target named as nicotinic acetylcholine receptors (nAChRs), a hetero-pentamer composed of α, β subunits existing with different subunit combinations such as α4β2, α3β4,$\alpha_6\beta_2$ β_3, or α7 [18–21].The stimulation of $\alpha_4\beta_2$ and α_7 receptors by nicotine have been reported to

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D-Mannose-Decorated Chitosan Nanoparticles for Enhanced Targeting of 5-Fluorouracil in the Therapy of Colon Cancer

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ABSTRACT

Colorectal cancer is one of the most familiar malignant tumor, which requires an efficient system specially fabricated for targeted delivery of anticancer agents. 5-Fluorouracil (5-FU) is mostly used as an antineoplastic agent in gastrointestinal cancer. Ligand-based targeting approaches increase the internalization of NPs within resistant cells, which results in highly well-organized treatment, markedly reduces systemic toxicities, and minimize collateral damage to adjacent healthy cells. Mannose-conjugation was carried out to increase its uptake by the cancer cells through receptor-mediated endocytosis. It was attempted to develop d-mannose conjugated 5-fluorouracil (5-FU) entrapped nanoparticles (NPs) with an objective to target colon cancer. The conjugated-NPs were characterized for distinct parameters, for instance, pH, viscosity, morphology of particles, particle size (PS), size-distribution, polydispersity index, %yield, surface charge, and entrapment efficiency. However, formulations were also examined (*in vitro*) for cell cytotoxicity against CT26 and drug leakage in dissolution fluid. The fabricated NPs produced sustained drug release effect and exhibited release of 5-FU for 24 h. In addition, conjugation of d-mannose with NPs significantly augmented sustained effect over non-conjugated formulations. The preliminary results obtained for this study suggested that conjugation of d-mannose with chitosan NPs augmented the targeting effect in colon cancer. In conclusion, d-mannose conjugated NPs proved to be a more efficient carrier system over other conventional formulation as a delivery system for tumor.

KEYWORDS: d-mannose, Chitosan; 5-fluorouracil, Nanoparticles, CT26, Colon cancer

Introduction

Colon cancer is a widely occurring cancer in the world. The signs for colon cancer are generally confirmed late when the ailment reached in advanced stages (Dikshit et al., 2011; Sitarz et al., 2018). The drug, 5-Fluorouracil (5-FU) is mostly used as an antineoplastic agent in gastrointestinal cancer (Grem, 2000; Pandey et al., 2020). It principally acts as a thymidylate synthase inhibitor because drug interferes with DNA synthesis. Furthermore, short half-life, wide distribution, and unexplained side effects limit its medical applicability. To date, sufficient research has been carried out on controlled/targeted drug delivery systems for 5-FU using different polymers to conquer these limitations. However, orally delivered 5-FU causes erratic plasma levels due to extensive inter- and/or intra-patient variability. This limitation can be overcome by developing a ligand-based targeted delivery system. Paclitaxel and cepharanthine co-loaded polymeric nanoparticles (NPs) were developed and study their synergistic anticancer efficiency against MKN45 cells (Yu et al., 2016). Elsewhere, hyaluronic acid (HA) decorated cellulose acetate phthalate-based NPs incorporating 5-FU advocated pronounced cytotoxicity against three cancer cell lines *viz.*, SKOV3, A549, and MDA-MB-435 (Garg et al., 2016). Yang *et al.* prepared a hybrid NP system bearing drugs SN38 and sorafenib for attaining a dual-targeted effect *via* targeting receptors (i.e., CD44 and HER2) overexpressed on HGC27 cells of gastric tumor. They reported efficient targeting potential of these engineered NPs against cancer cells (Yang et al., 2016). Our group has also prepared and examined folic acid coupled lipid NPs for their potential using cell lines COLO-205 and HT-29 against colorectal cancer (Rajpoot and Jain, 2018; Rajpoot and Jain,2019; Rajpoot and Jain, 2020).

Ligand-based targeting approaches increase the internalization of NPs within resistant cells, which results in highly well-organized treatment, markedly reduces systemic toxicities, and minimize collateral damage to adjacent healthy cells (Karra and Benita, 2012; Rajpoot, 2019). Mannose conjugated NPs were reported for lung cancer targeting and visceral leishmaniasis (Sahu et al., 2015; Chaubey and Mishra,

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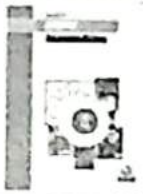
RESEARCH ARTICLE

BENTHAM SCIENCE

5-Fluorouracil Loaded Orally Administered WGA-decorated Poly(lactic-co-glycolic Acid) Nanoparticles for Treatment of Colorectal Cancer: *In Vivo* Evaluation



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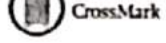

Abstract: ***Background*:** Several studies have suggested the potential aptitude of polylactic-co-glycolic acid (PLGA)-derived nanoparticles (NPs) to improve the antitumor efficacy of anticancer drugs against colon cancer. Further, conjugation of lectins over the surface of the NPs may ameliorate interaction and thus enhance the attachment of NPs with receptors.

***Objective*:** The main goal of the study was to prepare and evaluate the targeting potential (*in vivo*) of the optimized NPs against colorectal cancer.

***Methods*:** The 5-fluorouracil (5-FU) loaded and wheat germ agglutinin (WGA)-conjugated PLGA-NPs (WFUNPs) were prepared and then they were evaluated *in vivo* for targeting aptitude of formulation using gamma scintigraphy after oral delivery. The WGA-conjugated and non-conjugated optimized NPs were compared for any significant results. Further, optimized formulations were also assessed for different parameters such as radiolabeling efficiency, sodium pertechnetate uptake, stability of NPs, and organ distribution study.

***Results*:** Findings suggested prolonged retention of ^{99m}Tc-tagged WFUNPs in the colonic region after 24 h study. Eventually, the outcome from conjugated formulation revealed enhanced bioavailability of the drug in blood plasma for up to 24 h.

***Conclusion*:** In conclusion, WGA-conjugation to NPs could improve the performance of the PLGA-NPs in the treatment of colorectal cancer.

Keywords : Colorectal cancer, 5-Fluorouracil, nanoparticles, poly(lactic-co-glycolic acid), Wheat germ agglutinin, Gamma-scintigraphy.

1. INTRODUCTION

At present, scientists are working on the development of novel drug delivery systems, for instance, microspheres [1, 2], lipid nanoparticles (NPs) [3-5], microbeads [6-8], liposomes [9], especially *via* oral route for targeting gastrointestinal (GI) and colon associated diseases such as amebiasis, Crohn's disease, ulcerative colitis, and cancer [10]. It has been reported that available conventional chemotherapies are ineffective in the treatment of colorectal cancer as most of the orally administered drugs do not reach the target site in sufficient amount to show activity. Further, to attain the desired effect, this demands a higher dose as well as the frequency of administration. Besides, 5-Fluorouracil (5-FU) has been used for the treatment of different types of cancer, for example, colorectal cancer, liver cancer, pancreatic cancer, lung cancer, and breast cancer [11]. In past researches, it has been reported that 5-FU after oral delivery showed very low bioavailability and high pharmacokinetic variability (*i.e.*, AUC) owing to its inconsistent absorption through GI tract [12-14].

Numerous studies have suggested the potential aptitude of polylactic-co-glycolic acid (PLGA)-derived NPs to improve the antitumor efficacy of anticancer drugs against colon cancer [11, 15, 16]. In this context, Badran et al. synthesized 5-FU loaded chitosan coated NPs of PLGA and polycaprolactone. The *in-vitro* cytotoxicity results obtained for optimized formulations showed significant inhibition of colon cancer cells (*i.e.*, HT-29) [17]. Further, Pooja et al. reported wheat germ agglutinin (WGA)-conjugated solid lipid NPs (SLNs) to improve the oral delivery of the paclitaxel (PTX). Findings revealed the potential of WGA-conjugated SLNs for enhanced anticancer activity against lung cancer cells (*i.e.*, A549). Furthermore, lectin receptors encouraged the internalization of NPs as compared to free PTX [18]. Nevertheless, recently our research team reported improved targeting aptitude of Oxaliplatin drug when delivered after

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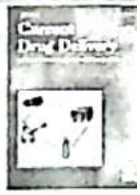
RESEARCH ARTICLE



Repaglinide and Metformin-Loaded Amberlite Resin-Based Floating Microspheres for the Effective Management of Type 2 Diabetes

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Abstract: ***Background*:** Low bioavailability of anti-diabetic drugs results in the partial absorption of the drug as they are mainly absorbed from the stomach and the lower part of the GIT. Drug bioavailability of anti-diabetic drugs can be significantly increased by prolonging gastric retention time through gastro-retentive dosage form such as floating microspheres.

***Objective*:** The study was aimed to develop and characterize resin based floating microspheres of Repaglinide and Metformin for superior and prolonged maintenance of normoglycaemia in type-2 diabetes mellitus.

***Methods*:** Repaglinide and metformin were complexed with amberlite resin, later resin complexed drug was encapsulated in Ethylcellulose floating microspheres. Floating microspheres were characterized for morphology, particle size, IR spectroscopy, DSC, *in vitro* release and buoyancy studies. Further, floating microspheres were tested for *in vivo* blood glucose reduction potential in Streptozocin-induced diabetic mice.

***Results*:** Floating microspheres had a spherical shape and slightly rough surface with the entrapment efficiency in a range of 49-78% for metformin and 52-73% for repaglinide. DSC studies revealed that no chemical interaction took place between polymer and drugs. Floating microspheres showed good buoyancy behavior ($P<0.05$) and prolonged drug release as compared to plain drug ($P<0.05$). The blood glucose lowering effect of floating microspheres on Streptozocin induced diabetic rats was significantly greater ($P<0.05$) and prolonged (>12h) and normoglycaemia was maintained for 6hr.

***Conclusion*:** Floating microspheres containing drug resin complex were able to prolong drug release in an efficient way for a sustained period of time; as a result, profound therapeutic response was obtained.

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1. INTRODUCTION

Diabetes Mellitus (DM), often termed as diabetes, is a serious long-term condition of collective metabolism disorders featuring a high level of blood sugar for a sustained timeperiod [1-3]. Diabetes, being one of the top 10 causes of death in adults, has reached an alarming level. In the past ten years, the estimated number of people having diabetes has exaggerated by 285 million (in 2009) to 463 million (in 2019), and it is anticipated that in 2030, nearly 578 million people will be suffering from diabetes, and this number will be increased up to 700 million in 2045 [4, 5]. Numbers of oral anti-diabetic agents have been approved by the FDA for the treatment of type-2 diabetes in recent years. However, the conventional use of oral anti-diabetic drugs does not specifically target or control a sudden rise in blood glucose level after food intake. Therefore, the development of a new formulation of oral anti-diabetic drugs is much needed to increase the effectiveness and minimize the side effects of drugs [6, 7].

From a large number of drugs, Metformin (MET) and Repaglinide (REPA) are the most acknowledged and commonly used drugs for the treatment of diabetes. MET, is considered to be in Class III of Biopharmaceutical Classification System (BCS) *i.e.* having high-solubility and low-permeability [8-11]. MET is a drug of choice for newly diagnosed type-2 diabetes and perhaps the best oral hypoglycemic agent proven to decrease cardiovascular mortality [12]. MET has a short biological half-life (1.5-3 hours), low bio-availability (50-60%), requirement of high dose (500 mg

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Flavonoids as potential therapeutics against novel coronavirus disease-2019 (nCOVID-19)

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ABSTRACT

Since time immemorial natural products have been a great source of medicine to mankind. The antiviral activities from several ayurvedic herbal medicines (in the form of crude extract or fraction or isolated compounds) have been established but their effectiveness against coronavirus still needs to be explored. They can provide a rich resource of anti-SARS-CoV-2 drug candidates. In this paper, *in-silico* techniques have been used to identify the potential lead molecules against SARS-CoV-2. A list of flavonoids having anti-viral activity was prepared and evaluated against the selected target. Rhoifolin, 5,7-dimethoxyflavanone-4′-O-β-d-glucopyranoside, baicalin, astragalin, luteolin, and kaempferol showed good binding affinity and thus these could be promising compounds. *In-silico* screening such as ADMET prediction has been performed which predicted that the selected flavonoids have good pharmacokinetics and pharmacodynamics properties. Molecular dynamics simulation studies and MM-PBSA binding free energy calculations showed luteolin to be a more effective candidate against viral protein Mpro. The novelty of the approach mainly rests in the identification of potent anti-viral natural molecules from natural products flavonoid group of molecules to be effective against the latest coronavirus infection.

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KEYWORDS
COVID-19; flavonoids; in-silico; ADMET; molecular dynamics; MM-PBSA

1. Introduction

COVID-19 (caused by SARS-CoV-2) is a highly infectious disease that originated in Wuhan, China, and was later declared as a global emergency and pandemic (in March 2020) by World Health Organization (WHO) (Sohrabi et al., 2020). Tracing through the history of coronaviruses, its first family member was discovered in the 1930s but it gained popularity in the year 2002–03 when a severe acute respiratory syndrome (SARS) outbreak joggled the world by its severity (Hui et al., 2003). After a decade later in 2012, it made hark back and was diagnosed in Saudi Arabia in the form of the Middle East respiratory syndrome (MERS), also known as camel flu which was believed to be originated from bats but humans had been typically infected from camels, either during direct contact or indirectly (Chafekar & Fielding, 2018). Lastly, it emerged as novel coronavirus disease-2019 (nCOVID-19) (Rothan & Byrareddy, 2020). As of January 27, 2021, there have been 99,363,697 confirmed cases of COVID-19, including 2,135,959 deaths as per reports of WHO (World Health Organization, 2021). In India, as of January 27, 2021, a total of 10,690,281 confirmed cases have been reported out of which 173,733 are active; 10,358,328 recovered; and 153,751 deaths (COVID19INDIA 2020).

Currently, no specific treatment is available for this dreadful disease as the proliferation and pathogenesis of the virus is not clear. The medicines used for this disease are mainly based on their effectiveness against other strains of coronavirus such as SARS-CoV and MERS-CoV. During the path of drug development some drug molecules, either single or in combination, have been screened against the virus, which exhibited the effect through various mechanisms. The different mode of actions of biomolecules against the virus includes rebalancing Renin-Angiotensin System (RAS), binding to SARS-CoV-2 M^{pro}, binding to SARS-CoV-2 protease, binding to angiotensin II human acetate, binding to SARS-CoV-2 3 C-like proteinase ($3CL^{pro}$), binding to SARS-CoV-2 papain-like proteinase (PL^{pro}), binding to AP2-associated protein kinase 1 (AAK1), etc. (Rismanbaf, 2020). In elderly people, some other disease conditions like hypertension, diabetes mellitus, and coronary heart disease enhance the vulnerability to COVID-19 (Danser et al., 2020). This is because the ACE2 receptor allows coronavirus entry into cells and prior use of RAS blockers might have a high risk of SARS-CoV-2

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*Gourav Rakshit and Pankaj Dagur Equal contribution.

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REVIEW

WILEY

A status report with critical analysis of research trends in exploring medicinal plants as antiviral: Let us dig into the history to predict the future

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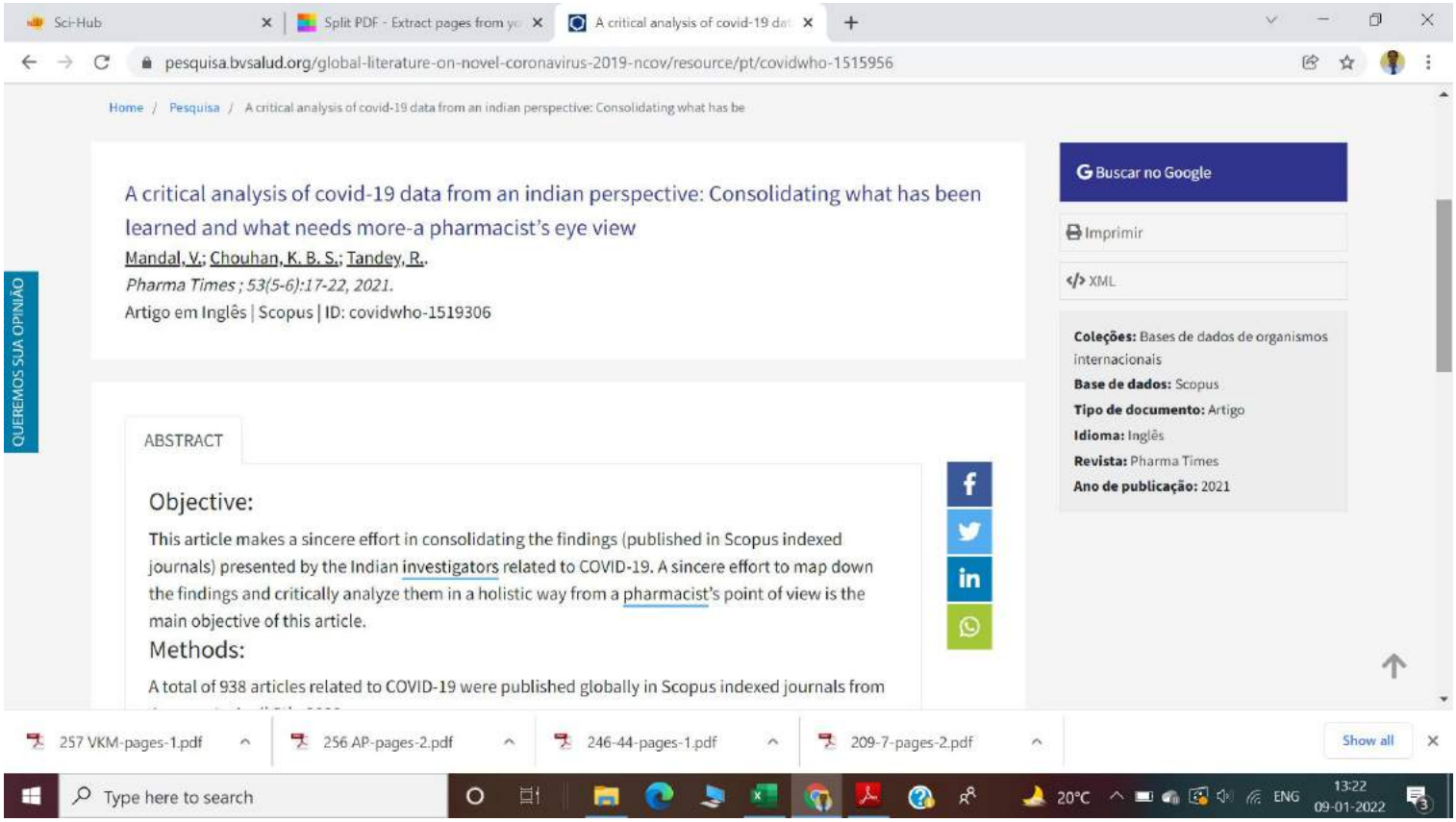
The review article serves as a mini directory of medicinal plants (662 medicinal plants have been identified) that have been investigated for antiviral property between 2015 and 2019. Data have been extracted from Scopus using specific keywords followed by manual sorting to avoid any duplication. Critical analyses of handpicked data have been presented. Mapping of medicinal plants, followed by critical analysis on the families and plant parts investigated in the said tenure, and its correlation with the participating countries and virus types have been critically analyzed. Interceptive role of phytochemicals in impeding viral replication has also been taken note of. Emphasis on India's exploration of various medicinal plants has also been given. Also presents a tutelage, which is likely to revive the interest in natural products for search of potential antivirals. This review is expected to serve as a rich data bank and as a guiding principle for researchers who are planning to explore medicinal plants in search for potential antiviral. It is time that researchers need to revisit their countries' own history of traditional medicine to predict something worthful in future.

KEYWORDS
antiviral, COVID-19, medicinal plant, SCOPUS

1 | INTRODUCTION

Viral diseases have always been a menace for public health. Considering the havoc of 1918 Spanish Flu, history is on the verge of repeating itself through its second version as COVID-19 pandemic (Ciotti et al., 2020; More et al., 2020). The cases of morbidity and mortality are the highest with viral diseases and the situation even worsens with the fact that the arsenal of antiviral drugs are not rich enough and do not have a wide spectrum with vaccination limited to only a selected viral diseases (Meijer, Jansen, & Molema, 1992). Moreover, the cost of available antivirals is on the higher side with the issue of resistance also cannot be ignored, which makes the situation more grim (Yashaswini, Geetha, & Prashanth, 2019). Migration of people to different countries for jobs, global travel, and urbanization has also been cited as one of the causes for spread of viral diseases (Denaro et al., 2020). Henceforth, it is the right time to revisit the options available from nature. Nature with its rich diversity of medicinal plants has always come to the rescue of mankind alleviating pain and suffering due to different diseases (Halberstein, 2005). Nevertheless, the current situation of COVID-19 is no different, as traditional Indian and Chinese medicines have shown a positive intervention in the management of COVID-19 (Hussain et al., 2020; Thota, Balan, & Sivaramakrishnan, 2020).

Data mining from Scopus revealed a whopping 489 published reviews in the last 5 years (2015–2019). The Scopus search was carried out with the help of the keywords "antiviral" and "extract." Careful manual sorting and elimination of duplication revealed that 215 review articles were committed to the involvement of medicinal plants as antiviral. Out of these 135, 29, 37, and 14 review articles were dedicated to exploring the antiviral potential of one particular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A critical analysis of covid-19 data from an indian perspective: Consolidating what has been learned and what needs more-a pharmacist's eye view
Mandal, V.; Chouhan, K. B. S.; Tandey, R..
Pharma Times ; 53(5-6):17-22, 2021.
Artigo em Inglês | Scopus | ID: covidwho-1519306
QUEREMOS SUA OPINIÃO
ABSTRACT
Objective:
This article makes a sincere effort in consolidating the findings (published in Scopus indexed journals) presented by the Indian investigators related to COVID-19. A sincere effort to map down the findings and critically analyze them in a holistic way from a pharmacist's point of view is the main objective of this article.
Methods:
A total of 938 articles related to COVID-19 were published globally in Scopus indexed journals from
Buscar no Google
Imprimir
XML
Coleções: Bases de dados de organismos internacionais
Base de dados: Scopus
Tipo de documento: Artigo
Idioma: Inglês
Revista: Pharma Times
Ano de publicação: 2021
257 VKM-pages-1.pdf
256 AP-pages-2.pdf
246-44-pages-1.pdf
209-7-pages-2.pdf
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09-01-2022

PalArch's Journal of Archaeology of Egypt / Egyptology

A NOVEL META-ENSEMBLE MODEL OF GENE-EXPRESSION BIG DATA

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Prem Kumar Chandrakar , Akhilesh Kumar Shrivas , Neelam Sahu: A Novel Meta-Ensemble Model Of Gene-Expression Big Data– Palarch's Journal Of Archaeology Of Egypt/Egyptology 17(6). ISSN 1567-214x

Keywords: Big data, Gene expression, DNA Microarray, Lung cancer, Ensemble methods, Decision tree, Classifier.

ABSTRACT

Big Data is turning intoone ofthe foremostimportant areas in current analysis in applied science, and data processing. There are severaldifficultproblemsrelated tomanaging theinformation and one vital issue is that the high-dimensional data analysis. High-dimensional information is relevant to a field reminiscent oforganic phenomenonidentification. Organic phenomenon data set manufacturingimmense amounts of information. Organic phenomenon levels are vital for un-wellness, such as gene-expression profiling. Gene expression levels are important for disease, such as Lung Cancer diagnosis.Continue to this, classification strategiesutilized in high dimensional big data studies for gene-expression are numerouswithin themethod they alter the underlying complexness of the info, also as within the technique wont to build the classification model. The classification of variousgene-expression datasets like carcinomasorts is important in cancer identification and drug discovery This paper planneda choice tree-based mostly ensemble classifier to classify the management and cancer teamssupportedorganic phenomenon levels from microarray information. A combinative algorithm with the choice tree formula is developed to pick outvitaloptionsand stylethe correct

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Heuristics Biases among Investors and its Impact on Investment Decision and Performance

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Abstract: Investing in capital market is asset across the globe; however, with a population of more than a billion in India, only about 1% of total population actively participate in capital market. Low participation in capital markets is mainly due to a low level of awareness and prejudice in investment choices. Errors and biases which are based on intuitions, sensation and cognitive biases impelled the investors to take irrational decisions. In this context, this study attempts to find out the impact of heuristic factors on investment decision and performance. Using a structured questionnaire, the primary data are collected randomly from 182 individual investors trading on NSE from Punjab. Descriptive Statistics, Factor analysis and Structural Equation Modeling (SEM) are employed for analysing data and testing hypothesis. Results reveal that the 'Availability of information', 'Overconfidence', 'Representativeness' and 'Price anchoring' are significant predictors of heuristic behaviour and that there is a significant impact of heuristics on investors investment decision and performance. The findings of the study would be productive for investors and policy makers to have a better understanding of behavioural factors and device strategies which lead to better returns.

Keywords: Behavioural Finance, Heuristics, Investment Analysis

1. Introduction

The widely recognized finance theories such as Modern Portfolio Theory (MPT), Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) are the quantitative financial models which are grounded on rational characteristics in investment decision. However, several studies are there which are not supporting traditional theories (Fama and French, 1998). The limitations in traditional theories have lead to behavioural finance theory. It is evident that investment appraisal and selection are not always based on rationality (Kishore, 2004). But most of the decisions are based on the intuitions, emotions

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Role of education in economic intellect of tribal women's entrepreneurs

(In Special Reference to Bilaspur District)

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Abstract

Business and related activities are the backbone of economic development of any country. For the strong development of any country, it is necessary that the citizens of that country continue to contribute to the business activities of the country on a speedy basis. And women and men should have equal contribution in this contribution of citizens, but it is generally found that women are not able to participate so enthusiastically in business activities and related activities because entrepreneurship is a difficult task, especially when it Be especially concerned with tribal population and tribal women. During this study, we have assessed the co-ordination ability of tribal women entrepreneurs in this contribution in terms of educational qualifications.

Keywords: - Tribal women, Entrepreneur, Economic Market, Economic Intellect & Education.

Introduction

Women are part and parcel of a family. In fact, they are the center of a family that in turn makes a strong society and nation. Women entrepreneurs make significant contributions to economic growth and poverty reduction.

Generally it has been experienced that, is not encouraging the significant participation of women in the economic entrepreneurship environment, and face them more problems. But for tribal women, these problems become more complicated.

This paper is a conceptual paper. It indicates the immense potential in that today's tribal women have as entrepreneurs and how they can solve the existing challenge about infrastructure, technological or economic market environment as per her economical sense / intellect and education level.

During this study, as per education point of view, we have divided tribal women entrepreneurs into two parts:

1. **Poorly educated:** Whose education was limited to school.
2. **Highly educated:** Whose have completed their school education and then also got higher education (Such as specific vocational courses/Diploma/Graduation/Post-Graduation).

During this study, we have divided the tribal women entrepreneurs' skill efficiency/performance about dealing with the economic problems of the market, challenges of the infrastructure & economic environment, into the following three categories:

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ANALYSIS OF FAMILY SUPPORT TO TRIBAL WOMEN'S ENTREPRENEUR IN BILASPUR DISTRICT (IN SPECIAL REFERENCE TO URBAN & RURAL AREA)

Dr. Sarika Agarwal*
Prof. Lalit Prakash Pateriya**

ABSTRACT

It is generally seen that in Indian society, women are either worshiped as goddesses or they are used as servants. But there is an acute shortage of people who view women as co-associate or co-partners and support them as normal human beings. The lack of this approach is further felt more, when those women have been considered socially backward, and those women have the responsibility of double operationalization of family and economic activities. In these circumstances, those women need more family cooperation and support in different dimensions. And in general it has also been seen that the role of women in the family is judged from different perspectives in urban and rural areas. In the study presented, we have reviewed the support of tribal entrepreneurial women from their families in different dimensions in the context of urban and rural areas.

Keywords: *Tribal Entrepreneurial Women, Tribes, Family Cooperation and Support, Business Management.*

Introduction

It has been seen in the male dominated society of India that every instruments, tools and resource is always started through the female goddess from the ancient Indian civilization. For example, if you wants to attain knowledge, Saraswati Devi; If you want to get wealth, Lakshmi Devi; If you want to achieve power, Durga Devi; And if you want to kill the wicked then Kali Devi. But, it is generally seen that in Indian society, women are either worshiped as goddesses or they are used as servants. But there is an acute shortage of people who view women as co-associate or co-partners and support them as normal human beings. The lack of this approach is further felt more, when those women have been considered socially backward, and those women have the responsibility of double operationalization of family and economic activities. In these circumstances, those women need more family cooperation and support in different dimensions. And in general it has also been seen that the role of women in the family is judged from different perspectives in urban and rural areas. In the study presented, we have reviewed the support of tribal entrepreneurial women from their families in different dimensions in the context of urban and rural areas.

Central and State Governments of India are designed and implemented various schemes and training programs, from time to time to make tribal entrepreneur women professionally competent and to establish and develop as a competent entrepreneur. But all these schemes and training programs can achieve their set objectives only when those women continue to get government support as well as family support.

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Analysis of gender affect in family support to tribal women entrepreneur in Bilaspur district

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ABSTRACT

It is generally seen that in Indian society, women are either worshiped as goddesses or they are used as servants. But there is an acute shortage of people in the society who continue to support women equally without any gender discrimination. In such a situation, she wants that at least she gets support from her family without any discrimination. In this study, we have reviewed the impact of this gender discrimination on the family support found in various dimensions in entrepreneurship activities in tribal families of Bilaspur district.

Keywords: - Tribal Family, Bilaspur District, Tribes, Family Cooperation and Support, Gender Discrimination, Women Controlled Enterprises/Business, Jointly Controlled Enterprises/Business, Men Controlled Enterprises/Business & Gender Equality.

A brief study on the impact of social media on Purchasing decision of Consumers

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Abstract: In this paper, a brief study is made on the influence of various factors of social media for purchase decision made by consumers. In today's world, the usage of Social websites is increasing rapidly. Several social networking sites are using by the consumer, which affects them in various ways. Which played an important role in affecting the behavior of the consumer. Social media sites like Instagram, Facebook, Twitter, YouTube, etc. offer many features that attract and affect the behavior of the people. In modern life, Social Media becomes one of the most used and effective tools used by the consumer before deciding to buy a particular product. It affects the buying decision of the consumer very much.

Apart from television marketing, social media marketing is very important for marketers and it becomes the most successful technique and tool among every type of advertising field. As we know that businessmen aim to consider, which types of marketing tools and techniques will increase their selling of articles. The main aim of this study is to understand that how, social media advertising affects the buying behavior of consumer who uses social media websites and also to examine the forecasted relationship among customer activities, their behavior, and social media marketing activities.

Keywords: Social media, buying decision, brand loyalty, consumer behavior

Introduction:

Now a days with high usage of Internet, the decision process of consumer regarding purchase of different products are widely influenced by various social media platforms. People all around the globe utilise internet to interface with one another or associations. They are now using various online networking platform like Twitter, Instagram, LinkedIn and Facebook to share their experience regarding the products and also people influenced by those experiences and motivated to purchase the particular product, hence the social media platform play a vital role in influencing the consumer regarding their buying decisions.

Nowadays, social media marketing has become the most powerful tool for the companies to promote their products and influence the buying decision of individuals. It has replaced the traditional way of marketing by providing new opportunities to the firm to communicate with their target consumers via social media platforms. The social interaction has taken a new phase with the evolution of internet particularly with the invention of social media.

With the ease of internet access, the total users of social media has increased to 36.1 million in 2018. Besides this, the social network users in the country were expected to be almost 448 million in 2023 (Statistica 2020)

If used properly social media can be a very powerful tool to capture the market. After evolving the concept of social media various businesses using this tool to interact with their customers. Social media marketing uses social media platforms to connect with the customers to increase sales and to create brand loyalty among their customers. Some of the advantages of using social media as a marketing tool are, it is inexpensive as compared to other media and also helpful to connect to more

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Exploring Sustainability Implications for Manufacturing Strategy Decision Areas-A New Model with a Case Study

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Abstract

There is a growing need for the firms to factor the sustainability concerns in developing their manufacturing strategy (MS). MS content comprises of competitive priorities and decision areas (DAs) of manufacturing and MS process generally revolves around two approaches to strategic reconciliation: an inside-out approach (resource based) and the outside-in approach (stakeholder requirements). There is only a handful of models in MS incorporating sustainability concerns. Few models that consider sustainability do not factor the resource-based view. This paper proposes a new model to include both resources-based view and stakeholder requirements of strategic reconciliation in MS while incorporating sustainability. A case study is conducted to validate the relationships depicted in the proposed MS model and also to derive insights on sustainability implications of MS DAs.

Keywords: Manufacturing strategy; Sustainable manufacturing; Decision areas; Strategic reconciliation; Case Study

1. Introduction

Even though manufacturing has contributed significantly to common progress, it has negative environmental and social impacts such as unlimited misuse of non-renewable resources, limited use of renewable resources, contamination of soil and water, discharge of greenhouse gases, etc. [1]. As a consequence, different stakeholders such as customers, governments, and environmental pressure groups are forcing manufacturing companies in various industries to actively consider the sustainability impacts related to their activities. Manufacturing performance metrics are shifting from economic-centric performance measures to the other components of the sustainability i.e., environmental and social [2][3]. Now a days sustainability figures in the agenda of many companies in the manufacturing industry. Despite this thrust, research on how sustainability issues are to be considered in the formulation of MS by the company is lacking.

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ANALYZING THE EFFECT OF WELDING PARAMETERS ON MILD STEEL PLATE GRADE IS2062E350 IN GMAW

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ABSTRACT

GMAW is extensively used due to its advantages such as production efficiency, less heat effective zone and environment friendliness. GMAW (Gas Metal Arc Welding) is used to join different types of ferrous metals and non-ferrous metals that cannot be welded by non-traditional welding processes. In this study, various important welding process parameters such as welding current, welding voltage, electrode diameter are used. Taguchi technique is applied to plan the experiments. Welding current ranges between 148-260 amp, welding voltage ranges between 18-28 volt and electrode diameter of 1mm & 1.2 mm is used in present study to grace experiments. The experimental results are analyzed to determine the impact of variation of arc voltage, arc current and electrode diameter on metal deposition rate for Mild Steel Plate Grade IS2062E350. The result shows that at low voltage and high current, metal deposition rate increases, however, when the voltage increases for the same current level, the metal deposition rate decreases. The study disclosed the significant impact of welding current on welding time..

KEYWORDS: Gas Metal arc welding (GMAW), Mild Steel Plate Grade IS2062E350, ANOVA (Analysis of Variance), Welding current, arc voltage, welding speed

Original Article

1.INTRODUCTION

From past few decades, GMAW has widely gained importance for joining diverse metals in many manufacturing processes due to its higher productivity and weld quality. GMAW welding evidence is honoured from the society of welding engineers at global standard due to its unique characteristics for establishing the high quality of weld between two work parts. The authors found many research documents inclination towards determining the optimum trade-off level amongst multiple welding parameters i.e., current, electrode diameter, current type, plate dimension, metal deposition rate, voltage. Gas Metal Arc Welding (GMAW) process utilizes various input process parameters, which solely affects the weld ability or in other terms cost of weldment, weld bead size, penetration and shape, etc. Lots of research work has been done to reflect the effect of GMAW variables on different materials. Ghazvinloo et al. [1] investigated the impact of processing variables i.e. arc voltage, welding current and welding speed on fatigue life, impact energy and bead penetration of AA6061 joints, which are prepared by MIG robotic welding process. Ibrahim et al. [2] used robotic GMAW on 6 mm thickness mild steel plate and investigated the effects of different parameters like arc voltage, welding current and welding speed on welding penetration, microstructural and hardness measurement. Karadeniz et al. [3] used cobalt coated steel SAE 1020 electrode and analyzed the influence of welding pulse parameters on the microstructure of the deposit.

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An Investigation Tool for Mounting Sustainable Practice:
Modeling Using GIVTFNs in an Indian Context

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ABSTRACT

Smart mobile devices of the present era offer many services i.e. SMS, gaming, a camera, navigation, the Internet, television, etc., and their utilization has significantly risen during the last decades. Today, individuals are addicted to mobiles and cannot think of living without using them. Conversely, these mobiles become obsolete due to certain shortcomings and are eventually replaced with new ones and thus create e-waste, which are alarmed as threat to the society. In this work, the authors describe mobiles and e-waste in a closed loop structure for supporting green issues. The work has rooted generalized interval-valued trapezoidal fuzzy numbers (GIVTFNs) with a degree of similarity measure approach to model the rationale and to furnish decision results. The authors developed a decision support system to prevent e-waste by defining significant inadequacy liable for the larger alteration of working mobiles. The present study demonstrates the technical model under an Indian context to verify its applicability, but it can be used it under any regional or worldwide scenario.

KEYWORDS

Critical Thinking, Decision Making, Evaluation, E-Waste, Generalized Interval-Valued Trapezoidal Fuzzy Numbers (GIVTFNs), Mobiles

1. INTRODUCTION

Nowadays, the legislations are strictly monitoring the business actions of the companies and interestedly setting obligatory rules to them, taking into account green aspects as a chief concern and thus companies cannot disregard ecological issues for performing business in today's scenario. Approximately; around the world, the governments are creating awareness programs to arouse interest among the public in protecting the environment and on the other side interestedly drafting strict rules for environmental performance, which have to be followed by the business companies to perform business. Nowadays, business companies are experiencing pressure for respecting ecological issues, utilization of eco-friendly resources along with rival's competition. Governments are hunting the areas

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Barriers to adoption of blockchain technology in green supply chain management

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Abstract

Purpose – The purpose of this study is to identify the barriers to the adoption of blockchain technology in green supply chain management (GSCM) and further analyze the cause and effect relationship to prioritize the barriers for making strategic decisions.

Design/methodology/approach – The study examines 15 potential barriers related to the adoption of blockchain in GSCM which is identified from the literature review and finalized after subsequent discussions with industry professionals. Integrated Fuzzy-Decision-Making Trial and Evaluation Laboratory approach is used to analyze cause and effect relationships and prioritize the barriers. Fuzzy set theory is used to handle the uncertainty and vagueness associated with the personnel biases and data deficiency problems. Three small to medium enterprises' (SMEs') are considered for gathering data and further analyzing the crucial barriers that are impeding the adoption of blockchain technology in GSCM.

Findings – The findings reveal that "lack of management vision" and "cultural differences among supply chain partners" are the most influencing barriers, whereas; "collaboration challenges" and "hesitation and workforce obsolescence" are the most influential barriers in the adoption of blockchain in GSCM.

Research limitations/implications – The study is developed based on 15 selected barriers which were further tested using data from three SMEs' in the emerging economy of India. The adoption of blockchain technology in GSCM is at a nascent stage and more research studies are necessary to extend the knowledge base.

Practical implications – Managers need to eliminate the barriers and extend the blockchain technology application in GSCM. Managers need to develop the mission and vision of the company by doing proper alignment of blockchain technology with GSCM goals. Second, managers need to make strong collaborations and remove the hesitation and workforce obsolescence barrier by providing the right education and pieces of training.

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DESIGN AND DEVELOPMENT OF MICROWAVE SYSTEM FOR WELDING OF MATERIALS

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ABSTRACT

The growth in the industries and the innovations taking place every day in the field of engineering and technology led the researchers to find new and improved methods for processing of wide range of materials. Permanent joining of materials has been one of the prime requirements in most of the assembling and manufacturing industries. The research is now focused on the use of microwave welding for industrial application. Microwave material processing, a novel method is emerging as one of the most promising sustainable process in the area of manufacturing. Microwaves have been used for long time to heat the materials in the industries because of its property of volumetric heating. The main advantage of microwave heating is its capability of volumetric heating but this advantage of heating becomes a very huge disadvantage in the field of welding application because welding requires heating at a particular point i.e. a welding zone. An attempt has been made to study the theoretical models that have been developed to overcome these kinds of problems, and simulations have been done for the different models at different conditions of heating effect by using COMSOL Multiphysics. Analysis for the most suitable condition for the welding application and its experimental investigation has been tried for the real time observations. This paper illustrates a novel method for welding thermoplastics through microwave heating. A microwave system has been developed and different tests are conducted to measure the welding ability of the system with the different thermoplastic materials like LDPE and HDPE. An attempt has been made to discuss, the control of thermal runway which is caused by the microwave heating by applying external magnetic field over the material.

KEYWORDS: Microwave, Microwave welding, COMSOL & Volumetric heating

Original Article

Exploitation of the advanced manufacturing machine tool evaluation model under objective-grey information: a knowledge-based cluster with the grey relational analysis approach

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Abstract

Purpose – Advanced manufacturing machines (AMMs) are searched as a momentous asset across the manufacturing societies for quenching and addressing the production units under economical circumstances, i.e. production of high-quality of goods under feasible cost. AMMs are significant in holding the managers against their rivals and competitors with high profit margins. The authors developed the decision support mechanism/portfolio (DSM-P) consist of knowledge-based cluster approach with a dynamic model. The purpose of research work is to measure overall economic worth of AMMs under objective and grey-imperfect (mixed) data by exploring the proposed DSM-P.

Design/methodology/approach – The authors developed the DSM-P that consist of knowledge-based cluster, three multi-criteria decision-making (MCDM) techniques-1-2-3 with complementary grey relational analysis-4(GRA), approach with a dynamic model (complied by technical plus cost and agility measures of AMMs). The proposed DSM-P enables the manager to map the overall economic worth of candidate AMMs under objective and grey-mixed data.

Findings – The presented DSM-P assist the managers for handling the selection problem of AMMs, i.e. CNCs, robots, automatic-guided vehicle, etc under mixed (objective cum grey) data. To enable the readers for intensely understand the work, the utility of proposed approach is displayed by illustrating a polar robot evaluation and selection problem. It is ascertained that the robot candidate-11 alternative is fulfilling the entire technical cum cost and agility measures.

Originality/value – The DSM-P provides more precise and reliable outcomes due to a usage of the dominance theory. Under the dominance theory, the ranks are obtained by MCDM techniques-1-2-3 are compared with ranks gathered by the GRA-4 under objective cum grey data, formed the novelties in presented research work. From a future perspective, the grey-based models in DSM-P can be built/extended/constructed more extensive and can be simulated by the same approach.

Keywords Grey information, Advanced manufacturing machines (AMMs), Robot, Objective information, Knowledge-based cluster approach, Economic worth assessment, Industrial management

Paper type Research paper

Grey Systems: Theory and Application

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A Review on the Research Growth of Industry 4.0:
IIoT Business Architectures Benchmarking

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ABSTRACT

Industry 4.0 is an evolutionary topic, which integrates the business with several production architectures e.g. big data analytics, autonomous networks of electronic devices, simulation, horizontal and vertical integration, the industrial internet of things, cyber security, cloud computing, additive manufacturing, virtual reality, etc. The present research aim is to quantify the research trends and contributions of industry 4.0's business architectures from years 2014-2018. The research responds to the literature review of current leading academic journals and conference proceedings, specific to IIoT-BRs such as I4-Business Growth (BG), I4-Business Optimization (BO), I4-Operational Excellence (OE), I4-Enterprise Resource Planning (ERP), I4-Manufacturing Executive system (MES), I4-Process Control Network (PNC), I4-Functional Excellence (FE), I4-Business Strategy, (BS), I4-Human Resource Management (HRM), I4-Integration (I). The authors utilize an open (Google) internet-based research search engine (OIBRSE) as a conduit to acquire the digital object identifiers and universal resource locators if the DOI non-exists with research articles. The research work archives the one hundred sixty-five research articles, gleaned by conducting the literature review upon IIoT-BRs. The research results that research trends and contributions of I4-(BO) and I4-(BG) are strong. However, I4-(BO) and I4-(BG) are slightly prose than I4-(MES) and I4-Network (PNC). The research growth is a weak residue of the industry 4.0's (IIoT-BRs). The research stores the authentic evidence to supervise the researchers for current research gaps and motivates them to extend their glance to weak IIoT-BRs. The research work aids the new researchers of industry 4.0 to learn and optimize their knowledge in empire of industry 4.0 too.

KEYWORDS

4.0 Business Architectures (BRs), Benchmarking, ICT, Inclusion and Elimination Parameters, Industrial Internet of Things- (IIoT), Industry 4.0 Business Architectures, Information and Communication Technologies, IoT, Literature Review, Research Articles (RAs), Benchmarking, Research Growth (RG)

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Evaluation of machine tool substitute under data-driven quality management system: a hybrid decision-making approach

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Abstract

Purpose – Today, industrial revolutions demands advanced technologies, means, mediums, tactics and so forth for optimizing their operating behavior and opportunities. It is probed that the effectual results can be seized into system by not only developing advance means and technologies, but also capably adapting these developed technologies, their user interface and their utilization at optimum levels. Today, industrial resources need perfect synchronization and optimization for getting elevated results. Accordingly, present study is furnished with the purpose to expose quality-driven insights to march toward excellence by optimizing existing resources by the industrial organizations. The present study evaluates quality attributes of mechanical machineries for seizing performance opportunities and maintaining competitiveness via synchronizing and reconfiguring firm's resources under quality management system.

Design/methodology/approach – In the present study, Kano's integrated approach is implemented for supporting decision rational concerning industrial assets. The integrative Kano–analytic hierarchy process (AHP) approach is used to reflect the relative importance of quality attributes. Kano and AHP tactics are integrated to define global relative weight and their computational medium is adapted along with ratio analysis, reference point theory and TOPSIS technique for understanding robust decision. The study described an interesting idea for underpinning quality attributes for benchmarking system substitutes. A machine tool selection case is discussed to disclose the significant aspect of decision-making and its virtual qualities.

Findings – The decision executives can realize massive benefits by streaming quality data, advanced information, technological advancements, optimum analysis and by identifying quality measures and disruptions for gaining performance deeds. The study determined quality measures for benchmarking machine tool substitute for industrial applications. Momentous machine alternatives are evaluated by means of technical structure, dominance theory and comparative analysis for supporting decision-making of industrial assets based on optimization and synchronization.

Research limitations/implications – The study linked financial, managerial and production resources under sole platform to present a technical structure that may assist in improving the performance of the manufacturing firms. The study provides a decision support mechanism to assist in reviewing the momentous resources to imitate a higher level of productive strength toward the manufacturing firms. The study endeavors its importance toward optimizing resources, which is an evident requirement in industries as the same not only saves money, escalates production, improves profit margins and so forth, but also gratifies the consumption of scarce natural resources.

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Evaluation of machine tool substitute under data-driven quality management system: a hybrid decision-making approach

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Abstract

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Structural analyses of nano-stitched composite laminates based on FSDT using finite element approach

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Micromechanics
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Static analysis

ABSTRACT

Here, the numerical analyses of nano-stitched graphite-epoxy laminated composite are presented. A micro-mechanical model is used to obtain the effective elastic properties of the nano-stitched layers by considering a very thin layer of polymer nanocomposite. The mechanical and structural characteristics are examined for thin and thick plates using the first-order shear deformation theory (FSDT) and a finite element analysis. Governing equilibrium equations and constitutive equations have been presented to investigate the out-of-plane shear stresses and in-plane normal stresses in the laminated plates. Further, transverse bending deflection and normal stresses are determined for different sets of composite laminates. Comparative studies of CNT stitched and unstitched laminated plates have been carried out for sinusoidal loading and different boundary conditions. . Results show a good agreement between present and available analytical results. The evaluation indicates that there is a significant reduction in normal and transverse stress components with the use of only 5% of vertically aligned carbon nanotubes (CNT) at the interface of the conventional laminated plates.

1. Introduction

Laminated composite structures are used in many applications due to high strength to weight ratio as compared to conventional materials. But, laminated composite plates are prone to damage due to delamination under static or dynamic load (O'Brien et al., 2008). Delamination in composite plates are caused by transverse shear stress. Therefore, complete stress analysis is necessary to understand and predict the failure behaviour of composite structure. Many nano-engineered composite structures have been developed to enhance the mechanical characteristics of the graphite-epoxy laminated composite structure. Vertically aligned carbon nanotubes (CNTs) have also been used as a stitching member to reinforce the two laminae of the graphite-epoxy laminate composite plate.

The carbon nanotube, invented in 1991 (S. Iijima, 1991) has mechanical properties greater than other fibers. It is widely used in many aerospace engineering due to high stiffness, as calculated by Treacy et al. (1996). In Shen and Li (2004), the effective properties of CNT have been calculated by assuming it as a transversely isotropic material. In Hassanzadeh-Aghdam and Ansari (2019), Kulkarni et al. (2010), and Kundalwal and Ray (2012); (2014), CNT was modeled as a transverse isotropic solid for micromechanical analysis. Using atomic simulation, the Young's modulus for CNT was found to be 5 TPa, which is five times greater than that of diamond (Srivastava et al., 2003). In Odegard et al. (2003) and Song and Youn (2006), modeling techniques have been presented to obtain elastic properties of aligned CNT stitched composites. Recently, Oskouie et al. (2019) have presented a micromechanics-based approach for effective mechanical properties of CNT/CF polymer hybrid nanocomposites. A multi-procedure micromechanics approach based on the Mori-Tanaka model (Hasanzadeh et al., 2019) is proposed to evaluate the effective properties of piezoelectric hybrid composites containing carbon nanotubes.

The CNT-based stitching can be synthesized by the prepreg and infusion method (García et al., 2007). The nano-stitched composite consists of graphite fiber, spurr polymer, and aligned CNT fiber perpendicular to the laminae interfaces to strengthen the inter-lamination properties of the laminates (Ajayan and Tour, 2007). Nano-stitched composite considered in present work, has CNTs of 8 nm mean outer diameter (Wang et al., 2007) and are equally spaced by an average value of 20 nm at the ply juncture, which gives a typical distribution of aligned CNT. Here the effect of 5% CNT is studied and furthermore the percentage variation of CNT can be carried out to optimize the stress analysis. The CNT volume fraction and interphase

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Numerical study of microstructural fatigue crack growth using damage mechanics

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Microstructure
Fatigue crack growth
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ABSTRACT

Generally the external load applied to engineering components is significantly below the yield strength. Yet, the materials fail without showing any visible indication. Furthermore, the fatigue crack growth behavior should be observed microscopically. Thus, the microstructural study of fatigue crack growth becomes important. The microstructural study of fatigue crack growth in metals does not only demonstrate the effect of microstructural properties (grain size, grain boundary thickness, etc.) on the mechanical response of the system but also informs about a microstructural modification to resist fatigue crack growth so that fatigue life of the component can be enhanced. In the present work, fatigue crack growth simulations are performed on compact tension (CT) specimen. The microstructure region is generated near the crack tip using the Voronoi tessellation approach. Further, an in-house MATLAB code based on the finite element method and continuum damage mechanics (CDM) is implemented to perform the numerical analysis. Damage based analysis is done on the microstructure meshing system to visualize the effect of microstructural quantities (average grain size, grain boundary thickness) and material constant on the fatigue crack growth in this work. Here, the obtained result shows good agreement with the experimental result and the effect of microstructural quantities on the crack initiation life is observed.

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1. Introduction

In the field of engineering different modes of failure exist, which occurs either in simple way or due to combined effect of load and environmental condition. It is evaluated that about 90% of all service failures occur due to fatigue failure. The term "fatigue" was first used to describe the failures in the 1840s [1] and the term "fatigue" is taken from human reaction due to repetitive work. The problem of metal fatigue is present since many years but the remarkable growth in computational analysis of fatigue fracture helps to interpret the fatigue crack initiation, growth, and its behaviour more effectively. Under the effect of fatigue loading, the material fails below the yield stress and this can be analysed by its microstructural aspects [2]. A microstructural study of fatigue crack growth facilitates the relative roles of intrinsic and extrinsic attributes of microstructure in the crack growth phenomenon [3-5]. The microstructural analysis can predict fatigue life more quantitatively. The microstructural study of fatigue crack growth in metal provides explicit information about crack initiation, growth and behavior which predicts fatigue life of mechanical components. The most common method used to model microstructure are Voronoi tessellation method and the image processing technique [6-8] and the most preferable microstructure approach for theoretical analysis/simulation is the Voronoi tessellation approach [4,9]. It is observed the continuum damage mechanics based methodology is better for fatigue fracture analysis because there is no need to assume a certain crack length initially [10-12]. A novel damage constitutive model was employed to calculate the damage accumulation by considering the effect of stress triaxiality [13,14]. In previous research, the effect of microstructural parameters (average grain size, grain boundary thickness, etc.) was not considered for fatigue crack growth analysis, only the effect of geometric and loading conditions was considered [15,16].

In this paper, the effect of microstructural parameters (average grain size and grain boundary thickness) and material constant are presented on fatigue crack growth and the crack initiation life. The fatigue life cycle is estimated in compact tension specimen.

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GREEN ENERGY FOR ENVIRONMENTAL SUSTAINABILITY

Efficient solar drying techniques: a review

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Abstract
In the absence of effective drying techniques, a lot of food gets wasted as there is a lack of post-harvest processes. In India, most of the agricultural produces like paddy, maize, wheat, corn, oil seeds, pulses, chillies, etc. require a temperature range of 50–80 °C for effective drying. Hence, in these conditions, solar drying techniques seem to be the most economical; also, it is safe and eco-friendly. Various types of solar dryers are used across India and worldwide; these are direct solar dryer, green house dryer and indirect solar dryer. Nowadays, indirect type solar dryers are most commonly used because of their several advantages over direct solar dryers. In case of indirect type solar dryers, the products to be dried are kept inside a separate compartment known as drying chamber. Hot air is obtained from the solar collectors either by direct heating method or by using a secondary heating medium and then supplied to the drying chamber for heating of the products. This paper presents a detailed review of various innovative designs of indirect type solar dryers and compares the performance of different types of dryer configuration in terms of collector efficiency, dryer efficiency, drying time and maximum air temperature. Also, the effects of various operating parameters on the thermal performance of such dryers have been discussed.

Keywords Solar drying · Indirect solar drying · Drying techniques · Agriculture product drying

Introduction

The quest for developing efficient methods to harness the maximum potential of renewable energy sources is the need of the hour. Decades ago, the drawbacks and shortcomings of non-renewable energy sources have been identified and acknowledged worldwide, and since then researchers across the world are looking for potential alternates. Among the several options available, solar energy has been recognized as the best alternate energy source due to several advantageous reasons, such as it is clean, cheap and available in abundance without any environmental impacts. Solar energy is now being used in various applications that can be divided into two major groups according to the method of energy collection and its use; those are (i) solar thermal energy where solar radiation energy is collected in the form of heat using collectors, and later on it is used for several applications such as water heating, space heating, cooling and ventilation, cooking, process heat, water treatment, etc. and (ii) solar electricity generation where solar energy is directly converted into electricity by means of a photovoltaic cell. One of the many applications of former group where solar thermal energy is used as a heat source is drying of various agriculture and industrial products.

Sun drying is still the most common method being used to preserve and store the agricultural products in many countries around the world. As adequate food preservation methods are not available, farmers have to spread their products to be dried in thin layers on open grounds or on mats where they are exposed to sun and wind. Mahesh et al. (2012) reported that significant losses may occur during natural sun drying because of various influences, such as rodents, birds, insects, rain, storms and microorganisms. The quality of the dried products by the open sun drying may also be degraded

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Modeling the predictive values of ultimate tensile strength in welded joint by response surface methodology

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Abstract

Strength always remains the prime requirement of any produced products, which normally explicate the capability of the products to sustain stress into it. Ultimate tensile strength is principally used to clarify the maximum values of stress, which can be resist by any product or material entity before breaking. Accordingly, study is conducted to verify the methodological way of determining the predictive values of ultimate tensile strength in welded joint. Response surface methodology is used in present study to grace decision results. In present study, the Metal Inert Gas (MIG) welding process is experimentally performed in mild steel plate specimens by considering three distinguish values of welding current, voltage and plate thickness. The objective of the study is to enroll the predictive equation to assists in deriving the elevated values of ultimate strength of the welded joint. The primary objective of present study is to demonstrate the utilization of competent structure of Response surface methodology under the dimensional arena of welding process. Here, the authors devised equation, which competently possess caliber to define the predicted values of ultimate tensile strength for the precise values of process parameter. The same assist in precisely understanding the behavior of ultimate tensile strength (dependent variable) under the influence of independent variables i.e. welding current, voltage and plate thickness. Response surface methodology is used and experiments based on Box-Behnken Design a

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ABSTRACT

Strength always remains the prime requirement of any produced products, which normally explicate the capability of the products to sustain stress into it. Ultimate tensile strength is principally used to clarify the maximum values of stress, which can be resist by any product or material entity before breaking. Accordingly, study is conducted to verify the methodological way of determining the predictive values of ultimate tensile strength in welded joint. Response surface methodology is used in present study to grace decision results. In present study, the Metal Inert Gas (MIG) welding process is experimentally performed in mild steel plate specimens by considering three distinguish values of welding current, voltage and plate thickness. The objective of the study is to enroll the predictive equation to assists in deriving the elevated values of ultimate strength of the welded joint. The primary objective of present study is to demonstrate the utilization of competent structure of Response surface methodology under the dimensional arena of welding process. Here, the authors devised equation, which competently possess caliber to define the predicted values of ultimate tensile strength for the precise values of process parameter. The same assist in precisely understanding the behavior of ultimate tensile strength (dependent variable) under the influence of independent variables i.e. welding current, voltage and plate thickness. Response surface methodology is used and experiments based on Box-Behnken Design are performed in present study. The work is supported by MINITAB software for generating graphs and originating driving equation between response and process parameters. The predictive values are determined based on multiple regression equation and compared with actual experimental values to demonstrate capability and applicability.

Selection and peer-review under responsibility of the scientific committee of Material TECH 2021.

1. Introduction

The strength is always considered as a major parameter for highlighting the quality of the material or product. In present study, the authors worked in the direction of appraising ultimate tensile strength by devising the predictive modeling equations using RSM. RSM is normally a predictive modeling technique that can be used for formulating the response equation [1]. Here, the authors considered welding current, voltage and plate thickness as independent parameters and the ultimate tensile strength as a dependent parameter for generating response equations. It is found that Pai et al. [2] optimize the machining parameters and investigated the effects of these parameters on surface roughness in grinding 6061Al-SiC25P (MMCs) specimen by RSM. Aggarwal et al. [3] utilized RSM to investigate the effects of cutting speed, feed rate, depth of cut, nose radius and cutting environment in CNC turning of AISI P-20 tool steel. Philip et al. [4] used RSM to study the effects of the machining parameters such as spindle speed, feed rate & depth of cut on surface roughness of duplex stainless steel in end milling operation. Sahin and Motorcu [5] used RSM in turning of mild steel using coated carbide tools. They developed model using cutting speed, feed rate and depth of cut as input parameters. Arbizu and Perez [6] developed RSM models to determine surface quality of parts obtained through turning processes. Ozel and Karpat [7] utilized neural network modeling to predict surface roughness and tool wear of flank for varieties of cutting conditions in turning process. They developed Regression models

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A novel integrated computational $TR_IF_MR_G$ approach with grey relational analysis toward parametric evaluation of weld bead geometry of ms-grade: IS 2062

Xiaohui Guo, Atul kumar Sahu, Nitin Kumar Sahu, Anoop Kumar Sahu

Grey Systems: Theory and Application

ISSN: 2043-9377 (International Standard Serial Number.)

Article publication date: 1 March 2021

Abstract

Purpose

In the presented research work, the authors fabricated the multiple MS plate (Grade: IS 2062) specimens and applied a novel integrated computational $TR_IF_MR_G$ approach with grey relational analysis (GRA) toward solving weld bead optimization problem in MIG welding procedure. The objective of research is to determine the optimum setting between MIG welding input process parameters, e.g. welding current, open circuit voltage and thickness of plate in attaining high tensile strength with weld bead geometry quality characteristics, e.g. bead width, reinforcement, penetration and dilution in investigating define MS specimens.

Design/methodology/approach

The Taguchi's L_9 orthogonal array (OA) design is respected to conduct the experiments on MS plate specimens to attain output objectives. Later, the evaluated multiple output objectives are transformed into single response by applying a novel integrated computational $TR_IF_MR_G$ approach with GRA. Thereafter, the outset of signal-to-noise ratio (S/N ratio) accompanied by ANOVA (Analysis of variance) is explored to optimize objective function.

Findings

The computed results are confirmed by conducting the experiments on same identical specimens. The outcome of the confirmation tests yielded an improvement of 0.24454, 0.372486, 0.686635 and 0.4106846 in grey relational grade (GRG), overall ratio index, reference grade and full multiplicative index, respectively, after validating the results.

Originality/value

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Originality/value

Modeling barriers of digital manufacturing in a circular economy for enhancing sustainability

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Abstract

Purpose – Circular economy denotes future sustainability that allows optimum utilization of resources. In the present era of technology, plenty of innovations are happening across the world, and digital manufacturing is one of such innovations. However, there are several barriers which are impeding adoption of digital manufacturing in circular economy environment. The study explores the barriers of digital manufacturing initiatives in a circular economy and develops a methodological model to prioritize the identified challenges for automotive parts manufacturing industry.

Design/methodology/approach – Seven categories of challenges namely process, human resources, financial, collaboration, technological, security and leadership challenges were identified from literature and further validated with subsequent discussions with experts from the industry. The study is conducted in two phases, where in the first phase, the Decision-Making Trial and Evaluation Laboratory (DEMATEL) technique is used to define the priority and importance of seven categories of challenges. In second phase, the barriers are ranked using a Fuzzy Performance Important Index (FPII), taking into account contextual factors associated with the challenges and linked barriers, to determine the extent to which they impede the adoption of digital manufacturing in the sample automotive parts manufacturing company.

Findings – The "risk of data security and information privacy in connection with use of external data and protecting customer data" appeared as the most significant barrier to digital manufacturing in circular economy. Furthermore, technological challenges emerged as the most significant category of challenges followed by financial challenges in adoption of digital manufacturing in circular economy.

Practical implications – Identification of the identified barriers and understanding the interrelationships will lead to easier adoption of digital manufacturing in circular economy.

Originality/value – Despite all the potential benefits of implementing Industry 4.0 technologies in manufacturing industries, the adoption thereof is still in nascent phase with significant challenges yet to be overcome to accelerate the pace of adoption. Hence, this study explores the barriers preventing companies from adopting and benefiting from digital manufacturing initiatives and further develops a methodological model.

Keywords Circular economy, Industry 4.0, Digital manufacturing, DEMATEL, Sustainability

Paper type Research paper

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Modeling barriers of digital manufacturing in a circular economy for enhancing sustainability

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Paper type Research paper

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"A conceptual four-stage maturity model of a firm's green manufacturing technology alternatives and performance measures"

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Abstract

Purpose – This paper develops a contingency based model to understand how green technologies and green manufacturing performance measures evolve with the green manufacturing maturity levels of the firms.
Design/methodology/approach – A conceptual research model is developed by synthesizing extant literature. An illustrative case study of a paint manufacturing company is conducted, analyzing its five key green initiatives, which it has undertaken to demonstrate the research model. The primary means of data collection was interviews and document analysis.
Findings – It was observed that for all the five green initiatives, the choice of green technologies and the use of green manufacturing performance measures corroborate with the proposed research model. Further, the initial green manufacturing effort was motivated to comply with regulations, which subsequently shifted to gain strategic advantage, such as cost reduction and visibility.
Research limitations/implications – The proposed model was applied only to an Indian paint manufacturing company with their five key green initiatives, which potentially limits the generalizability of the findings to other industries and/or geographies.
Practical implications – The findings would aid practitioners in understanding both selection of green technology and the use of green manufacturing performance measures, based on a firm's maturity stage.
Originality/value – This study conducts a much-needed research on the evolution of green technology alternatives and green manufacturing performance measures for firms according to the four-stage maturity model derived from the natural resourced-based view.

Keywords Green manufacturing maturity stage, Green technology, Green manufacturing performance measures, Research model, Natural resource-based view of the firm
Paper type Research paper

1. Introduction

Manufacturing has been playing a pivotal role in generating employment and improving national economies ever since the industrial revolution (Islam and Karim, 2011; Duflou *et al.*, 2012; Shukla and Adil, 2021). This trend is likely to continue due to an increased demand of goods by the world's ever-growing population (Eastwood and Haapala, 2015; Ghadimi *et al.*, 2020). Nonetheless, advancements in the manufacturing sector have had its adverse effects on our planet in the form of global warming, resource depletion and local waste disposal and related catastrophes (Sangwan, 2011; Famiyeh *et al.*, 2018). More than mining, oil and gas, agriculture or other such activities, manufacturing has been accountable for over 50% of solid waste produced all over the world (Hill and Symmonds, 2011). Moreover, manufacturing companies are responsible for 20.2% of water removal from land (Gavronski *et al.*, 2012;

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Research article

"A four-stage maturity model of green manufacturing orientation with an illustrative case study"

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ABSTRACT

Maturity models describe a process or an activity's characteristics at different stages, which generally evolve from an initial stage to a more advanced stage. Notably, most maturity models in green manufacturing (GM) do not clearly define and characterize the maturity stages, and are also not empirically validated. Therefore, this study considers four discrete maturity stages of GM, viz., I. compliance driven; II. eco-opportunist; III. green innovator and IV. green manufacturing evangelist, based on drivers for proactiveness towards greenness. It defines a construct "green manufacturing orientation" and develops a maturity stage model for green manufacturing orientation following a two-stage methodology. In the first stage, a conceptual model is developed by analyzing extant literature which fills an important research gap in literature. In the second stage, a case study is used to illustrate the application of this proposed conceptual model through eight key green initiatives that have been carried out. It was observed that the case firm, over a period of time moved to a higher level of GM maturity. Moreover, there was also a progressive trend in the firm's GM orientation. However, a uniform enhancement of GM orientation was not witnessed in the case.

1. Introduction

Manufacturing is an important sector in the world economy. The sector largely produces goods, and supports several industrial segments, such as retail, construction, transportation and utilities. However, manufacturing firms have been causing significant harm to the natural environment throughout different phases of their transformational journey that comprise the manufacturing cycle for goods (Chuang and Yung, 2014; Mangla et al., 2015). These in turn are associated with the extraction of raw materials, use of water and energy, air emissions in the manufacturing processes, cargo transportation, as well as various environmental impacts generated during the use of products vis a vis their random disposal by consumers (Govindan et al., 2014). A growing awareness of the threats associated with the deterioration of the natural environment has developed an added interest in tracking the negative consequences of manufacturing (Claver et al., 2007; Ormazabal et al., 2016; Yin et al., 2020). As a solution towards this problem, Green Manufacturing (GM) was introduced; it strives for renewing production processes, while establishing environment-friendly operations within the manufacturing field (Baah et al., 2020). Manufacturing firms have been trying to implement GM actions at a more fundamental level in order to comply with various environmental regulations (Bansal and Roth, 2000; Claver et al., 2007; Tsai et al., 2013). Additionally, businesses that are self-motivated to be socially responsible do tend to consider GM on their own, based on their respective awareness of environmental deterioration that has been triggered by their predecessors and/or their past activities (Angell and Klassen, 1999; Claver et al., 2007; Jabbour et al., 2014). In recent times, customers have been demanding products and services that minimize environmental impact (Abarca, 2001; Bastas and Liyanage, 2019; Fernando and Wah, 2017; Jabbour et al., 2014). Such pressures from different stakeholders have had great influence on a firm's environmental orientation (Kolk and Mauser, 2002; Gonzalez-Benito and Gonzalez-Benito, 2006; Bremmers et al., 2007; Jabbour, 2010; Sellitto et al., 2020). Extant literature has enumerated a range of possible positions that a firm can take against stakeholders' pressures as regards environmental issues, extending from the most reactive (or even unresponsive) to the most proactive stances, thereby giving rise to the notion of evolutionary maturity stage models (see for instance, Kolk and Mauser, 2002; Azzone and Noci, 1998; Jeswani et al., 2008; Jabbour et al., 2014; Ormazabal et al., 2016; Potrich et al., 2019).

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A maturity stage model to explore repercussions of green manufacturing for manufacturing strategy decision areas

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Abstract

Purpose – The researchers maintain that when a firm tackles "green concerns," there could be several repercussions for manufacturing strategy decision areas (MS DAs). However, such repercussions are complex and have not been widely researched. This paper aims to propose a conceptual maturity stage model to study the configuration of MS DAs.

Design/methodology/approach – Firms exhibit different levels of "green" maturity in their journey and tend to make different choices in green technologies (GTs), resulting thereby in other compatible choices in their MS DAs. Extant literature has been synthesized in this light to build a conceptual maturity stage model in two steps. First, what is the GT that is involved! The second step discusses the possible implications of such a GT for MS DAs. Further, such information is organized according to a firm's four maturity stages for all GTs that may be applicable. A case study has been undertaken to illustrate the model.

Findings – The results show good potential for the proposed conceptual model to examine the repercussions of MS DAs in industrial cases, and thereby develop relevant theories on this subject.

Research limitations/implications – The proposed model was applied to a paint manufacturing company, which potentially limits the findings' generalizability to other industries and/or geographies.

Practical implications – The proposed conceptual model can help managers assess the maturity stages of manufacturing to determine suitable adjustments that may be required in configuring MS DAs to improve their positions.

Originality/value – This is among the very few models to explore the repercussions of green manufacturing for MS DAs according to the four-stage maturity model.

Keywords Green manufacturing, Case study, Production and operations management, Green technology, Green manufacturing maturity stage, Manufacturing strategy decision area, Manufacturing strategy model

Paper type Research paper

1. Introduction

Manufacturing plays a vital role in society's economic progress. Nonetheless, it also contributes to serious environmental problems, such as unrestricted consumption of non-renewable energy, over-exploitation of renewable resources, land and water pollution, wastes and greenhouse gas (GHG) emission (Lee, 2009; Duflou *et al.*, 2012; Shukla and Adil, 2021a). The scarcity of natural resources, along with the negative environmental effect of manufacturing and growing concerns of stakeholders for green issues have compelled firms

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Design of Novel ETL Model to Analyse Corona Virus Data

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Abstract

INTRODUCTION:
The corona disease was first recognized in 2019 in Wuhan, which is the capital of China's Hubei-province, and from then it continued spreading and as a result declared as a pandemic by all nations. The COVID-19 virus has different effects on people in various ways. It is a kind of respiratory disease. The confirmed cases are increasing day to day in India, which leads to complete lockdown throughout the nation.
OBJECTIVE:
The objective of this research is to design a novel Extract-Trandform and Load NETL model to analyse covid-19 data in india.
METHODS:
The extraction of useful information from a large database is a well-connected research field of text mining. This paper is proposed a novel extract-transform-load ETL model to process the COVID-19 data of India to get the exact recovery data from the multiple data sources from different states of India. In this, a knowledge-based model that generate knowledge based on three different module split, validation, and join is discussed.
RESULTS:
The outcomes of the proposed NETL process are, output file which has the description of total positive cases, active cases, recovery cases, and death rate, based on different regions. The analysis of NETL is done based on accuracy, failure count, and execution time. The proposed NETL process is more accurate and taking less compilation time with minimum failure count as compared with existing models.
CONCLUSION:
To analyze the coronavirus data in India, a novel ETL (NETL) model is proposed. In this model, a total of 9 CSV files is processed as input files to get different results in different categories. This model is having three modules namely splitting, verification, and join. The dataset is split into based on its coupling attributes and then joined with a single value to produce the updated results as per the current dataset. The last stage of this process is to join the data which is generated through splitting. The proposed NETL model is more accurate as compared with existing ETM models.

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Keywords: Corona Virus, Text Mining, Data Analytics, ETL, Covid-19, Pandemic.

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1. Introduction

Self-information extraction is consistently been a significant application and research area since the origin of digital records. Therefore, classification and clustering of text is a need because of the extremely huge measure of content archives that we need to manage in day to day life. All in all, content order incorporates the text characterization based on topic, keyword, and cluster which have common properties. Moreover, text mining is a technique in which a document is classified under some predefined

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Impact of Particle Packing Method of Design Mix on Fracture Behavior of Concrete: Critical Analysis

Subhasis Pradhan[1]; Shailendra Kumar, Ph.D.[2]; and Sudhirkumar V. Barai, Ph.D.[3]

Abstract: This paper discusses the effect of the particle packing method (PPM) of mix design on the fracture behavior of concrete. A three-point bending (TPB) test was performed on single-edge notched beam for three different sizes. The fracture energy is estimated from the load (P)–crack mouth opening displacement (CMOD) relationship obtained from the TPB test. By truncating the end of the P–CMOD curve at different lengths, the sensitivity of fracture energy is analyzed, and eventually it is recommended to be at 2% of the depth of the beam. The fracture toughness parameters are calculated analytically using a double-*K* fracture model. The size effect on the fracture energy and fracture toughness parameters is studied. The PPM mix design provides improved fracture energy and fracture toughness parameters of concrete with respect to the conventional mix design approach. **DOI: 10.1061/(ASCE)MT.1943-5533.0003138.** © *2020 American Society of Civil Engineers.*

Introduction

Compressive strength and tensile strength are the accepted criteria to quantify the quality of concrete. However, these mechanical parameters of concrete are not the explicit measure of its performance in structural elements. This anomaly in performance is attributed to the variations in size and shape of the structure, statistical size effect on the quantity of microcracks, and interaction of concrete with the reinforcement. In this aspect, the fracture properties of concrete provide a better alternative for evaluating the performance parameters of a concrete structure.

Several experimental investigations have been performed by researchers across the globe to examine the fracture behavior of concrete. Hillerborg et al. (1976) propounded the fictitious crack model to encompass the response of plain concrete. Furthermore, in subsequent years Bažant and Oh (1983) and Lubliner et al. (1989) proposed the crack band model (CBM) and plastic damage model, respectively, to emulate the fracture behavior of plain concrete. Basically, in the aforementioned methods the researchers modelled the softening curve, which is governed by the true fracture energy (G_F) and size effect fracture energy (G_f) of concrete (Lee and Lopez 2014). Furthermore, Jenq and Shah (1985a, b) proposed a two-parameter fracture model by applying the modified linear elastic fracture mechanics concept, and the size-effect model by Bažant and Kazemi (1990), effective crack model by Karihaloo and Nallathambi (1989, 1990), and double-*K* fracture model by Xu and Reinhardt (1999a, b; 2000) were postulated to emulate the nonlinear fracture behavior of concrete or cementitious materials. In the process of complete fracture of concrete, three distinct stages—crack initiation, stable crack propagation, and unstable fracture—can be identified. In this context, the double-*K* fracture model describes all three important stages seen in the fracture process of concrete (Kumar et al. 2013; Kumar and Barai 2008; Lee and Lopez 2014).

RILEM TC 50-FMC (1985) recommended the three-point bending (TPB) test to estimate the fracture energy of concrete, and the suitability of this method was also confirmed by Hillerborg (1985a). It is theorized based on the total work-of-fracture principle of single-edge notched (SEN) beams in a TPB test configuration to evaluate tensile fracture. The TPB test of a SEN concrete beam specimen is widely used to assess the fracture energy and fracture parameters.

The fracture energy and critical stress intensity factor (SIF) are the representation of the fracture behavior of concrete. In addition to the size and shape of a specimen, these fracture parameters are also influenced by the type, size, and shape of the aggregate and mix proportion of the concrete. Bažant and Yu (2011) confirmed the necessity of a size effect study and recommended testing different sized concrete specimens owing to alike cohesive softening law. The asymptotic extension of the tail of the load (P)–crack mouth opening displacement (CMOD) curve (Petersson 1981; Planas et al. 1992) affects the true fracture energy (G_F) of concrete because of its dependence on the selection of the end point of the experimental P–CMOD curve. However, in previous studies, in-depth analysis on the determination of P–CMOD curve end points for different sized SEN concrete beams was not carried out.

The preceding discussion on the advances and shortcomings of the prevailing practices (concrete preparation and testing and analysis of results) necessitates addressing the following points while estimating the fracture toughness parameters of concrete. The fracture toughness parameters of concrete distinctly depend on its quality. Voids and microcracks are the obvious controlling factors of the quality of concrete in addition to the water-to-cement (w/c) ratio (Wittmann et al. 1987), aggregate shape and size (Elices and Rocco 2008), aggregate content (Amparano et al. 2000), and aggregate distribution (Siregar et al. 2017). The void content and size can be minimized by proper packing of aggregates of different sizes and appropriate compaction of fresh concrete. In this connection, the particle packing method (PPM) was proposed to minimize the void content in concrete, and improved mechanical performance was observed (Pradhan et al. 2017). The improved tensile strength of

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MEASUREMENT OF TRAFFIC CONGESTION FOR INDORE

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ABSTRACT

Traffic congestion is caused due to an imbalance of transportation demand and supply. Traffic congestion is not only responsible for harming our health but also for not gaining full potential in our economic sector. Traffic congestion is an obstacle to the development of any country as it creates a huge amount of economic costs, discomfort cost, and alike. In the current scenario Indore city also prevails such a condition, some intersections of the city are badly affected by traffic congestion which causes potential hazard and delays so traffic congestion study is much needed at some potential road intersections. Several parameters like segmental delay, delay ratio, and relative delay ratio have been used to effectively measure traffic congestion at some potential sections taken for 6 locations. A model developed for segmental delay (Vehicle-second), segmental delay (person-second), delay rate, and relative delay Rate.

KEYWORDS

Segmental delay, Delay rate, Relative Ddelay rate, Traffic congestion

INTRODUCTION

Transportation contributes to the social, economic, industrial, and cultural development of any country. Every product whether it is food, medicine, clothes, industrial items, or other essential commodities needs transport facility at all stages to get supply thoroughly throughout the country, which in term helps the country to uplift its economy and development hand to hand.

But in recent years, the usage of transportation facilities has been increased drastically. Many of the cities experiencing a huge number of traffic flow which leads to a system break down in some cases, in talking about India, considerable numbers of cities facing a huge transportation management problem, as a result, the movement of vehicle, speed characteristics have been observed not up to the mark.

Due to incessant increase in population, increase in household incomes and its resultant increase in the level of car usage coupled with poor land-use planning, poor transport design and planning. In urban areas, the problem of traffic is observed in road intersections for most of the cases [5]. Road intersections consist of too many actual and potential conflict points [4]. This is because at intersections, vehicular flows from several directions approaches making either left-turn, through and right-turn movements seek to occupy the same physical space at the same time. In addition to these vehicular flows, pedestrians also seek to use this space to cross the street and thereby worsening the already bad traffic situation.

Traffic congestion is the result of the gap between transportation demand and supply [2]. It may be said that traffic jam is killing our time only but that will be wrong. Traffic congestion can be held responsible not only for harming our health but also for not gaining full potential in our economic sector [1]. The transportation system has now become the spider that is sitting in the

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RESEARCH ARTICLE

Understanding the behavior of recycled aggregate concrete by using thermogravimetric analysis

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ABSTRACT The physio-chemical changes in concrete mixes due to different coarse aggregate (natural coarse aggregate and recycled coarse aggregate (RCA)) and mix design methods (conventional method and Particle Packing Method (PPM)) are studied using thermogravimetric analysis of the hydrated cement paste. A method is proposed to estimate the degree of hydration (α) from chemically bound water (W_B). The PPM mix designed concrete mixes exhibit lower α. Recycled aggregate concrete (RAC) mixes exhibit higher and α after 7 d of curing, contrary to that after 28 and 90 d. The chemically bound water at infinite time ($W_{B\infty}$) of RAC mixes are lower than the respective conventional concrete mixes. The lower $W_{B\infty}$, $Ca(OH)_2$ bound water, free $Ca(OH)_2$ content and FT-IR analysis substantiate the use of pozzolanic cement in the parent concrete of RCA. The compressive strength of concrete and α cannot be correlated for concrete mixes with different aggregate type and mix design method as the present study confirms that the degree of hydration is not the only parameter which governs the macro-mechanical properties of concrete. In this regard, further study on the influence of interfacial transition zone, voids content and aggregate quality on macro-mechanical properties of concrete is needed.

KEYWORDS recycled aggregate concrete, Particle Packing Method, thermogravimetric analysis, chemically bound water, degree of hydration, Fourier transform infrared spectroscopy

1 Introduction

Concrete is the second most-consumed material in the world and aggregates occupy about 70%–80% of its total volume. This causes the rapid exhaustion of non-renewable natural resources. The construction activities also produce construction and demolition (C&D) waste in abundance. The bulk amount of C&D waste is waste concrete. The waste concrete is considered as a source to recycle and extract qualified aggregates, which can be used as a new raw material for concrete production. However, the earlier investigations [1–5] substantiated the influence of inferior quality of recycled coarse aggregate (RCA) on the macro-mechanical properties of recycled aggregate concrete (RAC). Hence, it is required to study the influence of micro-level characteristics on the macro-level performance. The present paper discusses the effect of RCA on the degree of hydration of cement in RAC and its relationship with the mechanical properties of the prepared concrete.

The four major compounds present in ordinary Portland cement (OPC) are tricalcium silicate (C_3S), dicalcium silicate (C_2S), tricalcium aluminate (C_3A), and tetracalcium aluminoferrite (C_4AF). The hydration products of these compounds are the bridging units between the aggregates, as well as the strength contributors. The chemical compounds formed as a result of hydration reactions in concrete at the microstructure level can be examined by thermogravimetric analysis (TGA). The TGA technique measures the mass loss due to the decomposition of hydration products, such as ettringite, calcium silicate hydrate (CSH), calcium hydroxide (CH) and carbonated calcium hydroxide. The measured mass loss is due to the decomposition of chemically bound water (W_B) present in the hydration products. The extent of hydration can be

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Influence of brick dust, stone dust, and recycled fine aggregate on properties of natural and recycled aggregate concrete

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Abstract

The brick, stone, and construction industries produces huge quantities of non-biodegradable waste materials and incorporation of such waste materials in concrete eventually leads to the green and sustainable construction. The present paper study the effect of partial substitution of brick dust (BD), stone dust (SD), and recycled fine aggregate (RFA) as fine aggregate on the properties of natural aggregate concrete (NAC) and recycled aggregate concrete (RAC). In the present investigation, two groups of mixes were considered: Group A consists of 100% natural coarse aggregate (NCA) and group B consists of 50% NCA and 50% recycled coarse aggregate. In each group, the natural fine aggregate was partially replaced with 30% BD, 30% SD, and 30% RFA separately. All mixes were designed for M25 grade concrete with a constant w/c ratio of 0.45. The properties viz. compressive strength, density, indirect tensile strength, water absorption, ultrasonic pulse velocity of all mixes was performed. Also, durability performance of all the mixes under acid conditions viz.: HCl and H_2SO_4 solutions were studied. From the results it was found that the compressive strength and split tensile strengths (27.95–23.23%) of both natural and recycled aggregate concrete were significantly increased with the partial substitution of SD. Also, the results reveal that the water absorption decreased by 57.14–69.64% and 4.67–34.67%, respectively, when the replacement of NFA with BD and SD in both NAC and RAC. Both natural and recycled aggregate concrete were more susceptible for H_2SO_4 than HCl acid in terms of loss of weight and compressive strength.

Abbreviations: BD, brick dust; BIS, Bureau of Indian Standards; C&DW, construction and demolition waste; CH, calcium hydroxide; GCW, granite cutting waste; GD, granite dust; ITZ, interfacial transition zone; NAC, natural aggregate concrete; NCA, natural coarse aggregate; NFA, natural fine aggregate; PPC, Portland Pozzolana Cement; RAC, recycled aggregate concretes; RCA, recycled coarse aggregate; RFA, recycled fine aggregate; SD, stone dust; UPV, ultrasonic pulse velocity.

Discussion on this paper must be submitted within two months of the print publication. The discussion will then be published in print, along with the authors' closure, if any, approximately nine months after the print publication.

Alkali-Activated Slag/ Fly Ash Concrete: Mechanism, Properties, Hydration Product and Curing Temperature

Sonal Banchhor, Meena Murmu, Shirish V. Deo

Abstract*: Alkali-activated concrete (AAC) is mounting as a feasible alternative to OPC assimilated to reduce greenhouse gas emanated during the production of OPC. Use of pozzolana results in gel over-strengthening and fabricate less quantity of $Ca(OH)_2$ which provide confrontation to concrete against hostile environment. (AAC) is potential due to inheriting the property of disbursing CO_2 instantly from the composition. Contrastingly an option to ordinary Portland cement (OPC), keeping this fact in mind the goal to evacuate CO_2 emits and beneficiate industrial by-products into building material have been taken into consideration. Production of alkali-activated cement emanates CO_2 nearly 50-80% less than OPC. This paper is the general assessment of current report on the fresh and hardened properties of alkali-activated fly ash (AAF), alkali-activated slag (AAS), and alkali activated slag and fly ash (AASF) concrete. In the recent epoch, there has been a progression to blend slag with fly ash to fabricate ambient cured alkali-activated concrete. Along with that the factors like environmental friendliness, advanced studies and investigation are also mandatorily required on the alkali activated slag and fly ash concrete. In this way, the slag to fly ash proportion impacts the essential properties and practical design of AAC. This discusses and reports the issue in an intensive manner in the following sections. This will entail providing a good considerate of the following virtues like workability, compressive strength, tensile strength, durability issues, ambient and elevated-temperature curing of AAC which will improve further investigation to elaborate the correct test methods and to commercialize it.

Keywords: Fly ash, Slag, Alkali activator, Workability, Strength, Durability, Hydration Product, Curing temperature.

I. INTRODUCTION

The plunking of pozzolana is an environmental problem. Slag and Fly Ash (FA) are conventionally utilized binder to augment the workability, strength and durability properties. These industrial by-products FA, Slag with the partial replacement of OPC has been extensively utilized and resulted not merely in enhanced sustainability and environmental friendliness additionally improved the mechanical properties, durability and rheology. The auxiliary ratio is 15 to 25% for FA to total cementitious material and the replacement ratio for Slag is 50–70% [1, 2]. AAC utilizes industrial by-products as binders comprising silica and alumina, alkali activators for activating the binders and fine and coarse aggregates, later cured under apposite conditions [3]. Production of alkali-activated cement emanates CO_2 nearly 50-80% less than OPC [4]. Class F (low calcium) and Class C (high calcium) FA system are two major subclasses [5]. Researches on AAC illustrates that workability depends on fineness, the composition of raw material, alkaline concentration and activator modulus. It is investigated that durability properties like permeability, water sorption, carbonation of AAC can be enhanced by proper mix design [6]. The key features of AAF are low shrinkage, high acid and heat resistance [7] whereas those of AAS are rapid setting, high strength and fire resistance [8].

In AAC, the chemical and physical properties depend fundamentally on curing conditions and raw material. The AAC appraise in this article are composed of FA, Slag, and blend of FA and Slag, providing an assessment of research on the properties of AAC. Subsequent properties are discussed: workability, compressive strength, tensile strength, durability properties, ambient and elevated-temperature curing.

This comprehensive survey will entail providing a good considerate of the following virtues like workability, compressive strength, tensile strength, durability issues, ambient and elevated-temperature curing of AAC which will improve further investigation to elaborate the correct test methods and to commercialize it.

II. MATERIALS

A unanimous term applied to the reaction between solid aluminosilicate and activator, to fabricate a solidified binder based on hydrous alkali-aluminosilicate is Alkali activation (termed as ‘precursor’). These definitions ensue to include Slag, FA and alkali activator [9].

A Fly Ash: It is a by-product of coal-fired electric generating plants. Its particles are spherical and steadily finer than OPC, its diameter ranges from 1µm – 150µm and its size is exaggerated by the type of dust collection system [10]. The strength and additional properties depend upon the chemical composition and fineness of source material in AAC [11]. The mass ratio of SiO_2 and Al_2O_3 in class F fly ash is in the range of 1.7-4.0 while the amorphous content is generally more than 50 % [12]. (Class F) FA has a cleaner surface in contrast to (class C) FA due to the absence of alkalis and sulphates ions [13].

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COMPARATIVE ANALYSIS OF ROAD ACCIDENT SCENARIO IN PAST TWO DECADE: A CASE STUDY OF INDORE-KHALGHAT ROAD



H.S. Goliya[1] Kundan Meshram[2] Shravan Namdev[3]

ABSTRACT

Now-a-days, road accident is not just a traffic problem but it became a social cause which needs an attention for its remedial measure. Road accident results in the heavy monetary loss and human loss which at last effect the growth of nation. Numerous research have been done in past on the analysis methods of road accident and those literature concluded the effect of various elements on road accident and also suggested the remedial measure as per the need of location and black-spot. In the present study, road selected for study purpose is Indore-Khalghat. It is one of the major accident prone roads and formerly it was a part of NH-3 running from Agra to Bombay (AB) but at present this section is the part of Asian highway development program and designated as AH-47 running from Agra to Bangalore. The collected data is distributed on the various parameters to evaluate trend of accident, effect of route change, and effect of change in geometric element. Identification of various black-spots on the basis of measure notified by the MORTH and it was found that there are in total 9 black-spots identified in the study area. These black-spots were evaluated and road geometry is checked to find out the cause of accident because remedial measure suggested. Accident rate, co-relation between different factors and economic evaluation of loss were calculated.

1. INTRODUCTION

With the passage of time, the vehicle volume kept on increasing with a growth rate no less than that of the growth rate of the human being. The existing roads are not sufficient enough to meet the demand for such a huge amount of heterogeneous traffic and massive increase in the number of heavy and speedy vehicle on the road. It give rise to a very unfavourable situation or it can say that one of the biggest traffic problem of all time which led to the massive assets loss, as well as loss of life, known as Road Accident.

This tragic economic and human loss needs the attention of a specialized person in the field of traffic engineering and road safety. They must not only evaluate the severity of the incident but also suggest some measure to tackle the problem in an efficient manner.

Normally there are many factors which lead to the scenario of accident some of them are inappropriate road user behaviour, improper vehicle condition, unscientific manner of traffic accident evaluation and investigation, lack of law body control over traffic, uneasy availability of the proper fast medical facility and inefficient traffic management planning. Road accident statics from various government and non-government institution show that around 70% of the road accident is due to the error performed by human and around 3-4% is because of the deficiencies in the road. Road accident is one of the biggest man-made tragedy which is even worse than any atomic or hydrogen bomb.

1.1 Global Scenario of Accident

Road accidents are not the case of one nation or an area specific problem but a universal scenario almost every country facing this devastating thing in some of the other face and different in the density and number of accident. It can be estimated that more than 1.35 million deaths and

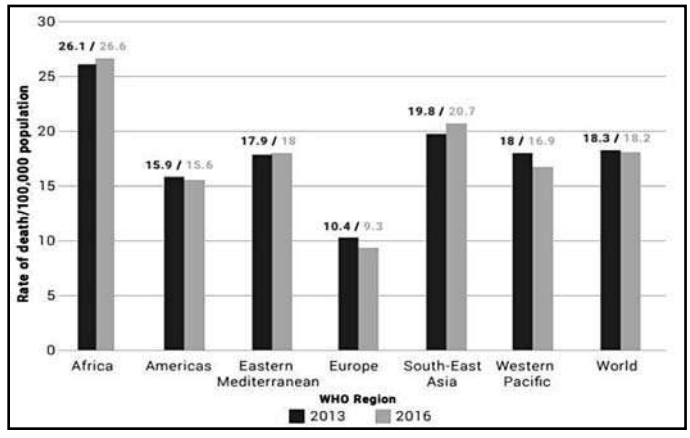

Fig.1 Rates of road traffic death (Global Status Report on Road Safety 2018)

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Impact of Particle Packing Method of Design Mix on Fracture Behavior of Concrete: Critical Analysis

Subhasis Pradhan[1]; Shailendra Kumar, Ph.D.[2]; and Sudhirkumar V. Barai, Ph.D.[3]

Abstract: This paper discusses the effect of the particle packing method (PPM) of mix design on the fracture behavior of concrete. A three-point bending (TPB) test was performed on single-edge notched beam for three different sizes. The fracture energy is estimated from the load (P)–crack mouth opening displacement (CMOD) relationship obtained from the TPB test. By truncating the end of the P–CMOD curve at different lengths, the sensitivity of fracture energy is analyzed, and eventually it is recommended to be at 2% of the depth of the beam. The fracture toughness parameters are calculated analytically using a double-*K* fracture model. The size effect on the fracture energy and fracture toughness parameters is studied. The PPM mix design provides improved fracture energy and fracture toughness parameters of concrete with respect to the conventional mix design approach. **DOI: 10.1061/(ASCE)MT.1943-5533.0003138.** © *2020 American Society of Civil Engineers.*

Introduction

Compressive strength and tensile strength are the accepted criteria to quantify the quality of concrete. However, these mechanical parameters of concrete are not the explicit measure of its performance in structural elements. This anomaly in performance is attributed to the variations in size and shape of the structure, statistical size effect on the quantity of microcracks, and interaction of concrete with the reinforcement. In this aspect, the fracture properties of concrete provide a better alternative for evaluating the performance parameters of a concrete structure.

Several experimental investigations have been performed by researchers across the globe to examine the fracture behavior of concrete. Hillerborg et al. (1976) propounded the fictitious crack model to encompass the response of plain concrete. Furthermore, in subsequent years Bažant and Oh (1983) and Lubliner et al. (1989) proposed the crack band model (CBM) and plastic damage model, respectively, to emulate the fracture behavior of plain concrete. Basically, in the aforementioned methods the researchers modelled the softening curve, which is governed by the true fracture energy (G_F) and size effect fracture energy (G_f) of concrete (Lee and Lopez 2014). Furthermore, Jenq and Shah (1985a, b) proposed a two-parameter fracture model by applying the modified linear elastic fracture mechanics concept, and the size-effect model by Bažant and Kazemi (1990), effective crack model by Karihaloo and Nallathambi (1989, 1990), and double-*K* fracture model by Xu and Reinhardt (1999a, b; 2000) were postulated to emulate the nonlinear fracture behavior of concrete or cementitious materials. In the process of complete fracture of concrete, three distinct stages—crack initiation, stable crack propagation, and unstable fracture—can be identified. In this context, the double-*K* fracture model describes all three important stages seen in the fracture process of concrete (Kumar et al. 2013; Kumar and Barai 2008; Lee and Lopez 2014).

RILEM TC 50-FMC (1985) recommended the three-point bending (TPB) test to estimate the fracture energy of concrete, and the suitability of this method was also confirmed by Hillerborg (1985a). It is theorized based on the total work-of-fracture principle of single-edge notched (SEN) beams in a TPB test configuration to evaluate tensile fracture. The TPB test of a SEN concrete beam specimen is widely used to assess the fracture energy and fracture parameters.

The fracture energy and critical stress intensity factor (SIF) are the representation of the fracture behavior of concrete. In addition to the size and shape of a specimen, these fracture parameters are also influenced by the type, size, and shape of the aggregate and mix proportion of the concrete. Bažant and Yu (2011) confirmed the necessity of a size effect study and recommended testing different sized concrete specimens owing to alike cohesive softening law. The asymptotic extension of the tail of the load (P)–crack mouth opening displacement (CMOD) curve (Petersson 1981; Planas et al. 1992) affects the true fracture energy (G_F) of concrete because of its dependence on the selection of the end point of the experimental P–CMOD curve. However, in previous studies, in-depth analysis on the determination of P–CMOD curve end points for different sized SEN concrete beams was not carried out.

The preceding discussion on the advances and shortcomings of the prevailing practices (concrete preparation and testing and analysis of results) necessitates addressing the following points while estimating the fracture toughness parameters of concrete. The fracture toughness parameters of concrete distinctly depend on its quality. Voids and microcracks are the obvious controlling factors of the quality of concrete in addition to the water-to-cement (w/c) ratio (Wittmann et al. 1987), aggregate shape and size (Elices and Rocco 2008), aggregate content (Amparano et al. 2000), and aggregate distribution (Siregar et al. 2017). The void content and size can be minimized by proper packing of aggregates of different sizes and appropriate compaction of fresh concrete. In this connection, the particle packing method (PPM) was proposed to minimize the void content in concrete, and improved mechanical performance was observed (Pradhan et al. 2017). The improved tensile strength of

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MEASUREMENT OF TRAFFIC CONGESTION FOR INDORE

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ABSTRACT

Traffic congestion is caused due to an imbalance of transportation demand and supply. Traffic congestion is not only responsible for harming our health but also for not gaining full potential in our economic sector. Traffic congestion is an obstacle to the development of any country as it creates a huge amount of economic costs, discomfort cost, and alike. In the current scenario Indore city also prevails such a condition, some intersections of the city are badly affected by traffic congestion which causes potential hazard and delays so traffic congestion study is much needed at some potential road intersections. Several parameters like segmental delay, delay ratio, and relative delay ratio have been used to effectively measure traffic congestion at some potential sections taken for 6 locations. A model developed for segmental delay (Vehicle-second), segmental delay (person-second), delay rate, and relative delay Rate.

KEYWORDS

Segmental delay, Delay rate, Relative Ddelay rate, Traffic congestion

INTRODUCTION

Transportation contributes to the social, economic, industrial, and cultural development of any country. Every product whether it is food, medicine, clothes, industrial items, or other essential commodities needs transport facility at all stages to get supply thoroughly throughout the country, which in term helps the country to uplift its economy and development hand to hand.

But in recent years, the usage of transportation facilities has been increased drastically. Many of the cities experiencing a huge number of traffic flow which leads to a system break down in some cases, in talking about India, considerable numbers of cities facing a huge transportation management problem, as a result, the movement of vehicle, speed characteristics have been observed not up to the mark.

Due to incessant increase in population, increase in household incomes and its resultant increase in the level of car usage coupled with poor land-use planning, poor transport design and planning. In urban areas, the problem of traffic is observed in road intersections for most of the cases [5]. Road intersections consist of too many actual and potential conflict points [4]. This is because at intersections, vehicular flows from several directions approaches making either left-turn, through and right-turn movements seek to occupy the same physical space at the same time. In addition to these vehicular flows, pedestrians also seek to use this space to cross the street and thereby worsening the already bad traffic situation.

Traffic congestion is the result of the gap between transportation demand and supply [2]. It may be said that traffic jam is killing our time only but that will be wrong. Traffic congestion can be held responsible not only for harming our health but also for not gaining full potential in our economic sector [1]. The transportation system has now become the spider that is sitting in the

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RESEARCH ARTICLE

Understanding the behavior of recycled aggregate concrete by using thermogravimetric analysis

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ABSTRACT The physio-chemical changes in concrete mixes due to different coarse aggregate (natural coarse aggregate and recycled coarse aggregate (RCA)) and mix design methods (conventional method and Particle Packing Method (PPM)) are studied using thermogravimetric analysis of the hydrated cement paste. A method is proposed to estimate the degree of hydration (α) from chemically bound water (W_B). The PPM mix designed concrete mixes exhibit lower α. Recycled aggregate concrete (RAC) mixes exhibit higher and α after 7 d of curing, contrary to that after 28 and 90 d. The chemically bound water at infinite time ($W_{B\infty}$) of RAC mixes are lower than the respective conventional concrete mixes. The lower $W_{B\infty}$, $Ca(OH)_2$ bound water, free $Ca(OH)_2$ content and FT-IR analysis substantiate the use of pozzolanic cement in the parent concrete of RCA. The compressive strength of concrete and α cannot be correlated for concrete mixes with different aggregate type and mix design method as the present study confirms that the degree of hydration is not the only parameter which governs the macro-mechanical properties of concrete. In this regard, further study on the influence of interfacial transition zone, voids content and aggregate quality on macro-mechanical properties of concrete is needed.

KEYWORDS recycled aggregate concrete, Particle Packing Method, thermogravimetric analysis, chemically bound water, degree of hydration, Fourier transform infrared spectroscopy

1 Introduction

Concrete is the second most-consumed material in the world and aggregates occupy about 70%–80% of its total volume. This causes the rapid exhaustion of non-renewable natural resources. The construction activities also produce construction and demolition (C&D) waste in abundance. The bulk amount of C&D waste is waste concrete. The waste concrete is considered as a source to recycle and extract qualified aggregates, which can be used as a new raw material for concrete production. However, the earlier investigations [1–5] substantiated the influence of inferior quality of recycled coarse aggregate (RCA) on the macro-mechanical properties of recycled aggregate concrete (RAC). Hence, it is required to study the influence of micro-level characteristics on the macro-level performance. The present paper discusses the effect of RCA on the degree of hydration of cement in RAC and its relationship with the mechanical properties of the prepared concrete.

The four major compounds present in ordinary Portland cement (OPC) are tricalcium silicate (C_3S), dicalcium silicate (C_2S), tricalcium aluminate (C_3A), and tetracalcium aluminoferrite (C_4AF). The hydration products of these compounds are the bridging units between the aggregates, as well as the strength contributors. The chemical compounds formed as a result of hydration reactions in concrete at the microstructure level can be examined by thermogravimetric analysis (TGA). The TGA technique measures the mass loss due to the decomposition of hydration products, such as ettringite, calcium silicate hydrate (CSH), calcium hydroxide (CH) and carbonated calcium hydroxide. The measured mass loss is due to the decomposition of chemically bound water (W_B) present in the hydration products. The extent of hydration can be

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TECHNICAL PAPER

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Influence of brick dust, stone dust, and recycled fine aggregate on properties of natural and recycled aggregate concrete

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Abstract

The brick, stone, and construction industries produces huge quantities of non-biodegradable waste materials and incorporation of such waste materials in concrete eventually leads to the green and sustainable construction. The present paper study the effect of partial substitution of brick dust (BD), stone dust (SD), and recycled fine aggregate (RFA) as fine aggregate on the properties of natural aggregate concrete (NAC) and recycled aggregate concrete (RAC). In the present investigation, two groups of mixes were considered: Group A consists of 100% natural coarse aggregate (NCA) and group B consists of 50% NCA and 50% recycled coarse aggregate. In each group, the natural fine aggregate was partially replaced with 30% BD, 30% SD, and 30% RFA separately. All mixes were designed for M25 grade concrete with a constant w/c ratio of 0.45. The properties viz. compressive strength, density, indirect tensile strength, water absorption, ultrasonic pulse velocity of all mixes was performed. Also, durability performance of all the mixes under acid conditions viz.: HCl and H_2SO_4 solutions were studied. From the results it was found that the compressive strength and split tensile strengths (27.95–23.23%) of both natural and recycled aggregate concrete were significantly increased with the partial substitution of SD. Also, the results reveal that the water absorption decreased by 57.14–69.64% and 4.67–34.67%, respectively, when the replacement of NFA with BD and SD in both NAC and RAC. Both natural and recycled aggregate concrete were more susceptible for H_2SO_4 than HCl acid in terms of loss of weight and compressive strength.

Abbreviations: BD, brick dust; BIS, Bureau of Indian Standards; C&DW, construction and demolition waste; CH, calcium hydroxide; GCW, granite cutting waste; GD, granite dust; ITZ, interfacial transition zone; NAC, natural aggregate concrete; NCA, natural coarse aggregate; NFA, natural fine aggregate; PPC, Portland Pozzolana Cement; RAC, recycled aggregate concretes; RCA, recycled coarse aggregate; RFA, recycled fine aggregate; SD, stone dust; UPV, ultrasonic pulse velocity.

Discussion on this paper must be submitted within two months of the print publication. The discussion will then be published in print, along with the authors' closure, if any, approximately nine months after the print publication.

Alkali-Activated Slag/ Fly Ash Concrete: Mechanism, Properties, Hydration Product and Curing Temperature

Sonal Banchhor, Meena Murmu, Shirish V. Deo

Abstract*: Alkali-activated concrete (AAC) is mounting as a feasible alternative to OPC assimilated to reduce greenhouse gas emanated during the production of OPC. Use of pozzolana results in gel over-strengthening and fabricate less quantity of $Ca(OH)_2$ which provide confrontation to concrete against hostile environment. (AAC) is potential due to inheriting the property of disbursing CO_2 instantly from the composition. Contrastingly an option to ordinary Portland cement (OPC), keeping this fact in mind the goal to evacuate CO_2 emits and beneficiate industrial by-products into building material have been taken into consideration. Production of alkali-activated cement emanates CO_2 nearly 50-80% less than OPC. This paper is the general assessment of current report on the fresh and hardened properties of alkali-activated fly ash (AAF), alkali-activated slag (AAS), and alkali activated slag and fly ash (AASF) concrete. In the recent epoch, there has been a progression to blend slag with fly ash to fabricate ambient cured alkali-activated concrete. Along with that the factors like environmental friendliness, advanced studies and investigation are also mandatorily required on the alkali activated slag and fly ash concrete. In this way, the slag to fly ash proportion impacts the essential properties and practical design of AAC. This discusses and reports the issue in an intensive manner in the following sections. This will entail providing a good considerate of the following virtues like workability, compressive strength, tensile strength, durability issues, ambient and elevated-temperature curing of AAC which will improve further investigation to elaborate the correct test methods and to commercialize it.

Keywords: Fly ash, Slag, Alkali activator, Workability, Strength, Durability, Hydration Product, Curing temperature.

I. INTRODUCTION

The plunking of pozzolana is an environmental problem. Slag and Fly Ash (FA) are conventionally utilized binder to augment the workability, strength and durability properties. These industrial by-products FA, Slag with the partial replacement of OPC has been extensively utilized and resulted not merely in enhanced sustainability and environmental friendliness additionally improved the mechanical properties, durability and rheology. The auxiliary ratio is 15 to 25% for FA to total cementitious material and the replacement ratio for Slag is 50–70% [1, 2]. AAC utilizes industrial by-products as binders comprising silica and alumina, alkali activators for activating the binders and fine and coarse aggregates, later cured under apposite conditions [3]. Production of alkali-activated cement emanates CO_2 nearly 50-80% less than OPC [4]. Class F (low calcium) and Class C (high calcium) FA system are two major subclasses [5]. Researches on AAC illustrates that workability depends on fineness, the composition of raw material, alkaline concentration and activator modulus. It is investigated that durability properties like permeability, water sorption, carbonation of AAC can be enhanced by proper mix design [6]. The key features of AAF are low shrinkage, high acid and heat resistance [7] whereas those of AAS are rapid setting, high strength and fire resistance [8].

In AAC, the chemical and physical properties depend fundamentally on curing conditions and raw material. The AAC appraise in this article are composed of FA, Slag, and blend of FA and Slag, providing an assessment of research on the properties of AAC. Subsequent properties are discussed: workability, compressive strength, tensile strength, durability properties, ambient and elevated-temperature curing.

This comprehensive survey will entail providing a good considerate of the following virtues like workability, compressive strength, tensile strength, durability issues, ambient and elevated-temperature curing of AAC which will improve further investigation to elaborate the correct test methods and to commercialize it.

II. MATERIALS

A unanimous term applied to the reaction between solid aluminosilicate and activator, to fabricate a solidified binder based on hydrous alkali-aluminosilicate is Alkali activation (termed as ‘precursor’). These definitions ensue to include Slag, FA and alkali activator [9].

A Fly Ash: It is a by-product of coal-fired electric generating plants. Its particles are spherical and steadily finer than OPC, its diameter ranges from 1µm – 150µm and its size is exaggerated by the type of dust collection system [10]. The strength and additional properties depend upon the chemical composition and fineness of source material in AAC [11]. The mass ratio of SiO_2 and Al_2O_3 in class F fly ash is in the range of 1.7-4.0 while the amorphous content is generally more than 50 % [12]. (Class F) FA has a cleaner surface in contrast to (class C) FA due to the absence of alkalis and sulphates ions [13].

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COMPARATIVE ANALYSIS OF ROAD ACCIDENT SCENARIO IN PAST TWO DECADE: A CASE STUDY OF INDORE-KHALGHAT ROAD



H.S. Goliya[1] Kundan Meshram[2] Shravan Namdev[3]

ABSTRACT

Now-a-days, road accident is not just a traffic problem but it became a social cause which needs an attention for its remedial measure. Road accident results in the heavy monetary loss and human loss which at last effect the growth of nation. Numerous research have been done in past on the analysis methods of road accident and those literature concluded the effect of various elements on road accident and also suggested the remedial measure as per the need of location and black-spot. In the present study, road selected for study purpose is Indore-Khalghat. It is one of the major accident prone roads and formerly it was a part of NH-3 running from Agra to Bombay (AB) but at present this section is the part of Asian highway development program and designated as AH-47 running from Agra to Bangalore. The collected data is distributed on the various parameters to evaluate trend of accident, effect of route change, and effect of change in geometric element. Identification of various black-spots on the basis of measure notified by the MORTH and it was found that there are in total 9 black-spots identified in the study area. These black-spots were evaluated and road geometry is checked to find out the cause of accident because remedial measure suggested. Accident rate, co-relation between different factors and economic evaluation of loss were calculated.

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This tragic economic and human loss needs the attention of a specialized person in the field of traffic engineering and road safety. They must not only evaluate the severity of the incident but also suggest some measure to tackle the problem in an efficient manner.

Normally there are many factors which lead to the scenario of accident some of them are inappropriate road user behaviour, improper vehicle condition, unscientific manner of traffic accident evaluation and investigation, lack of law body control over traffic, uneasy availability of the proper fast medical facility and inefficient traffic management planning. Road accident statics from various government and non-government institution show that around 70% of the road accident is due to the error performed by human and around 3-4% is because of the deficiencies in the road. Road accident is one of the biggest man-made tragedy which is even worse than any atomic or hydrogen bomb.

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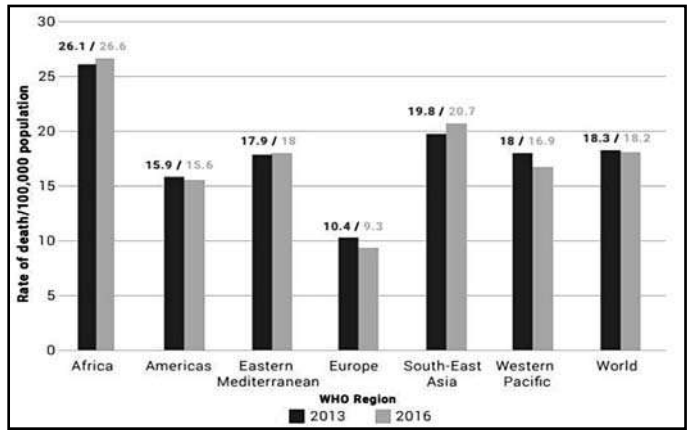

Fig.1 Rates of road traffic death (Global Status Report on Road Safety 2018)

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Article

A Two-Phase Approach for Semi-Supervised Feature Selection

Amit Saxena [1], Shreya Pare [2], Mahendra Singh Meena [2], Deepak Gupta [3], Akshansh Gupta [4], Imran Razzak [5], Chin-Teng Lin [2] and Mukesh Prasad [2,*]

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Abstract: This paper proposes a novel approach for selecting a subset of features in semi-supervised datasets where only some of the patterns are labeled. The whole process is completed in two phases. In the first phase, i.e., Phase-I, the whole dataset is divided into two parts: The first part, which contains labeled patterns, and the second part, which contains unlabeled patterns. In the first part, a small number of features are identified using well-known maximum relevance (from first part) and minimum redundancy (whole dataset) based feature selection approaches using the correlation coefficient. The subset of features from the identified set of features, which produces a high classification accuracy using any supervised classifier from labeled patterns, is selected for later processing. In the second phase, i.e., Phase-II, the patterns belonging to the first and second part are clustered separately into the available number of classes of the dataset. In the clusters of the first part, take the majority of patterns belonging to a cluster as the class for that cluster, which is given already. Form the pairs of cluster centroids made in the first and second part. The centroid of the second part nearest to a centroid of the first part will be paired. As the class of the first centroid is known, the same class can be assigned to the centroid of the cluster of the second part, which is unknown. The actual class of the patterns if known for the second part of the dataset can be used to test the classification accuracy of patterns in the second part. The proposed two-phase approach performs well in terms of classification accuracy and number of features selected on the given benchmarked datasets.

Keywords: feature selection; semi-supervised datasets; classification; clustering; correlation

1. Introduction

Pattern classification [1] is one of the core challenging tasks [2,3] in data mining [4,5], web mining [6], bioinformatics [7], and financial forecasting [8,9]. The goal of classification [10,11] is to assign a new entity to a class from a pre-specified set of classes. As a particular case, the importance of pattern classification can be realized in the classification of breast cancer. There are two classes of patients, one belonging to the "benign" class, having no breast cancer, while the other class of patients belong to the "malignant" class, which shows strong evidence of breast cancer. A good classifier will reduce the uncertainty of misclassifying patients from being in one of these two classes. Recently,

sustainability

MDPI

Article

An Early Flame Detection System Based on Image Block Threshold Selection Using Knowledge of Local and Global Feature Analysis

Ting Wei Hsu [1], Shreya Pare [2], Mahendra Singh Meena [2], Deepak Kumar Jain [3], Dong Lin Li [4], Amit Saxena [5], Mukesh Prasad [2,*] and Chin Teng Lin [2]

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Abstract: Fire is one of the mutable hazards that damage properties and destroy forests. Many researchers are involved in early warning systems, which considerably minimize the consequences of fire damage. However, many existing image-based fire detection systems can perform well in a particular field. A general framework is proposed in this paper which works on realistic conditions. This approach filters out image blocks based on thresholds of different temporal and spatial features, starting with dividing the image into blocks and extraction of flames blocks from image foreground and background, and candidates blocks are analyzed to identify local features of color, source immobility, and flame flickering. Each local feature filter resolves different false-positive fire cases. Filtered blocks are further analyzed by global analysis to extract flame texture and flame reflection in surrounding blocks. Sequences of successful detections are buffered by a decision alarm system to reduce errors due to external camera influences. Research algorithms have low computation time. Through a sequence of experiments, the result is consistent with the empirical evidence and shows that the detection rate of the proposed system exceeds previous studies and reduces false alarm rates under various environments.

Keywords: feature extraction; video surveillance; image processing; fire detection; block-based analysis

1. Introduction

Fire is one of the most uncontrollable phenomena with respect to time and space and directly endangers human life and property and nature. Based on the National Fire Protection Association (NFPA) report, 1,342,000 fire incidents were reported. Moreover, there was 10.6 billion U.S. Dollars in property damage in the U.S. in 2016 [1]. There are fast ways of detecting it: (1) heat detection (e.g., Fixed Temperature Detectors), (2) chemical-compound-smoke detection (e.g., ionization and gas sensors), and (3) flame detection (e.g., ultraviolet and infrared sensors) [2]. Traditional methods

big data and cognitive computing

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Article

An Intelligent Automatic Human Detection and Tracking System Based on Weighted Resampling Particle Filtering

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Abstract: At present, traditional visual-based surveillance systems are becoming impractical, inefficient, and time-consuming. Automation-based surveillance systems appeared to overcome these limitations. However, the automatic systems have some challenges such as occlusion and retaining images smoothly and continuously. This research proposes a weighted resampling particle filter approach for human tracking to handle these challenges. The primary functions of the proposed system are human detection, human monitoring, and camera control. We used the codebook matching algorithm to define the human region as a target and track it, and we used the practical filter algorithm to follow and extract the target information. Consequently, the obtained information was used to configure the camera control. The experiments were tested in various environments to prove the stability and performance of the proposed system based on the active camera.

Keywords: color distribution; particle filter; human tracking; codebook matching; PID controller; GMM; active camera

1. Introduction

Recently, security surveillance has applied visual-based tracking and detection techniques for improving convenience and safety for humans. Human tracking and detection are essential topics in a surveillance system. Human recognition and moving object extraction are the two parts of any typical human detection system. Human recognition identifies an object as nonhuman or human, and objects are extracted from the background by means of moving object extraction, which determines the related size and position of the object in an image. The tracking system is essentially able to predict the location during and after occlusion, as the tracked object or human is possibly occluded by other objects while tracked.

Surveillance systems typically use two kinds of the cameras: fixed camera and active camera. The fixed camera has the benefit of being low cost but comes with limited field of view (FOV), whereas

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Prediction of compressive strength of geopolymer concrete using machine learning techniques

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Abstract

Geopolymer concrete (GPC) is the result of an inorganic polymerization reaction that takes place in presence of an alkaline medium in the materials such as fly ash and slag, which are rich in silicates and aluminates. In this study, an artificial neural network (ANN), multiple linear regression, and the multivariate nonlinear regression (MNLR) models were designed to predict the 28 days compressive strength of the GPC. To train the models, a total of 289 data sets were used, which were published by different researchers in the open literature. The input parameters, namely, binder content, amount of slag, rest period, curing temperature, curing period, the ratio of $NaOH/Na_2SiO_3$, amount of superplasticizer, extra water added, the molarity of NaOH, alkaline activator to binder ratio, amount of coarse, and fine aggregate were used. The performance of the ANN model was better than the multi linear regression (MLR) and multi non-linear regression (MNLR) models to estimate the strength. The sensitivity analysis on ANN was also performed to study the influence of each parameter. The sensitivity analysis shows that the ratio of $NaOH/Na_2SiO_3$ significantly affects the compressive strength of GPC.

KEYWORDS

ANN, back-propagation, compressive strength, feed-forward network, GPC, MNLR

1 | INTRODUCTION

Geopolymer is an inorganic polymeric material, synthesized by alkaline activation of materials rich in silicates and aluminates, such as fly ash, metakaolin, blast furnace slag, and so forth. A three-dimensional aluminosilicate structure with empirical formula $M_n\{-(SiO_2)_z\text{-}AlO_2\}_n,wH_2O$, where M is the cation such as potassium, sodium, or calcium, n is the degree of polycondensation, and z is 1, 2, and 3.[1] The dissolution of Si and Al ions from the source materials takes place at high pH, which leads to the formation of a complex supersaturated solution. This concentrated solution forms a gel with large networks because of the condensation of oligomers in the aqueous phase. The water used during the dissolution phase is released which resides in the pores of the gel. The structure of gel continues to rearrange resulting in the formation of an aluminosilicate structure known as a geopolymer.[2,3]

The strength of the geopolymer concrete (GPC) depends on various factors such as type and amount of fly ash,[4] additives,[5–10] alkalinity ratio (i.e., sodium hydroxide to sodium silicate ratio [SH/SS]),[6,11–13] the concentration of NaOH,[5,13–17] the ratio of alkaline activator to the binder,[14,18] and size and amount of aggregates.[15] In addition to this, the strength of GPC also depends on the rest period before curing of concrete,[17] curing time, and curing temperature[12,15,17,19–22] at which GPC is cured; also

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Properties of Partially Replaced Cement Concrete with Rice Husk Ash

Rochak Pandey, Shailendra Kumar

Abstract*: This study investigates the progressions in mechanical properties of concrete by substitution of cement by Rice Husk Ash (RHA) in conjunction with superplasticizers. Rice husk is a by-product of the rice milling process, with inexact generation of 200 kg for every one ton of rice. Diffusion of Rice Husk Ash in the concrete matrix enhance the properties of the concrete. This investigation has been done to determine the strength parameters of concrete with various extents of cement supplemented by Rice Husk Ash. M20 grade concrete (Designed as per Indian standards) was tried with substitutions by weight of the cement amount by 2.5%, 5%, 7.5%, 10% and 15%. Various strength Test results reveal enhancement of strength at 5% substitution of cement by rice husk with compressive strength and flexural strength having an increment of 9.78% and 25.09% respectively as compared to the control mix. Pulse velocity test of the modified concrete at 5% replacement of cement by rice husk ash confirms it as a "good" dense Concrete matrix.

Keywords: Rice husk ash (RHA), Cement replacement, superplasticizers, workability, Compressive strength, Flexural strength, split tensile strength, Pulse velocity.

I. INTRODUCTION

Due to the wide use of concrete, the cost of building materials is increasing enormously in some parts of the world also in developing country like India. This rising cost can however be reduced by use of alternative building materials that are locally available and cheap. Some industrial and agricultural waste products may be used as a replacement of conventional building material. There are different wastes available in large quantities that have similar binding properties as that of cement. Rice husk ash is one of the suitable substitutions of cement. Rice husk is a byproduct of agricultural waste generated in rice mills. During milling of paddy 80% weight found out as rice and remaining 20% weight received as husk. This husk is used as fuel in industries to generate steams and other purposes. This husk contains about 75 % organic fickle matter and the remaining 25 % of the weight of this husk is converted into ash during the firing process, this ash is known as rice husk ash (RHA).

From the 20th century, there had been an increase in the economic consumption of mineral admixtures for the replacement of cement in construction industries. The use of by-products also reduces the pollution and proved as an environment friendly method of disposal of large quantities of waste materials that would otherwise pollute land, air and water. Typically, RHA contains 80 – 90% of amorphous silica 1-2 % Potassium oxide (K_2O) and remaining being sunburn carbon. Related studies have been carried out to investigate impact of Rice husk ash as partial replacement which has depicted that RHA is suitable for replacement of cement in making of concrete. As per a study, Rice husk ash can be added to cement concrete as partial replacement of cement up to 10% without any significant reduction in any of the property of concrete (Bhushan et. al., 2017).

The use of RHA in concrete has following positive impact:

- Increased compressive and flexural strengths (Zhang et al.,1996; Ismaila 1996; Rodriguez 2005).
- Reduced permeability (Zhang et al., 1996; Ganesan et al.,2007).
- Increased resistance to chemical attack & Reduced potential for efflorescence due to reduced calcium hydracids (Chindaprasirt et. al., 2007).
- Increased durability (Coutinho 2002).
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- Reduced amount of super plasticizer (Sata et al., 2007).

Additionally, RHA blended concrete can decrease the total porosity of concrete and modifies the pore structure of the cement, mortar, and concrete, and significantly reduce the permeability which allows the influence of harmful ions leading to the deterioration of the concrete matrix. RHA blended concrete can improve the compressive strength as well as the tensile and flexural strength of concrete (Alireza Naji Givi et. al. 2010).

In the present study, Ordinary Portland cement (Grade 43) was replaced by rice husk ash at different percentage such as 2.5, 5, 7.5, 10% & 15% of weight of the cement to find out the optimum percentage of rice husk ash in concrete mix with the help of strength parameters like compressive strength, split tensile strength, flexural strength and ultrasonic pulse velocity. The mechanical property tests of materials have been carried for fine aggregates, coarse aggregates and cement in the laboratory followed by designing of M20 grade concrete as per Indian standards. Super plasticizers (Polymer based, 1% by weight) has been also used in the concrete mix for increasing the workability at adopted water/cement ratio of 0.45.

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Probabilistic Seismic Hazards Analysis of Ambikapur-Chhattisgarh (India)

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ABSTRACT

The present study reveals the seismic hazard analysis of district headquarter Ambikapur, in the state of Chhattisgarh. Usually, seismic hazard study attempts to analyze two different kinds of anticipated ground motions, "the Deterministic Seismic Hazard Analysis (DSHA)" and "the Probabilistic Seismic Hazard Analysis (PSHA)". The maximum Peak Ground Acceleration (PGA) has been estimated by using Iyengar and Raghu Kanth (2004) attenuation relationship. The regional recurrences relation is obtained by using available historical data and 33 numbers of seismic sources (liner faults) that are likely to cause ground motion, around the study area. The probabilistic seismic hazard analysis has been applied over Ambikapur, to assess the probability of exceedance for various PGA(g)values the seismic hazard curve has been developed by using Raghu Kanth and Iyengar (2007) attenuation relationship. The probability of exceedance for PGA(g) values as 0.01g,0.05g,0.10g,0.15g for their corresponding return periods have also been assessed. The liner seismic source having length 46kM, produced maximum peak ground motion as 0.15259g for recurrence period of 100 years. For Ambikapur district headquarter the probability of exceedance for 0.1g with a return period of 8788 years is estimated as 63.22%. Maximum Peak Ground Acceleration value and % probability of exceedance reflects that the seismicity of Ambikapur district headquarter is found to have exceeded from 0.1g as recommended by IS:1893 (Part 1): 2016 (Sixth Revision) for Chhattisgarh. Hence, it is recommended from present study that, Ambikapur should be included in zone III instead of zone II.

Key words : Ground Motion Attenuation, Peak Ground Acceleration, Uncertainty, Seismic Hazard Curve.

1. INTRODUCTION

Since the dawn of human civilization, seismic tremor is known to be one of the primary complex phenomenon that the present world is facing. Efforts are being made to develop realistic and probabilistic models, for determining the location and time of
upcoming earthquakes. It is indispensable that the after effects can be reduced to some extent. Regional seismic hazard maps that are developed, give an idea of seismic hazard vulnerability of an area. So various researchers have carried out seismic microzonation of different Indian cities and states using probabilistic approach. In seismic map of India Chhattisgarh state is located in "low" seismically active region Ambikapur, is said to be one of the oldest but prominent city there, the name being derived from the Hindu Goddess worshipped in that area. The location can be traced towards the east of central India, at 23º 12' N 83º 2' E. The city is said to be a proud owner of many valuable heritage structures, outlining the precious constituents of history, culture and human evolution. There are many evidences existing to the olden construction technology, aesthetics, civilizing practices, arts, defenses and governance of the region. These ancient masonry structures were constructed based on empirical acquaintance of structural behavior by trial-and-error processes, essentially taking into consideration dead loads only. Not overlooking their bulky mass due to masonry walls, poor connections between structural elements and structural distress due to deteriorated material properties they are often found to undergo destruction. Conservation of such historical buildings from natural disasters like an earthquake becomes a paramount responsibility of the modern society, so that it may be conserved for the future generations.

2. PIONEER RESEARCH IN INDIA

As Peninsular India (PI) lies within intra-plate setting (a region far from well-defined plate boundaries) very little crustal deformation is expected [1]. When compared to the foothills of mighty Himalayas, earthquakes are generally less likely to occur near the plate boundaries. Although the frequency of occurrence of large earthquakes is low, their impact on civilization is high. Thus, it becomes imperative to compute the seismic hazard for Peninsular India for future

Multilevel Color Image Segmentation using Modified Fuzzy Entropy and Cuckoo Search Algorithm

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Abstract: To handle the fuzziness and spatial uncertainties among pixels entailed in color images, this paper proposes a novel fuzzy entropy function for multi-threshold image segmentation based on the energy curve concept and minimum fuzzy entropy criterion. The proposed energy curve based new fuzzy entropy function (ECFE) considers intensity distribution and spatial contextual information among the pixels. To improve efficiency and threshold selection process of the method, cuckoo search algorithm is employed. For comparison, backtracking search algorithm, and Lévy flight based firefly algorithm included. Comparison with recent color image multilevel segmentation techniques presented to test the effectiveness of the proposed algorithm. The performance of the proposed technique is evaluated using different satellite and natural color images. Quantitative and Qualitative results demonstrate that the proposed algorithm is highly accurate, robust, and efficient for color image multilevel segmentation.

Keywords: Multi-level thresholding, Energy curve, minimum fuzzy entropy, Cuckoo search algorithm, Optimization algorithms

1 Introduction

Segmentation is a classic example of multichannel information processing. Multichannel information processing is very important owing to evolution of the fields of remote sensing (RS), multispectral data management, geographical information system (GIS), biomedical imaging, etc. [1-4]. In satellite imaging, segmentation is one of the most important processes to retrieve important and useful information or to detect the region of interest. Satellite images contain large and dense information which is used for processing and analysis. But, these images normally have ill-defined features and ambiguous regions, very low spatial resolution, poor illumination, and high dependency over environmental conditions [5]. Therefore, proper segmentation of satellite images is demanded in many practical applications including forest-type classification, sea-ice-type classification, soil moisture and vegetation, measurement, land cover classification, etc. [6]. Currently, various image segmentation techniques are presented in the literature [7,8].

In the field of image segmentation, information entropy theory-based thresholding is most popular area in theoretical research and applications as it is fit for the images exhibiting distinct gray levels of objects and background. The advancements in the information theory have intensified the scope to investigate different entropy models for efficient thresholding based segmentation [9, 10]. Various entropy models such as Shannon Entropy, Kapur's entropy, Otsu method, Rényi entropy, Tsalli's entropy, and minimum cross entropy (MCE) reported in [11], [12] have been proposed. The goal of thresholding is to select the single pixel (bi-level thresholding) or multiple pixels (multilevel thresholding) which can distinguish the region of interest from its background.

Due to the development of multi-object technology such as multi-object tracking and multi-object optimization, multilevel image thresholding (MIT) is an appropriate method to fulfill the requirements of most machine vision and pattern recognition applications. MIT segmentation techniques can be broadly categorized into: (a) classical approach [13, 14] (b) Swarm Intelligence (SI)/Evolutionary Algorithms (EA) based approach [15, 16]. In past few decades, large amount of techniques have been developed in the field of image segmentation, and it has been noticed that multilevel thresholding based on classical implementations is computationally complex and time inefficient as they optimize the objective function by exhaustively searching for the optimum values. To determine acceptable sub-optimal thresholds quickly, applications of some well-known meta-heuristics can be found in literature meant for thresholding based segmentation of Satellite images and other color images [5], [13-21] this paper, a new fuzzy based entropy function is proposed using minimum fuzzy entropy criterion. Histogram based thresholding techniques has been unable to consider the contextual and local information for selecting an optimum threshold. As a consequence, the images of different characteristics may have very similar 1-D histogram to yield close thresholding results, which may lead to inaccurate satellite image segmentation. To mitigate these limitations, MFE has been proposed to search optimal thresholds based on information derived from energy

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An Empirical Study on Initializing Centroids in K-Means Clustering for Feature Selection

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ABSTRACT

One of the main problems in K-means clustering is setting of initial centroids which can cause misclustering of patterns which affects clustering accuracy. Recently, a density and distance-based technique for determining initial centroids has claimed a faster convergence of clusters. Motivated from this key idea, the authors study the impact of initial centroids on clustering accuracy for unsupervised feature selection. Three metrics are used to rank the features of a data set. The centroids of the clusters in the data sets, to be applied in K-means clustering, are initialized randomly as well as by density and distance-based approaches. Extensive experiments are performed on 15 datasets. The main significance of the paper is that the K-means clustering yields higher accuracies in majority of these datasets using proposed density and distance-based approach. As an impact of the paper, with fewer features, a good clustering accuracy can be achieved which can be useful in data mining of data sets with thousands of features.

KEYWORDS

Centroid, Classification, Feature Selection, Information Gain, K-Means Clustering, Laplacian Score, Ranking Methods of Features in Data Sets, Variance

1. INTRODUCTION

The curse of dimensionality is a major problem in large datasets. A dimension is commonly known by names like feature or attribute or property or even column in a dataset. In order to save more and more information, many irrelevant features are also preserved in a dataset and these features can be contributing nothing while classifying the dataset for taking some inference out of it and sometimes even adding to misclassification of patterns. A dataset with large dimensionality may increase the time and space complexity wile classifying it. More specifically, the performance of a classifier depends on several factors: i) number of training instances. ii) Dimensionality, *i.e.*, number of features, and iii) complexity of the classifier (Saxena et al., 2010). Feature selection is an important component in pattern recognition (Duda et al., 2001). Feature Selection can be done in supervised or unsupervised manner. When feature selection techniques use the knowledge of class given in the data sets, it is called supervised feature selection. Feature selection without using class information is called unsupervised feature selection. For unsupervised feature selection, Mitra (Mitra et al., 2010), proposed a method that partitions original feature set into distinct subsets or clusters so that features in one cluster are highly similar while those in different clusters are dissimilar. A single feature is then selected from each cluster to form a reduced feature subset. Feature Selection for clustering is discussed in (Dash et al., 2000). Dy and Brodley (2000) presented a wrapper framework for feature

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Ferrocene decorated unusual mercury(II) dithiocarbamate coordination polymers: crystallographic and computational studies†‡

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Three new one dimensional ferrocene decorated Hg(II) based coordination polymers with the general formula of $(FcCH_2N(C_2H_4OH)NCS_2HgX)_n$ {X = Cl (**FcHgCl**); Br (**FcHgBr**); I (**FcHgI**)} have been synthesized using a functionalized dithiocarbamate ligand with a redox active ferrocene pendant and $-C_2H_4OH$ and have been characterized by microanalyses, FTIR, ^1H, ^{13}C, and ^{199}Hg NMR, electronic absorption and photoluminescence spectroscopy. The redox properties of these compounds have been assessed by cyclic voltammtery which suggested their quasi-reversible redox behaviour. Single crystal X-ray diffraction studies suggested that the geometries around all three Hg(II) polymers are square pyramidal and two such square-pyramids fuse in an antiparallel mode in **FcHgCl** and **FcHgI** and in an orthogonal mode in **FcHgBr** to generate a ferrocene decorated 1D polymeric framework. The adjacent 1D polymeric chains in all three compounds are held by different intermolecular interactions which provide stability to these compounds in the solid state. Also, these compounds exhibit interesting Hg···X (X = Cl, Br and I) spodium bonding interactions. The nature of all these interactions have been studied by Hirshfeld surface analyses, density functional theory and quantum theory of atoms in molecules (QTAIM). The QTAIM results indicated that Hg···X interactions are moderately strong with interaction energies of 9.32, 44.37 and 19.56 kJ mol^{-1} for chloro, bromo and iodo derivatives, respectively. Further bond order calculations also suggest the presence of spodium bonding interaction in all three polymers.

Introduction

In previous decades and in this decade, the design and development of coordination polymers (CPs) derived from various multifunctional ligands has been extensively studied and this interesting class of compounds has been utilised for an abundance of applications.[1] Although reports on CPs comprising polycarboxylate and nitrogen donor ligands are numerous,[1] reports on CPs containing dithiolate ligands are scarce.[2] Recently, dithiolates have emerged as an important class of ligands to generate an array of self assembled polymers.[2,3] Dithiolates in general are categorized into 1,1-dithiolates or 1,2-dithiolates. Amongst 1,1-dithiolates two broad categories *viz.* monoanionic dithiolates and dianionic dithiolates exist. Monoanionic 1,1-dithiolates *viz.* dithiocarbamates and xanthates also known as dithiocarbonates and dithiophosphates have been proven to be very interesting ligands for crystal engineering as single source precursors for metal and mixed metal chalcogenides, where the metal can belong to the main group as well as to the transition family.[2–7] In comparison to xanthates, dithiophosphates and dithiophosphinates, the prospects of functionalization of the dithiocarbamate backbone are more probable as one can incorporate/alter and functionalize the alkyl/aryl groups attached to the nitrogen center of the $RR'NCS_2^-$ backbone.[2–7] Such functionalization can lead to a programmed self-assembly which can form interesting architectures and can offer interesting physico-chemical properties. Recently McDonagh *et al.* reported that the presence of two or more dtc ligands in the same molecule can yield interesting CPs.[8]

During the past couple of years, significant development in chemistry utilizing the redox active ferrocenyl entity as a cornerstone in molecules has been perceived. Such

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Taguchi Optimization of Adsorptive Treatment of Effluent from Lead-acid Battery Recycling unit Using Pressmud-a Sugar Industry Waste

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ABSTRACT: Lead-acid battery recycling is one of the organized process which helps in overcoming the demand of lead for the production of the storage batteries. During recycling, a large amount of effluent is generated which contains lead beyond the permissible limit and harmful for the environment. This effluent was treated by adsorption as an alternative technique by using another waste (pressmud) as an adsorbent obtained from the sugar industry. Properties of the pressmud were determined through Fourier transform infrared spectroscopy, scanning electron microscope and X-ray diffraction analysis. Taguchi method L16 orthogonal array (4^3) was used for batch adsorption study for the parameters, initial pH, adsorbent dose and contact time. The optimum value for the adsorption of Pb(II) onto pressmud was found at effluent pH 4.5, adsorbent dose 1.0 g/50mL and time 240 min from the Signal-to-Noise ratio analysis. Kinetic and isotherm studies were also carried out to understand the mechanism of adsorption. Langmuir isotherm fitted best to the experimental data with R^2=0.994 and kinetics of adsorption followed the pseudo-second-order model with R^2=0.993.

Keywords: Isotherm, kinetic, lead adsorption, Taguchi analysis.

INTRODUCTION

Lead-acid battery recycling units are the major sources of lead pollutants in the soil which is hazardous to the surrounding communities (Gottesfeld et al., 2018). Recycling of Lead-acid battery is a beneficial process as it not only supplies lead for producing battery but also reduces the pollution. Battery recycling involves the production of the pure lead ingot from exhausted lead electrodes. During the recycling, the electrolyte solution is discharged without treatment by the small recyclers. This effluent of electrolyte solution contains a large concentration (2-300 mg/L) of Pb(II) and it is harmful to the environment and human health (Matlock et al., 2002). This effluent is treated conventionally by neutralization with sodium carbonate, which leads to the generation of a large amount of sludge. However, this method is not effective because the lead hydroxide formed is moderately soluble and remains in the effluent (Dermentzis et al., 2012). According to the Indian Standard Institution, the safe limit of Pb(II) in surface discharge is 0.1 mg/L (Meshram et al., 2020), hence, the effluent must be treated before discharge to the soil or aquatic system to keep the concentration of Pb(II) safe.

Various treatment methods like ion exchange, coagulation, electrocoagulation,

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Adsorption of Pb(II) form battery recycling unit effluent using granular activated carbon (GAC) and steam activated GAC

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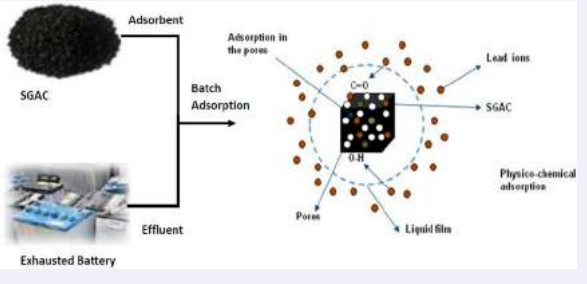
ABSTRACT

The effluent of the lead-acid battery recycling unit contains a significant amount of Pb(II). Small scale battery recyclers are discharges this effluent without treatment, which is harmful to the environment. This effluent was treated by adsorption as an alternative technique to remove Pb(II) using granular activated carbon (GAC) and steam activated granular activated carbon (SGAC). Both adsorbents were characterised by using BET, SEM, FTIR and XRD techniques. Batch adsorption studies were performed to understand the effect of parameters like pH, contact time and adsorbent dose on percent removal of Pb(II) from effluent. The best result was observed at pH 4.5, time 60 min and an adsorbent dose of 2 g/L for SGAC with over 95% removal of Pb(II). Isotherm studies were carried out by testing the experimental data using Langmuir, Freundlich, Dubinin-Radushkevich and Temkin isotherm models. Pseudo first and second order, intra-particle diffusion and Elovich kinetic models were used to understand the mechanism of adsorption. A Regeneration study was also performed to reuse the SGAC for Pb(II) adsorption.



KEYWORDS

Lead; activated carbon; battery recycling effluent; adsorption

Nomenclature

B_T	constant for Temkin isotherm, J/mol
C_o, C_e	concentration of Pb(II) in effluent at initial and at equilibrium, respectively, mg/L
E	mean free energy of adsorption per molecule of adsorbate, kJ/mol
K_1	rate constant for pseudo-first-order kinetic, min^{-1}
K_2	rate constant pseudo-second order kinetic, g/mg.min
K_F	constant for Freundlich isotherm, mg/(g $(mg/L)^{1/n}$)
k_{id}	rate constant for the intra-particle diffusion model, $mg.g^{-1}.min^{-0.5}$
K_L	constant for Langmuir isotherm, L/mg
K_T	equilibrium binding constant corresponding to maximum binding energy, L/mg
m	mass of adsorbent, g

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Removal of fluoride from water by electrocoagulation using Mild Steel electrode

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ABSTRACT

Electrocoagulation process was used for defluoridation of synthetic fluoride containing water. In the process Mild Steel (MS) was used as sacrificial electrode and experiments were performed with different varying parameters such as pH and current density (CD). The fluoride removal efficiency was found to be maximum at pH 6 and CD 75.44 A/m^2 (2 A). At these conditions fluoride concentration reduces from initial concentration of 50 mg/dm^3 to 5.2 mg/dm^3. Kinetic study of electrocoagulation process revealed that the order of the reaction was in the range 1.61–1.64 with respect to fluoride concentration. It was observed that fluoride removal efficiency of the present MS electrode is comparable to the other electrodes used in electrocoagulation process available in the literature.

1. Introduction

Fluoride is an important mineral of drinking water up to a certain limit. The fluoride occurs mainly as sellaite (MgF_2), fluorspar (CaF_2), cryolite (Na_3AlF_6) and fluorapatite [$3Ca_3(PO_4)_2Ca(FCl_2)$]. As fluorspar and cryolite are found in sedimentary rocks and igneous rocks respectively, these fluoride minerals are of very low solubility in water. Hence, fluorides will be present in groundwater only when conditions favor their dissolution or high fluoride containing effluents are discharged to the water bodies from industries [1].

It is a well known fact that an excess amount of fluoride is harmful to the human body. Fluoride in drinking water has strong effects on teeth and bones [1]. Due to its strong electronegativity, it gets attached to positively charged calcium in bones and teeth. Moderate fluoride (0.5–1.5 mgL^{-1}) in drinking water is an essential micronutrient for the calcification of the dental enamel and bone formation. Hydroxide ions get displaced by fluoride from hydroxyapatite $Ca_5(PO_4)_3OH$, which is the principal mineral constituent of teeth (in particular the enamel) and bones, to form the harder and tougher fluoroapatite, $Ca_5(PO_4)_3F$. Up to a small level, this strengthens the enamel. However, fluoroapatite is an order of magnitude less soluble than hydroxyapatite, and at high fluoride concentration, the conversion of a large amount of the hydroxyapatite into fluoroapatite makes the teeth and (after prolonged exposure) the bones denser, harder and more brittle. In the teeth, this causes mottling and embrittlement, a condition known as dental fluorosis. With prolonged exposure at higher fluoride concentrations, dental fluorosis progresses to skeletal fluorosis [2]. Thus fluoride is considered beneficial in drinking water at levels of about 0.7 mg/L, but harmful, once it exceeds 1.5 mg/L which is the world health organization limit being followed in most of the nations [3,4]. The difference between a desirable dose and a toxic dose of fluoride is ill-defined and fluoride may therefore be considered as an essential mineral with a narrow margin of safety [5]. Hence, its treatment is required.

Various techniques are available for defluoridation such as coagulation and precipitation [6], reverse osmosis [7–9], nanofiltration [10,11], electrocoagulation [12–17], ion-exchange [18,19] and adsorption [20,21]. Each process has its own limitations. The traditional coagulation method is low cost but its removal efficiency is low and also generates a large amount of sludge. Chemical precipitation generates low-density sludge and induces secondary pollution consequently difficulties to cleanup trace heavy metal pollution. Reverse osmosis is done at high pressure and requires a dense layered polymer matrix membrane which is usually expensive and complicated. Additionally, membrane fouling is another problem with the membrane filtration process [20].

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Wet oxidation of coking wastewater: Optimization of degradation parameters through RSM

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Present study deals with the degradation of COD contained in coking wastewater using catalytic wet air oxidation process. The investigated experimental parameters were pH, temperature (T °C), air partial pressure (p_{air}), catalyst loading (C_w) and time (t_R). Among various catalysts, copper chloride was found to best for degradation of COD. The optimum condition evaluated for the degradation of organic compounds using Response Surface Methodology (RSM) was T = 159.93°C, p_{air} = 5.80 MPa, C_w = 3.1 kg/m^3 and t_R = 5.98 h. The central composite design (CCD) was used for the experimental design and optimization of the process. Analysis and interaction between the four most important operating variables T, p_{air}, C_w and t_R were studied. ANOVA analysis of variance showed the good regression coefficient with R^2 = 0.977 for the degradation of COD.

Keywords: Catalytic wet air oxidation, coking wastewater, response surface methodology, COD.

Introduction

Iron and steel industries are come under the profitable industries in India. It was the largest producer of raw steel and sponge iron in the world during 2014-2016[1]. The wastewater produced by the iron and steel industries are called coking wastewater (CWW), and comes under hazardous effluent as it contains cyanide, thiocyanide, ammonium nitrogen, phenolic compounds, sulphate, polynuclear-aromatic etc. Most of them are highly toxic and causes harmful effects to environment and ecology too[2–4]. Thus, it must be treated before discharge into water bodies. CWW is produced during coke conversion process; in this process coal is heated at high temperature in absence of air to produce coke, which is the raw material of blast furnace to manufacture iron and steel[5]. Hot coke produced during carbonization is cooled by spraying of water, during this process huge amount of water was used and becomes polluted due to transfer of chemicals from coke to water. The polluted water is called coking wastewater (CWW) or coke oven wastewater.

Wet air oxidation (WAO) is the simplest oxidation technique[6] for the treatment of industrial wastewater containing highly concentrated organic pollutants. In WAO process high temperature (100–320°C) and high oxygen pressure (1–20 bar) is used as oxidize organic pollutants present in water and convert into CO_2 and H_2O[7]. Although, WAO is the effective process, but it requires high temperature and high pressure which increases its cost[8], thus, to reduce the cost and time WAO is performed in presence of catalyst called catalytic wet air oxidation. CWAO increases the rate of reaction and reduces temperature, pressure and treatment time[8]. Literature review of CWAO process shows it is an effective treatment technique for acetic acid present in solutions (aqueous) over noble metal catalysts[9]. Treatment of methylamine over manganese dioxide catalyst[10]. Removal of phenol studied using catalyst like Ru and Pt were supported on TiO_2/CeO_2 oxide for CWAO process and the catalyst were prepared by sol-gel process as TiO_2, $TiCe_5$, $TiCe_{10}$, $TiCe_{25}$, $TiCe_{50}$, $TiCe_{75}$, CeO_2[11] and the degradation of three phenolic compounds such as phenol, *o*-cresol and 2,5-dimethyl phenol has been studied by catalytic wet air oxidation[12].

In present study various type of catalysts were tested for the degradation of CWW. The parameters like T, p_{air}, C_w, t_R and pH were selected to find out its effects on oxidation of CWW. Optimization of COD removal was performed by using RSM. The experiments were designed using CCD which is good tool for the optimization of the process.

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Synthesis and characterization of cellulose acetate based proton exchange membranes

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The proton exchange membranes (PEMs) were prepared using cellulose acetate (CA), orthophosphoric acid (OPA) and polyvinyl alcohol (PVA) and epichlorohydrin (ECH) as an active agent. Polyvinyl alcohol (PVA) was used as polymeric backbone for the synthesized PEMs. CA was used as a hydrophilic agent and OPA provided acidic matrix for the membranes. Polymeric membranes have minimal environmental effects and hence we focused on these membranes for fuel cell applications. These membranes were prepared by physical blending and casting methods. The cellulose acetate was dissolved in the required amount of pure acetone to form a solution and subsequently activated using ECH at 45°C for 6 h. Activated cellulose acetate and OPA was used in molar ratios of 1:1 and 1:2 in this study. PVA was added in the desired quantity. The approach allowed the membrane to have an excellent ion exchange capacity (IEC) and water uptake (WU) such as 1.14 meq/g and 11.83%, respectively.

Keywords: Proton exchange membrane, ion exchange capacity, swelling ratio, water uptake.

Introduction

The enhancement in the demand of power requirement makes the researchers to focus on the renewable energy sources. PEM fuel cells have a promising ability to convert electrochemical energy into power. They gained sufficient interest because of their high efficiency and low emissions of wastes. Essentially, the mechanism of PEM is to transfer the protons from anodic compartment to cathodic compartment. The PEM serves as a media to conduct electrons from anode chamber to cathode chamber in a fuel cell. It is a polymeric membrane prepared using different types of polymers[1,2]. Commercially available PEM is Nafion. Nafion is widely used proton exchange membrane due to its high mechanical, chemical, and thermal stability and proton conductivity. However, these Nafion membranes are lavish. Hence, several researchers explore the alternative to Nafion membranes for fuel cell applications. Fuel cell converts the energy with high efficiency and extremely low pollutant emission. PEM fuel cell consists of a polymeric membrane, which transports the protons from anode chamber to cathode chamber. The electrons generated in anode chamber travels through the external circuit of cell to cathode chamber and produce electricity. Hydrogen based fuel cell was charged through a field flow plates to the anode side, where hydrogen splits into H^+ ions and charged electrons. Hence, there's no change of emission of pollutants it is an eco-friendly way of production of energy. The key component of the fuel cell is PEMs, which may be polymeric membranes or acid base membranes. The products of these fuel cells are water from cathode chamber and electricity from the external circuit. To produce H^+ ions and negatively charged electrons fuel cell requires hydrogen which is costlier and it is difficult to produce hydrogen and also to store. Hence many of the fuel cells use H^+ ions producing gases such as methanol or gasoline etc., where direct methanol fuel cell gained success by using liquid methanol fuel[3]. But emission of CO is the noticeable disadvantage of the direct methanol fuel cell, which damages the platinum electrodes[4] and may decrease the efficiency of the fuel cell. In this study, we prepared a polymeric proton exchange membrane using cellulose acetate (CA) and epichlorohydrin as an active agent, orthophosphoric acid (OPA) and polyvinyl alcohol (PVA). The prepared membrane should be thin having high ion exchange capacity and water uptake.

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Preparation and characterization of activated carbon from spent coffee grounds using NaOH and KCl as activating agents

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Activated carbons were by double stage activation method using spent coffee grounds (SCG) as precursor. The process involved impregnation of SCG with NaOH or KCl followed by heat treatment. Proximate analysis of raw SCG was done to investigate moisture, ash, volatile matter and fixed carbon content. Characterization of the adsorbents was done through FTIR, BET and XRD analyses. Activated carbon (AC) prepared using NaOH as activating agent was used to adsorb lead (Pb(II)) from an aqueous solution. Adsorption study result showed that 98% Pb(II) could be removed with the adsorbent dose of 20 g/L and 90 min of contact time from the aqueous solution initially containing 400 mg/L of Pb(II).

Keywords: Activated carbon, double stage activation, spent coffee grounds, lead.

Introduction

Coffee is a popular beverage and almost 50% of the world's total coffee production is used for making soluble coffee. The residue left after the brewing of coffee is known as spent coffee grounds. According to the coffee market report of International Coffee Organization for December 2019 the global coffee production is estimated to be 168.71 million bags (each bag weighs 60 kg) in 2019-20. Murthy and Naidu[1] have reported that one ton of green coffee generates about 650 kg of SCG making it an abundant feed stock for AC synthesis.

Several studies have reported the use of coffee residue as a precursor for the synthesis of AC. Baquero *et al.*[2] chemically activated the coffee residue by H_3PO_4 to prepare AC for adsorption of phenol. Kankeu *et al.*[3] produced biochar from SCG by hydrothermal method and then treating it with sodium dodecyl sulphate to remove cadmium from coal tailing leachates. The $ZnCl_2$ impregnated SCG was carbonized around 400 to 500°C to produce AC for heavy metal removal[4]. The ACs obtained from SCG by impregnating it with phosphoric acid and KOH and carbonization at 600°C for the removal of lead and copper[5]; phosphoric acid for the adsorption of ethylene and n-butane[6].

In this study, SCG was impregnated with NaOH and KCl activating agents, carbonized at 500°C to produce activated carbons referred as AC-NaOH and AC-KCl, respectively. The properties of the ACs obtained through raw SCG, AC-NaOH and AC-KCl were evaluated and compared to examine their relative characteristics. Since the BET surface area determined was higher for AC-NaOH than other two adsorbents, it was chosen for batch removal of Pb(II) from the prepared solution.

Materials and methods

Spent coffee grounds:

Coffee beans was purchased from local market of Bilaspur, Chhattisgarh and after using them to make soluble coffee, the residue (SCG) was collected. The SCG was washed with water and sun dried for 24 h. The SCG was kept for 1 h in oven for drying at 100°C, ground and sieved to get 16 mesh size particles.

Activation process:

Activation method adopted in this study is similar to the one reported by Kalderis and coworkers[7] for the activation of rice husk derived activated carbon. The SCG sample was impregnated with NaOH by mixing them in equal proportion

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Extractive recovery of *p*-coumaric acid using natural and conventional organic solvents

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p-Coumaric acid is usually found in effluent from olive oil, pulp-paper and winery industries. It degrades slowly and deteriorates the fertility of soil. On the other hand, it has exceptional medicinal properties and has wide application in health, food, and pharmaceutical industries. In this work physical extraction has been carried out with two natural solvents, rice bran oil and soybean oil and two conventional organic solvents, 1-octanol and *p*-ether. To identify the suitable solvent, partition coefficient (P), distribution coefficient (K_d), dimerization constant (D) and extraction efficiency (E%) have been investigated and compared. The results showed that 1-octanol is the most effective solvent with extraction efficiency and distribution coefficient being 43.1% and 0.93, respectively.

Keywords: Phenolic acids, reactive extraction, partition coefficient, dimerization constant, extraction efficiency.

Introduction

p-Coumaric acid being a hydroxycinnamic acid, subgroup of phenolic acids, has an important role in human immune regulations. *p*-Coumaric acid is phenolic acid, present in various food items and possesses different physiological properties like antioxidant, anti-allergic, anti-cancerous, anti-microbial, anti-inflammatory etc.[1]. The studies have confirmed its protective effect in doxorubicin-induced oxidative stress in rats and also formation of ultra-violet B induced oxidative damage in SIRC cells[2]. It has many uses in pharmaceutical, cosmetic, chemical, food and health industries[3]. *p*-Coumaric acid could be obtained either from plant source directly, chemical synthesis or bio-synthesis. Direct extraction from the plant source is difficult whereas bio-synthesis is economic and can be used to fulfill the demand of the acid as it has vivid applications. *p*-Coumaric acid is present in effluent from paper, olive oil, grapes-based wine industry[4,5]. Its degradation is very slow and hence it stays for long time in the soil. The untreated effluent discharged over a land severely damages the fertility of soil[6,7]. Hence, removal of *p*-coumaric acid not only provides a valuable product, because of its physiological properties, but also mitigates soil pollution.

Among various separation techniques, reactive extraction is energy incentive and convincing technique for the efficient separation, especially from the dilute solutions[8]. Reactive extraction is a proven technique for effective extraction of carboxylic acids such as, lactic, picolinic, glycolic, phosphoric, itaconic acid[9–13] and phenolic acids like gallic acid, 4-hydroxy benzoic acid[14,15]. The technique uses three different types of extractants, the oxygen donor extractants namely carbon bonded and phosphorous bonded and the aliphatic amine extractant and the diluents, polar protic, dipolar aprotic and non-polar[16].

Exploring the different physical extraction parameters helps in finding the suitable and most efficient diluents for the particular solute. In this context, two conventional solvents; 1-octanol and *p*-ether; and two natural solvents; rice bran and soyabean oil have been used and the physical parameters were explored experimentally to identify the suitable solvent among them.

Experimental

The laboratory grade *p*-coumaric acid (98% pure) was acquired from Sigma Aldrich and its solution of different

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Removal of fluoride using fly ash adsorbent

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Abstract. Flouride (F^-) content in groundwater above 1.5 mg/L is a serious concern all over the world due to adverse health effects beyond that concentration. Hence, apart from its monitoring, an effective and low-cost removal technique is necessary. In this work, the removal of fluoride using fly ash has been studied. Batch adsorption studies, using laboratory shaker, were performed to examine the effect of pH in the range 2-10, adsorbent size (0.225 mm, 0.45 mm, and 0.90 mm), and adsorbent dose, varied from 2-6 g/L, for a contact time of 4 hours in all the experiments. The optimum condition for the F^- removal was observed as pH:5, adsorbent size:0.225 mm and adsorbent dose: 5 mg/L, providing 67.20 % F^-removal from the solution. Different kinetic models were tested and it was found that adsorption kinetics is of Pseudo second order and Elovich type. The study showed that fly ash can be effectively used for fluoride removal from water.

1. Introduction

Fluoride contaminated groundwater is a serious issue as most Indian populations resort to groundwater for drinking water needs. In rural areas, facilities to remove F^- from such water supply are usually not available. Some of the causes of the occurrence of F^- in the groundwater are leaching of fluoride bearing rocks, geochemical reactions, and industrial discharges[1]. F^- is highly electronegative and has low bond energy which makes it highly reactive, leading to its presence in a combined state such as sodium fluoride, fluorite, etc. [2]. While the presence of F^- in amounts 0.5 mg/L to 1.5 mg/L is essential for bones and dental strength in animals and humans[3], its concentration, more than 1.5 mg/L, as specified by World Health Organization(WHO), causes irreversible demineralization of bones and tooth tissues resulting in skeletal and dental fluorosis, harmful to the brain, kidney liver, skin and death in extreme cases is also possible [2-4].

The Indian scenario of F^- contamination in groundwater is such that 19 of Indian states are severely affected by high F^-concentration in groundwater ranging from 2.0 mg/L in Haryana to 38.0 mg/L in Rajasthan. And one of the reasons for such a high concentration of F^- in groundwater is attributed to the presence of 12 million out of 85 million of F^- deposits on earth surface is present in India only [4]. As the WHO as well as the Bureau of India Standards (BIS) authorizes a safe F^- concentration limit in drinking water as 1.5 mg/L, removal of fluoride through a cheap and effective method has become a mandate.

Adsorption of cadmium from water using activated carbon derived from *Ipomoea Carnea* using chemical impregnation

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Abstract. Ipomoea Carnea is a wild shrub, and because of its abundance, it was chosen as precursor for making activated carbon. Adsorbent preparation method involved the impregnation of dried precursor with zinc chloride followed by activation at 500°C. Surface morphology of prepared adsorbent was compared with the raw Ipomoea Carnea by Scanning Electron Microscope analysis. Batch adsorption studies were carried out to understand the effect of parameters like, metal initial concentration, contact time, adsorbent dose and pH on percent removal of cadmium. More than 96% removal of Cd(II) was obtained at the adsorbent dose of 0.3 g/L in 20 minutes at pH 6. Experimental data were fitted to isotherm and kinetic models to understand the mechanism of adsorption. Adsorption of Cd(II) onto raw Ipomoea Carnea followed the Langmuir isotherm, whereas adsorption onto activated Ipomoea Carnea followed the Freundlich isotherm. Kinetic study reveal that the experimental data of adsorption of Cd(II) onto activated Ipomoea Carnea followed the second order kinetic.

Keywords: Water Treatment, Ipomoea Carnea, Adsorption, Cadmium.

1. Introduction

Application of cadmium is very common in industries like electroplating, alkaline batteries, smelting, pigments, mining and metallurgical processes. It is B1 carcinogen according to United States Environmental Protection Agency which upon accumulation in the human bodies causes the diseases such as neuralgia, nephritis, hypertension and anemia [1]. According to Minimal National Standard (MINAS), Ministry of Environment and Forest, Government of India, the safe discharge limit for cadmium in effluent is 0.2 mg/L [2]. Techniques such as electrochemical treatment, ion-exchange, filtration, membrane separation, precipitation and adsorption are used to treat wastewater. These methods have the drawbacks like large sludge production, large capital cost and high operational and maintenance cost [3]. The adsorption onto activated carbon (AC) has emerged as a promising method for wastewater treatment, but AC is not economical due to its high manufacturing cost. Many researchers have focused on reducing the cost of manufacturing of AC by using wastes like crab shell, peanut hull pellets, corn starch, soybean hull, rice husk, de-oiled soya, turmeric waste, pomegranate peel as the precursor to make activated carbon [4-10].

Ipomoea Carnea plant is an abundantly available shrub and the extract of different parts of this plant has the medicinal values such as anti-bacterial, anti-fungal, anti-oxidant, and tranquilizing properties.

Removal of fluoride using bagasse adsorbent: Process optimization using response surface methodology

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Abstract. The high fluoride (F-) content in drinking water is highly hazardous to human health. Bagasse is a solid waste generated in the cane-based sugar industry. It can be used to get energy after firing in boilers or used to produce activated charcoal. The activated carbon is used as an adsorbent material to remove pollutants from water. In the present study, the activated carbon prepared from bagasse was used to remove F- contain in water. Batch adsorption studies were performed to examine the effect of temperature (T), treatment time (tR), and initial fluoride concentration (Fi-) on F- removal. Response surface methodology (RSM) was used to generate a mathematical model and for the optimization of parameters. The optimum operating condition was evaluated to be T = 26°C, treatment time (tR) = 3.5 h, and Fi- = 25.14 mg/L, at which F- concentration in solution after treatment reached to 0.8 mg/L. The predicted values of F- in the solution obtained from the quadratic model were found to be well-matched with the experimental data. The model gave significant coefficients of determination R2 = 99.61%, R2 (adjusted) = 99.11%, and R2(predicted) = 97.71%, which shows that the model developed from RSM is highly accurate and well represents the process with its process parameters.

Keywords: de-fluoridation, water purification, bagasse adsorbent, optimization

1. Introduction

Most of the Indian population living in rural areas rely on groundwater for their drinking water need. F- may enter into groundwater by weathering rocks, industrial effluent discharge, and geochemical reactions [1]. While F- is an essential element to be present in water in a small amount for bones and dental enamel, its high concentration (>1.5 mg/L) can lead to several health disorders such as dental fluorosis, irreversible demineralization of bones, damage of brain tissues, the adverse effect over kidney and lever, etc.[2,4]. It is highly electronegative and usually found in a combined state because of its high chemical reactivity.

In India, the F^- concentration in groundwater ranges from 4.21 mg/L to 48 mg/L [5], which is well above the limit of F^- in the water of 1.0 mg/L to 1.5 mg/L, as specified by the Bureau of Indian Standards [6]. Needless to say, it poses a significant threat to health. This necessitates the removal of F^- from water through a cheap and effective method to bring its concentration within the specified limit.

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Research Article

Determination of Physicochemical Parameters and Levels of Heavy Metals in Food Waste Water with Environmental Effects

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Bioinorganic chemistry is found as a sizzling field in today's era. It deals with chemistry amongst the heavy metals with natural resources, i.e., air, soil, water, plant byproducts (foods), and environmental essences. The aim of this research is to determine the concentration of heavy metals present in the food waste water sample and to study the environmental effects of metal ion concentration. To conduct the research work, the physicochemical parameters and levels of five heavy metals of food waste water samples were collected from five sampling points of renowned hotels, restaurants, canteens, and confectionaries of a state of India and assessed using the standard analytical procedure. Sampling was carried out from January 2017 up to December 2017. The physicochemical parameters were determined such as pH, temperature, turbidity, conductivity, total dissolved solids, total suspended solids, total alkalinity, biological oxygen demand, chemical oxygen demand, dissolved oxygen, total organic carbon, sulphate, nitrate, and phosphate. The heavy metal concentration was determined by using the UV-spectrophotometer, and the results were compared with the standards prescribed by the WHO, BIS, ICMR, and municipal authorities. The results obtained in the physicochemical analysis revealed that a few parameters were found beyond limits, and the metal ion concentration (iron and zinc) results were found above the permissible limits set by the CPCB (Central Pollution Control Board), ICMR, BIS, and World Health Organization (WHO), most especially, effluent from point *P*1. It was concluded that all the effluents required further treatment before releasing them into the water body or land to prevent pollution. The obtained results reveal that waste water used for irrigation and farming of nearby areas and water drained from restaurant kitchens were considerably polluted and not suitable for aquatic organisms, irrigation, and agricultural purposes.

1. Introduction

In the present situation across the world, the poor quality of discharged water by restaurants, hotels, and various food-selling commercial sites contains various levels of pollutants. This poor quality of discharged water is the result of poor management of discharged food waste water. These pollutants are discharged either with intent or mistakenly into the environment, which are released straight or indirectly into public sewer lines, dumping yards, and reservoirs [1]. It is probed that heavy metals such as Pb, Cu, Fe, Ni, Hg, and Zn are found in food waste water. They not only produce toxic or chronic poisoning in aquatic animals but also pose threat to the environment. Waste water used for irrigation fields contains considerable amount of potentially toxic substances including dissolved salts and heavy metals like Fe^{2+}, Cu^{2+}, Zn^{2+}, Mn^{2+}, Ni^{2+}, and Pb^{2+}. It is seen that, in agriculture fields, waste water contaminates the soil to such an extent that it becomes toxic to flora and fauna. The crops and plants accumulate heavy metals of waste food water in their tissues at concentrations ranging above the acceptable levels, which is considered harmful to the ecosystem and aquatic organisms. Researchers proved that high rate of exploration and recharging, poor management of dumping

Barriers to adoption of blockchain technology in green supply chain management

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Abstract

Purpose – The purpose of this study is to identify the barriers to the adoption of blockchain technology in green supply chain management (GSCM) and further analyze the cause and effect relationship to prioritize the barriers for making strategic decisions.

Design/methodology/approach – The study examines 15 potential barriers related to the adoption of blockchain in GSCM which is identified from the literature review and finalized after subsequent discussions with industry professionals. Integrated Fuzzy-Decision-Making Trial and Evaluation Laboratory approach is used to analyze cause and effect relationships and prioritize the barriers. Fuzzy set theory is used to handle the uncertainty and vagueness associated with the personnel biases and data deficiency problems. Three small to medium enterprises' (SMEs') are considered for gathering data and further analyzing the crucial barriers that are impeding the adoption of blockchain technology in GSCM.

Findings – The findings reveal that "lack of management vision" and "cultural differences among supply chain partners" are the most influencing barriers, whereas; "collaboration challenges" and "hesitation and workforce obsolescence" are the most influential barriers in the adoption of blockchain in GSCM.

Research limitations/implications – The study is developed based on 15 selected barriers which were further tested using data from three SMEs' in the emerging economy of India. The adoption of blockchain technology in GSCM is at a nascent stage and more research studies are necessary to extend the knowledge base.

Practical implications – Managers need to eliminate the barriers and extend the blockchain technology application in GSCM. Managers need to develop the mission and vision of the company by doing proper alignment of blockchain technology with GSCM goals. Second, managers need to make strong collaborations and remove the hesitation and workforce obsolescence barrier by providing the right education and pieces of training.

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Experimental and thermal performance investigations on sensible storage based solar air heater

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ABSTRACT

The thermal performance of the solar collector for air heating purpose is investigated with and without packed bed through experimental and theoretical methods. A simple flat plate solar air heater was developed with $2m^2$ corrugated absorber plate and integrated with porous pebble bed in the airflow path to act as a sensible heat storage medium. The experimental studies were carried out for different mass flow rates of air from 0.014 to 0.087 kg/s with the increment of 0.0095 kg/s. Steady-state theoretical models have been established to predict the thermal performance of the air heaters and the results indicated that they are well enough to predict the outlet air temperature with acceptable error percentage. The collector with packed bed storage medium is more efficient than without packed bed in terms of energy efficiency as well as in reducing temperature fluctuation of air at the outlet of the collector. The energy and exergy efficiency of the collector with packed bed veried from 20.35% to 50.92% and +3.97% to −2.807% for the airflow rates 0.014 kg/s to 0.087 kg/s respectively. Solar collectors with packed bed are capable to deliver the hot air in the range of 45 to 60 °C for a longer period and which can be preferred for achieving a better quality of the dried products as well as for space heating applications.

1. Introduction

Solar air heaters are simple heat exchangers used to produce hot air by converting solar energy into thermal energy and transferring it to flowing air. They are widely used for various applications such as drying of agricultural and industrial products, seasoning of timbers, desiccant regeneration and space heating etc [30]. Many variants of solar collectors are available for air heating, though the flat plate type is predominantly used for low-temperature applications due to simple design, easy to operate, low or nil maintenance and low costs, etc. Moreover, the solar flat plate air heaters are well suitable for producing the hot air in the temperature range of 50–60 °C and this temperature range is optimum for drying of agricultural products [32]. The hot air from the solar collectors can be extracted either by natural or forced convection methods. A conventional flat plate air heater usually consists of a glazing, an absorber, a bottom plate and insulation materials. The flow of air takes place either above or below the absorber plate to collect the heat, sometimes both the sides. The flat plate solar air heaters may be simply classified based on the thermal storage as shown in Fig. 1.

The major drawback of the conventional type solar air heaters is of lower thermal efficiency due to low heat carrying capacity of air and less convective heat transfer coefficient between air and absorber surface [4]. Numerous methods were attempted to enhance the performance of the system through the increased heat transfer area or improved convective heat transfer coefficient of flowing air, the first one is achieved through corrugated or finned absorber plates and the later using artificial roughened absorber surface via machining, casting, sandblasting attaching ribs or thin wires, etc. [6]. Apart from that, researchers have attempted to enhance the heat transfer rate through other methods also such as multiple pass of air [13,31], jet impingement [18], recirculation of hot air, wire matrix [28], etc.

Among various techniques, corrugated absorber is one of the simple and efficient method of enhancing the performance of flat plate air collectors [15]. Joudi and Mohammed [10] investigated the performance of V-corrugated-plate solar air heater. Temperature rise across

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Research Article

Exploiting GWmZd Model by Exploring Knowledge-Based Grey-Holistic Technique for Sustainable Vendor Evaluation

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It is investigated that the thoughts of sustainability gained the momentum among researchers in the present era. The industrial empirical research survey proved that green operations, waste minimization strategies, and zero defect planning are three potential pillars in mapping the sustainability of supplier/vendor units. The authors built and proposed a grey knowledge-based green-waste minimizing and zero defect (GWmZd) sustainability appraisement hierarchical structural evaluation model/framework to production companies for assessing the sustainability ratio of their candidate suppliers/partners. Due to the uncertainty associated with the measures and metrics of the proposed model, the incomplete information is procured from a cluster of professionals' vs GWmZd measures and metrics in the terms of the grey (except fuzzy) set. It is sensed by the prior literature survey that a few grey knowledge-based sustainability model are framed, but they were constrained to the individual first level layer without weight evaluation cum noncomparative analysis-based modern technique, and it is respected as a major research gap and challenge. To compensate the major research gap, the authors elected AHP and enabled AHP (analytic hierarchy process) to materialize and aggregate the assigned rating of each expert for evaluating weights of 2^{nd} level metrics (overcoming the drawback of combined/group ratings). Later, the authors structured and proposed a new mathematical equation, assisted authors to evaluate the global weight of the first layer-three pillars-measures of the proposed model. Eventually, the authors constructed and fruitfully implemented a grey-holistic technique (merger of grey-MOORA-FMF fused with the dominance theory) on the model to compute sustainability index and score of suppliers. A production company is investigated to exhibit the application of the research work practically. The sustainability of supplier A_1 is found the best than the residue of suppliers. The research forum can be explored by production companies to opt the feasible supplier under the proposed model. The conducted research has a value across the global production companies. The research forum can be explored by managers of production companies for benchmarking the performance of global suppliers under GWmZd and future advancing models along with grey-holistic technique fused with the dominance theory.

1. Introduction of Sustainability

The application of technological and performance measurement tools towards attaining the green-lean-economic architectures in vendor units is called as vendor sustainability. The vendor firms can gain the sustainability if firms preserve the cost-effective and best practices/processes, i.e., green, waste minimizing, and zero defects planning across production measures practices, as these practices holistically enable the vendor organizations sustainable at the global platform. It is sensed that numerous vendor organizations attain the sustainability by minimizing miscellaneous wastes, preserving the best green performance, and maintaining economic tradeoffs in their production units in the present era. It is ascertained by the literature survey that advancement in metrics-practices of the green-waste minimizing and zero defect (GW_MZ_D) model advise the production companies to materialize the sustainability of vendor

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Experimental investigation on heat transfer characteristics of phase change composite for thermal energy storage system

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ABSTRACT

A novel technology to produce a low-cost thermal energy storage system using composite phase change materials was presented in this paper. This article examines the enhancement of the charging and discharging rate of the phase change material (PCM). In this paper, paraffin was used as the PCM. The steatite powder was used as the additive material to enhance the thermal property of the PCM. Steatite powder was concentrated in the paraffin at three weight fractions of 10%, 20%, and 30%. The performance of the Paraffin/steatite composite was investigated using a horizontal latent heat energy storage system. The charging and discharging rate during the melting and solidification of the paraffin/steatite composite were studied in detail. From, the experimental analysis, it was observed that as the solidification rate of the PCM increases than the melting rate as the addition of steatite powder in the paraffin increases. This significant effect of increasing rate is mainly due to the property of the steatite material as it has a large latent heat retention rate. From the experimental investigation, it is observed that the solidification rate was improved by about 25%, 37% and 40% than the melting time by adding the low-cost steatite powder in the paraffin with weight fraction 10%, 20%, and 30% respectively. Hereby, this low-cost paraffin/steatite composite was best suited for heating storing applications like solar collector systems.

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1. Introduction

Energy becomes the basic requirement for various range of applications and it is a time variable. Energy storage is essential when energy is abundantly available. The need for energy storage is to conserve energy and it can be used whenever necessary. Latent heat thermal energy storage system (LHTESS) has the potential to store heat when excess heat is available and it can be used when there is a demand. The use of the thermal energy storage system has been increased abundantly in solar applications [1]. Phase change materials will be the keynote to store thermal energy. In recent years, more researchers used phase change material to store thermal energy for solar collector systems [2]. Hossain et al. [3] used lauric acid as PCM to store the thermal energy of the Photovoltaic/Thermal (PVT) collector system to enhance the thermal performance of the system. However, the material cost of the lauric acid is high and the life cycle of the material is up to 5 to 6 years. M. Longeon et al. [4] studied the phase change phenomenon of the RT32 paraffin using shell and tube heat exchanger experimentally and numerically. They reported that the melting rate was higher at the injection side of the heat transfer fluid (HTF) and also they recommended injection of HTF to be at the top and bottom side of the energy storage unit during the charging and discharging phase respectively. Meng and Zhang [5] investigated the performance of the thermal energy storage system using paraffin with copper foam. The inlet temperature and mass flow rate of the heat transfer fluid influenced the charging rate of the composite PCM. The presence of copper foam in the paraffin enhanced the thermal conductivity of the PCM and thus result in an increased heat transfer rate of the PCM composite. Preet et al. [6] examined the performance of the solar PVT system using water as coolant and RT30 paraffin as thermal energy storing material. They reported that the reduction in the temperature of the solar cell was higher for the PVT/water/PCM based system. This leads to electrical efficiency enhancement of the PV module. Sardarabadi et al. [7] investigated the perfor-

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Evaluation of machine tool substitute under data-driven quality management system: a hybrid decision-making approach

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Abstract

Purpose – Today, industrial revolutions demands advanced technologies, means, mediums, tactics and so forth for optimizing their operating behavior and opportunities. It is probed that the effectual results can be seized into system by not only developing advance means and technologies, but also capably adapting these developed technologies, their user interface and their utilization at optimum levels. Today, industrial resources need perfect synchronization and optimization for getting elevated results. Accordingly, present study is furnished with the purpose to expose quality-driven insights to march toward excellence by optimizing existing resources by the industrial organizations. The present study evaluates quality attributes of mechanical machineries for seizing performance opportunities and maintaining competitiveness via synchronizing and reconfiguring firm's resources under quality management system.

Design/methodology/approach – In the present study, Kano's integrated approach is implemented for supporting decision rational concerning industrial assets. The integrative Kano–analytic hierarchy process (AHP) approach is used to reflect the relative importance of quality attributes. Kano and AHP tactics are integrated to define global relative weight and their computational medium is adapted along with ratio analysis, reference point theory and TOPSIS technique for understanding robust decision. The study described an interesting idea for underpinning quality attributes for benchmarking system substitutes. A machine tool selection case is discussed to disclose the significant aspect of decision-making and its virtual qualities.

Findings – The decision executives can realize massive benefits by streaming quality data, advanced information, technological advancements, optimum analysis and by identifying quality measures and disruptions for gaining performance deeds. The study determined quality measures for benchmarking machine tool substitute for industrial applications. Momentous machine alternatives are evaluated by means of technical structure, dominance theory and comparative analysis for supporting decision-making of industrial assets based on optimization and synchronization.

Research limitations/implications – The study linked financial, managerial and production resources under sole platform to present a technical structure that may assist in improving the performance of the manufacturing firms. The study provides a decision support mechanism to assist in reviewing the momentous resources to imitate a higher level of productive strength toward the manufacturing firms. The study endeavors its importance toward optimizing resources, which is an evident requirement in industries as the same not only saves money, escalates production, improves profit margins and so forth, but also gratifies the consumption of scarce natural resources.

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A novel integrated computational $TR_IF_MR_G$ approach with grey relational analysis toward parametric evaluation of weld bead geometry of ms-grade: IS 2062

Xiaohui Guo, Atul kumar Sahu, Nitin Kumar Sahu, Anoop Kumar Sahu

Grey Systems: Theory and Application

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Abstract

Purpose

In the presented research work, the authors fabricated the multiple MS plate (Grade: IS 2062) specimens and applied a novel integrated computational $TR_IF_MR_G$ approach with grey relational analysis (GRA) toward solving weld bead optimization problem in MIG welding procedure. The objective of research is to determine the optimum setting between MIG welding input process parameters, e.g. welding current, open circuit voltage and thickness of plate in attaining high tensile strength with weld bead geometry quality characteristics, e.g. bead width, reinforcement, penetration and dilution in investigating define MS specimens.

Design/methodology/approach

The Taguchi's L_9 orthogonal array (OA) design is respected to conduct the experiments on MS plate specimens to attain output objectives. Later, the evaluated multiple output objectives are transformed into single response by applying a novel integrated computational $TR_IF_MR_G$ approach with GRA. Thereafter, the outset of signal-to-noise ratio (S/N ratio) accompanied by ANOVA (Analysis of variance) is explored to optimize objective function.

Findings

The computed results are confirmed by conducting the experiments on same identical specimens. The outcome of the confirmation tests yielded an improvement of 0.24454, 0.372486, 0.686635 and 0.4106846 in grey relational grade (GRG), overall ratio index, reference grade and full multiplicative index, respectively, after validating the results.

Originality/value

In the presented work, the authors constructed a novel integrated computational $TR_IF_MR_G$ approach via clustering GRA, overall ratio

(RG) and tested as well as applied with Taguchi concept to attain objective of the research work.

Keywords

ANOVA | Full multiplicative index (FMI) | Grey relation analysis (GRA) | Gas metal arc welding | Orthogonal array | Overall ratio index (ORI) | Reference grade (RG) | Signal-to-noise ratio | Taguchi approach | Weld bead geometry

Citation
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Influence of twisted tape fins on heat transfer and friction factor characteristics for impinging jet solar air heater

MM Matheswaran[1], TV Arjunan[2] and Mukesh K Sahu[3,4]

Abstract

In this work, an experimental study was carried out to investigate the enhancement of heat transfer and friction factor characteristics of an impinging jet solar air heater integrated with twisted tape fins. During the analysis, the Reynolds number fin design parameters namely twist ratio (Y), and pitch ratio (p_y) are varied from 3500 –13500, 5.5–9.5, and 0.1–0.3, respectively. During the experimentation, the constant heat flux of 1000 W/m^2 was maintained on the absorber plate. From the results, it was observed that the heat transfer rate increases while increasing the twist ratio up to 7.5 and further increase in twist ratio diminishes the performance. It was also concluded that the rise in pitch ratio (p_y) deteriorates the rate of heat transfer. The present work enhances the heat transfer and friction factor by the maximum of 1.9 and 1.81 times as compared with the conventional jet impingement solar air heater at identical operating conditions.

Keywords

Jet impingement, twisted tape fins, heat transfer, Nusselt number

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Introduction

The energy requirement for the heating process has occupied about 40% of the world's final energy demand. Therefore, it is essential to design energy-efficient thermal energy conversion systems.[1] Solar Air Heater (SAH) is a simple energy conversion device which transfers the absorbed solar radiation to the fluid flows through the duct. The energy conversion process that happens in the SAH is economical and also not affecting the environment. Therefore, it is used for the industrial and agricultural sectors to fulfil their hot air requirements. Even though the system has its own merits, its thermal performance is low due to the poor thermo-physical properties of air, which diminishes the heat transfer coefficient between the air and absorber plate. Air jet impingement on the heated surface is an effective technique to enhance the local heat transfer coefficient. Chauhan et al.[2] analysed the array of impinging jet heat transfer on the SAH channel and optimized the jet plate design parameters. They concluded that the heat transfer and friction factor were enhanced by 2.67 and 3.5 times compared with parallel flow ducts. Further, the developed correlation can be used for predicting the Nusselt number and friction factor to evaluate the thermohydraulic performance of the air heater. The thermohydraulic performance was improved by a maximum of 57.89%.[3] Rajaseenivasan et al.[4] proposed a new jet impingement SAH and analyzed the influence of the angle of attack of the jets on the performance. The experimental results show that 30° angle of attack enhances the heat transfer by 2.19 times when compared with conventional SAH. Then, by using Taguchi, PSI, and ENTROPY-TOPSIS techniques, the inline jet impingement SAH design and operating conditions

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Techno-Economic evaluation of an evacuated tube solar air collector with inserted baffles

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Abstract

Evacuated tube solar collectors exhibit excellent performance even in poor insolation periods and are highly preferred for low as well as for medium temperature applications. In this study, an evacuated tube with inserted baffle solar air collector (ETIBSAC) was developed to investigate the effect of mass flow rate of air on energy, exergy, enviro-economic characteristics. The results revealed that the maximum outlet air temperature was observed during the peak irradiance period as 80.5 °C and the system is capable of delivering hot air above 50 °C between 9:30 am to 4:00 pm in clear sky days at the mass flow rate 100 kg/h. The maximum thermal efficiency of 55.4% was achieved at the mass flow rate of 500 kg/h. The highest exergy efficiency of 2.7% was recorded at 100 kg/h and diminishes with increasing mass flow rate of air due to more exergy destruction. The cost per kWh to deliver the hot air in the range of 60 to 70 °C is estimated as 0.00027 $(0.02 INR) at the mass flow rate of 100 kg/h. It is concluded that the developed air collector can be efficiently used for process heating applications.

Keywords

Evacuated tube solar air collector, air heating, baffles, energy efficiency, exergy efficiency, thermal performance

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Introduction

The solar collectors are mainly designed and developed for converting the solar insolation collected from the sun into useful heat energy and which can be utilized for various domestic and industrial applications.[1,2] The collectors are commonly classified into concentrating and non-concentrating collectors. Non-concentrating collectors such as flat plate collectors[3–5] and Evacuated Tube Solar Collectors (ETSC) are commonly used in low temperature applications.[6,7] Nowadays, ETSCs are gaining great attention from the research academia and industries over flat plate collectors due to the most favourable features including low-cost, better performance, easy installation and low transportation cost.[8,9] Further, the ETSCs usually exhibit low energy loss because of the absorber surface which is surrounded by vacuum envelope and most of the studies were devoted to water heating applications rather than air heating due to their low heat transfer characteristics.

The usage of an appropriate mechanism is deliberately important for guiding the working fluid inside the evacuated tube such as to extract the maximum amount of energy available at the absorber surface of the inner tube. Because the suitable guiding mechanism is capable of enhancing the overall performance of the collector system particularly in low specific heat air heating applications. In this direction, the researchers are started working with various design modifications in order to improve thermal performance. The study of the performance of ETSCs for air heating applications have been attempted through few different methods; (i) directly using air as heat transferring medium from the absorber surface,[10] (ii) circulating air through the metal heat exchanger

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Thermal performance of an evacuated tube solar collector with inserted baffles for air heating applications

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ABSTRACT

The thermal performance of an evacuated tube solar air collector with inserted baffles (ETSACIB) was investigated experimentally and analytically investigated under the indoor solar thermal simulator. The effects of the operating parameters such as flow rate, inlet air temperature, baffle length and solar insolation on the thermal behaviour of ETSACIB system were analyzed. Experiments were performed different flow rates of air (100–1000 kg/h). The maximum temperature rise of 42.8 °C was achieved with the lowest thermal efficiency of 35.31% at the flow rate of 100 kg/h. The experimental results show that a heat transfer enhancement in terms the thermal efficiency is obtained with inserted baffle arrangements. An increase in the inlet temperature of air causes a decrease in temperature rise as well as the thermal efficiency of the collector. The results indicated that the increase in baffle length has a positive impact on temperature rise and thermal efficiency but induces higher pumping power. It is concluded that the developed evacuated tube solar air collector has sufficient potential for industrial process heating applications.

1. Introduction

Solar energy is the clean renewable energy resource available in abundance for various industrial applications including space heating, water heating, drying, cooking, desalination and power generation, etc. (Kalogirou, 2004). A wide range of solar thermal applications have been developed by many researchers to address the major challenges like rapid depletion of fossil fuels and concern towards environmental protection. However, solar thermal energy conversion applications have not attained a remarkable position compared with the electricity generation using PV panels (Tian and Zhao, 2013; Tyagi et al., 2012). Solar collector is a familiar solar thermal energy conversion device which collects the solar insolation and transfers the collected thermal energy to the moving fluid (water or air). Many types of solar collectors are available; they are generally categorized as concentrating and non-concentrating collector. Non-concentrating solar collectors such as flat plate collectors, evacuated tube collectors are frequently used for low and medium temperature applications especially in the fluid temperature range around 60–100 °C. Mostly, flat plate collectors are used to fulfill the requirements (Sivakandhan et al., 2020; Saravanakumar et al., 2019; Matheswaran et al., 2019). However, flat plate collectors suffer from lower thermal efficiency due to higher convective heat loss coefficients, even after the introduction of many heat transfer enhancement techniques. Evacuated tube collectors emerged as a prospective replacement for flat plate collectors due to their improved thermal performance even at low insolation periods and they are capable of delivering the hot fluid in the range of 80–120 °C (Chopra et al., 2020).

Evacuated Tube Solar Collectors (ETSC) are often used for water heating applications. It is a known fact that an efficient guiding mechanism is essentially required while using one ended ETSC to ensure the extraction of maximum available heat energy at the inner surface of the absorber. In this direction, few researchers have incorporated different guiding methods to enhance the rate of heat transfer. The common methods used by many researchers to guide the air to the inner part of ETSCs are inserting a coaxial tube (Zhang et al., 2014) and using metal heat exchanger arrangements (Nie et al., 2017). The inner tube arrangement is made such that the air passing axially into the tube could collect the heat through the annular space provided between the tube and absorber surface (Kumar et al., 2013; Kumar et al., 2015; Kumar et al., 2016). The air flowing into the tube has direct contact with the absorber surface during the exchange of heat energy and some

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Performance assessments and techno and enviro-economic analyses on forced convection mixed mode solar dryer

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Abstract

Solar drying is an energy-efficient and eco-friendly process, and it is extensively used in low-temperature drying. In this paper, the year around performance and techno enviro-economic assessments of a forced convection mixed-mode solar dryer (MSD) are presented. The developed MSD has been tested throughout the year for the drying of various agricultural products such as jackfruit, red chili, turmeric, and ginger. The drying temperature of MSD was maintained 15–33°C higher than the ambient air temperature. The economic evaluation was done based on the net present worth, payback period, life cycle saving, and internal rate of return. The payback period was estimated as 0.9 years. The internal rate of return of 130% was obtained on the initial capital investment of the MSD. The effect of the embodied energies of the developed MSD on the environment was investigated based on equivalent thermal energy. The energy payback time (EPBT) of the developed dryer was 3.75 years, and the net CO_2 mitigation potential over the life span of the dryer was 8.4 t. The developed MSD dries the agricultural products under hygienic conditions and provides economic viability to the potential users.

Practical application

The developed mixed-mode solar drying system is used for drying various agricultural products. The moisture content of the product is removed at a much faster rate compared to the traditional sun-drying method. The performance test for various agricultural products dried during their harvesting season shows its efficient performance throughout the year. The main focus of this work is to analyze the techno and enviro-economic of the designed mixed-mode solar dryer. The economic analysis shows a higher internal rate of return for the various products dried over the life span of the dryer. Drying in the solar dryer will enhance product quality, reduce post-harvest losses, carbon emission and establish economic feasibility, helping the farmers get a good return on their produce.

1 | INTRODUCTION

India is the largest producer of fruits and vegetables, especially the North-East (NE). India is famous for the cultivation of jackfruit, red chili, turmeric, ginger, and spices. The NE India produced 1.97 lakh metric tons of jackfruit in the year 2015–2016 and shared a major contribution to the jackfruit production (Dey & Baruah, 2019). Ginger and turmeric are the main cash crop of this region, the production of ginger and turmeric for the year 2016–2017 was 1.07 and 1.06 t, respectively (Verma et al., 2019). Red chili is considered as the main ingredient in Indian cuisine, and during 2014–2015, the contribution from the NE region of India to the annual chili production was 16.5

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Parametric study on pressure-based packed bed adsorption system for air dehumidification

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Abstract

Compressed air free from traces of water vapour is vital in many applications in an industrial sector. This study focuses on parametric optimization of a pressure-based packed bed adsorption system for air dehumidification through the Taguchi method and Genetic Algorithm. The effect of operational parameters, namely absolute feed air pressure, feed air linear velocity, and purge air flow rate percent on adsorption uptake rate of molecular sieve 13X-water pair, are studied based on L_{25} orthogonal array. From the analysis of variance, it has been found that absolute feed air pressure and purge air flow rate percent were the parameters making significant improvement in the adsorption uptake rate. A correlation representing the process was developed using regression analysis. The optimum adsorption conditions were obtained through the Taguchi method and genetic algorithm and verified through the confirmation experiments. This system can be recommended for the industrial and domestic applications that require product air with the dew point temperature below 0°C.

Keywords

Air dehumidification, molecular sieve 13X-water pair, parametric study, optimization

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Introduction

Nowadays, compressed air finds a wide variety of applications in industries. Most manufacturing operations that use compressed air face many problems in pneumatic circuits, solenoid valves, due to the moisture present in the air. The moisture is the leading cause of wear and rust of part in the system as the lubrication is washed away. Many industrial units that use compressed air depend on pneumatic controls for proper functioning. Moisture present in compressed air is the leading cause of rust, clogged orifices, and scale formation in the pipelines and controls. These things lead to malfunctioning of the same and results in corrosion in pipe work, product spoilage, premature failure of components, and costly shutdowns. In addition to that, control lines are severely affected by the freezing of moisture due to cold weather. For many years, problems caused due to moisture in compressed air lines were tolerated. Despite several attempts made, including the use of filters to separate moisture and unwanted contaminants, the problem is not solved completely. The growing use of compressed air in industries and the improvement of many new and extra state-of-the-art equipment and controls have intensified the need for easy, dry air.[1,2]

Production of dry air to meet such demands can be carried out using an adsorption system with solid adsorbents, namely silica gel, activated alumina, and molecular sieve. The adsorption systems use a packed bed to hold the selected solid desiccants. The selection of adsorbents plays a crucial role in deciding the adsorption and regeneration performance of the adsorption system. For pressure based packed bed adsorption, molecular sieve 13X adsorbent is most suitable due to its high adsorption performance

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ANALYZING THE EFFECT OF WELDING PARAMETERS ON MILD STEEL PLATE GRADE IS2062E350 IN GMAW

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ABSTRACT

GMAW is extensively used due to its advantages such as production efficiency, less heat effective zone and environment friendliness. GMAW (Gas Metal Arc Welding) is used to join different types of ferrous metals and non-ferrous metals that cannot be welded by non-traditional welding processes. In this study, various important welding process parameters such as welding current, welding voltage, electrode diameter are used. Taguchi technique is applied to plan the experiments. Welding current ranges between 148-260 amp, welding voltage ranges between 18-28 volt and electrode diameter of 1mm & 1.2 mm is used in present study to grace experiments. The experimental results are analyzed to determine the impact of variation of arc voltage, arc current and electrode diameter on metal deposition rate for Mild Steel Plate Grade IS2062E350. The result shows that at low voltage and high current, metal deposition rate increases, however, when the voltage increases for the same current level, the metal deposition rate decreases. The study disclosed the significant impact of welding current on welding time..

KEYWORDS: Gas Metal arc welding (GMAW), Mild Steel Plate Grade IS2062E350, ANOVA (Analysis of Variance), Welding current, arc voltage, welding speed

Original Article

1.INTRODUCTION

From past few decades, GMAW has widely gained importance for joining diverse metals in many manufacturing processes due to its higher productivity and weld quality. GMAW welding evidence is honoured from the society of welding engineers at global standard due to its unique characteristics for establishing the high quality of weld between two work parts. The authors found many research documents inclination towards determining the optimum trade-off level amongst multiple welding parameters i.e., current, electrode diameter, current type, plate dimension, metal deposition rate, voltage. Gas Metal Arc Welding (GMAW) process utilizes various input process parameters, which solely affects the weld ability or in other terms cost of weldment, weld bead size, penetration and shape, etc. Lots of research work has been done to reflect the effect of GMAW variables on different materials. Ghazvinloo et al. [1] investigated the impact of processing variables i.e. arc voltage, welding current and welding speed on fatigue life, impact energy and bead penetration of AA6061 joints, which are prepared by MIG robotic welding process. Ibrahim et al. [2] used robotic GMAW on 6 mm thickness mild steel plate and investigated the effects of different parameters like arc voltage, welding current and welding speed on welding penetration, microstructural and hardness measurement. Karadeniz et al. [3] used cobalt coated steel SAE 1020 electrode and analyzed the influence of welding pulse parameters on the microstructure of the deposit.

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Exergy and thermo-economic analyses of various tubular solar still configurations for improved performance

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ABSTRACT

Solar energy is being used for the purpose of water distillation since long. The present work demonstrates the comprehensive experimental investigation of various heat transfer enhancement arrangements on tubular solar still for its performance improvement. These arrangements include; case-1: Tubular solar still (TSS) with flat plate basin (TSS-FP), case-2: TSS with U-corrugated basin (TSS-UA), case-3: TSS with the coupled cylindrical parabolic collector (TSS-CPC). According to the available literature, the exergy and economical analysis of tubular solar stills are not explored much in the previous studies. Thus, a comparative thermo-economic analysis, exergy analysis and system productivity analysis have been carried out. In addition to this, the study investigates the effects of different basin water depths on system productivity. It has been found that the case-3: TSS-CPC gives the highest productivity; it was 37.75% and 80.63% higher as compared to the case-2 and case-1 respectively. Also, in the same arrangement, the enhancement in the exergy efficiency was around 48.6% and 85.2% as compared to case-2 and case-1 respectively. The per liter cost of water obtained by TSS-FP, TSS-UA, and TSS-CPC were about 0.00592, 0.00511, and 0.00567 US $/m^2 respectively. The study concludes that the U-Corrugated basin surface, less basin water depth, and the secondary heating arrangement improve the productivity of the tubular still significantly.

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Tubular solar still; U-corrugated absorber; cylindrical parabolic collector; thermal analysis; exergy analysis; productivity enhancement

Introduction

The rising water crisis is faced by one-fourth of the human society, which is difficult to imagine when 70% of the Earth's surface is covered with water. While up to 80% of the surface water and groundwater available is used annually, the global water demand is expected to rise upto 55% by 2050. Over the last century, the fresh water consumption has risen more than double the rate of human population due to growth of various industrial and commercial agricultural enterprises. Such enterprises accounts for 70% of the global fresh water consumption (Water Crisis | World Water Council n. d.). Desalination is a simple and promising technique for water distillation. Firstly C. Wilson a Swedish engineer built the conventional solar still in 1872 (Muthu Manokar, Kalidasa Murugavel, and Esakkimuthu 2014). Compared with other sources of energy, the main benefit of solar energy is that it is a renewable and abundant source of energy. Therefore, solar energy utilization powered by thermal energy for water desalination processes is considered a leading technology in the renewable energy research field (Kabeel, Omara, and Younes 2015; Panchal 2016). Many desalination plants use fossil fuel as a source of energy, such as membrane distillation, reverse osmosis, and multiple effect distillation. The desalination processes are available for supplying the urban populace with clean

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Modeling the predictive values of ultimate tensile strength in welded joint by response surface methodology

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ABSTRACT

Strength always remains the prime requirement of any produced products, which normally explicate the capability of the products to sustain stress into it. Ultimate tensile strength is principally used to clarify the maximum values of stress, which can be resist by any product or material entity before breaking. Accordingly, study is conducted to verify the methodological way of determining the predictive values of ultimate tensile strength in welded joint. Response surface methodology is used in present study to grace decision results. In present study, the Metal Inert Gas (MIG) welding process is experimentally performed in mild steel plate specimens by considering three distinguish values of welding current, voltage and plate thickness. The objective of the study is to enroll the predictive equation to assists in deriving the elevated values of ultimate strength of the welded joint. The primary objective of present study is to demonstrate the utilization of competent structure of Response surface methodology under the dimensional arena of welding process. Here, the authors devised equation, which competently possess caliber to define the predicted values of ultimate tensile strength for the precise values of process parameter. The same assist in precisely understanding the behavior of ultimate tensile strength (dependent variable) under the influence of independent variables i.e. welding current, voltage and plate thickness. Response surface methodology is used and experiments based on Box-Behnken Design are performed in present study. The work is supported by MINITAB software for generating graphs and originating driving equation between response and process parameters. The predictive values are determined based on multiple regression equation and compared with actual experimental values to demonstrate capability and applicability.

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1. Introduction

The strength is always considered as a major parameter for highlighting the quality of the material or product. In present study, the authors worked in the direction of appraising ultimate tensile strength by devising the predictive modeling equations using RSM. RSM is normally a predictive modeling technique that can be used for formulating the response equation [1]. Here, the authors considered welding current, voltage and plate thickness as independent parameters and the ultimate tensile strength as a dependent parameter for generating response equations. It is found that Pai et al. [2] optimize the machining parameters and investigated the effects of these parameters on surface roughness in grinding 6061Al-SiC25P (MMCs) specimen by RSM. Aggarwal et al. [3] utilized RSM to investigate the effects of cutting speed, feed rate, depth of cut, nose radius and cutting environment in CNC turning of AISI P-20 tool steel. Philip et al. [4] used RSM to study the effects of the machining parameters such as spindle speed, feed rate & depth of cut on surface roughness of duplex stainless steel in end milling operation. Sahin and Motorcu [5] used RSM in turning of mild steel using coated carbide tools. They developed model using cutting speed, feed rate and depth of cut as input parameters. Arbizu and Perez [6] developed RSM models to determine surface quality of parts obtained through turning processes. Ozel and Karpat [7] utilized neural network modeling to predict surface roughness and tool wear of flank for varieties of cutting conditions in turning process. They developed Regression models

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Research Article

Research Trends and Performance of IIoT Communication Network-Architectural Layers of Petrochemical Industry 4.0 for Coping with Circular Economy

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In the present era, many Petrochemical Industries (PIs) are driven energetically due to IIoT (Industrial Internet of Things) Communication Networks/Architectural Layers (CNs/ALs), abbreviated as $PI_{4.0}$-CNs/ALs. $PI_{4.0}$ fruitfully participated to achieve the Circular Economy (CE) by speeding the reutilization, recovery, and recycling of scrap materials by minimizing cost, unproductive operations, energy consumption, emission of flue gases, etc. Recently, it has been ascertained that the identification and measurement of Research Trends (RTs) of CNs-ALs help the $PI_{4.0}$ to build the future CE. In addressing the said research challenge, the objective of this research dossier is turned towards inculcating into future $PI_{4.0}$ researchers the RTs of CNs/ALs of $PI_{4.0}$, so that the researches can be organized over the very weak and moderately performing CNs-ALs to hike the future CE. To materialize the RTs of PI_4-CNs/ALs, the authors conducted the Systematic Literature Survey (SLS) focusing on $PI_{4.0}$-CNs/ALs, i.e., Internet of Things (IoTs), Cyber Physical System (CPS), Virtual Reality (VR), Integration (I), Data Optimization (DO), Enterprise Resource Planning (ERP), Plant Control (PC), Data and Analytics (DA), Network (N), and Information and Data Management (IDM). The authors searched three hundred two research documents, wherein two hundred seventy-five research manuscripts qualified as RQ_2. Next, the authors collected the DOIs/URLs corresponding to each CN-AL and explored the Sum of Digit Scoring System (SDSS) to summarize the DOIs/URLs of $PI_{4.0}$-CNs/ALs. The RTs of DO have been determined as excellent and stronger over 2007-2017 than residue CNs/ALs. Eventually, the authors advised scholars to focus on the research areas of very weak and moderately weak performing CNs/ALs in order to attain future CE.

1. Introduction

In the last decade, the demand from customers for customized products with the lowest prices thrust Production Systems (PSs) into more digitalized capabilities with an effort of minimizing the wastefulness of industries. This approach is called the Circular Economy (CE). The growth of the population also propelled industrialists to establish, expand, and integrate their business empires by incorporating different varieties of customized products with the least waste. This is another way to describe CE. Today's emergent demands of domestic oils and gas resources are stimulating the research communities towards devising appropriate means to monitor and evaluate the physical performance for saving energy, processes which are respected as CE as per [1, 2]. Firms adapt a technical and institutional framework for enrolling, recycling, and disposal monitoring systems to ensure utilization of waste oils and hazardous wastes with a huge public interest in developing CE [3, 4]. The employment of appropriate technology can radically reduce ecological pollution and wastes by improving connectivity, integration, and automation towards oil mill processors and allied systems for attaining CE [5, 6].

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Investigations on thermal properties of CeO_2/water nanofluids for heat transfer applications

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ABSTRACT

At present, the nanofluids are being considered to be new emerging area of research which has lot of benefits in heat transport applications over traditional heat transport fluids. Since, nanofluids showcases an enhanced thermo-physical properties over the conventional fluids, they give better performance when compared with conventional working fluid. The current study evaluates the thermophysical properties of CeO_2/water nanofluids by experimentally by varying the temperature and volume concentrations. The volume concentration of CeO_2/water nanofluids is varied in five different values ranging from 0.01 to 0.3. The elemental composition of cerium oxide nanoparticles is analysed with the aid of EDX. The surface characteristics of the CeO_2 nanoparticles are explored with scanning electron microscope. It is evaluated that thermal conductivity, co-efficient of viscosity and co-efficient of density of CeO_2/water nanofluids with 0.3 vol fractions have been increased by 35.97%, 1.76% % and 1.56% respectively when compared to that of 0.01 vol concentration. It has also been evaluated that specific heat of CeO_2/water nanofluids is decreased by 5% with 0.3 vol concentrations when compared to 0.01 vol concentrations.

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1. Introduction

Heat transport fluids such as water based fluids, oil, and glycols are having deprived thermo physical properties due to which the thermal performance enhancement cannot be improved to optimal level to meet the current requirements of the solar collectors. In order to meet these requirements, nanofluids could be employed as operational fluids in place of conventional fluids to increase the absorption of solar energy. Thermal conductivity, specific heat, effective density, co-efficient of dynamic viscosity, and capacity are the important factors which controls their heat shifting characteristics [1,2]. Further, the thermal properties of nanofluids are relying on size of particle, volume fraction, operating temperature, etc. Therefore, it is essential to assess the temperature dependent properties of nanofluids as they are important for estimation of heat transport coefficient.

The term 'nanofluid' had been first coined by Choi [3] as mentioned in his work. The nanoparticles disbanded in the base fluid show enduring stability and greater thermal conductivity when compared to micro-level particles in addition to little pressure drop. A lot more investigations have been conceded in order to acknowledge the variation in heat conductivity in the past. It is found that the assimilation of nanoparticles in a base fluid augments their heat transport property owing to the Brownian motion which influences the thermal behavior of nanofluid [4,5,6]. Masuda et al. [7] performed the experiments for exploring the opportunity of shifting the characteristics of conventional heat transport fluids by disbanding nano level particles such as Al_2O_3 and TiO_2 particles with the water based fluid. It was observed that the enhancements in the effective thermal conductivities were found to be 32.0% and 11.0%, respectively for the fluids containing of 4.3% volume concentration.

Murshed et al. [8] accomplished an experiment to gauge the thermal conductivities by using dissimilar shaped nano-TiO_2 particles in water by hot-wire technique. It was perceived that the heat

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ORIGINAL ARTICLE

Drying characteristics of mint leaves (*Mentha arvensis*) dried in a solid desiccant dehumidifier system

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Abstract In this present study, solid desiccant-based pressure-swing adsorption (PSA) dehumidifier was developed and the process parameters were optimized to deliver the air continuously at 0.1% relative humidity. Mint (*Mentha arvensis*) leaves are tested to study the drying characteristics at varied flow rates of dehumidified air in the drying chamber. The initial moisture content of 5.059 g water/g dry matter have been reduced to a safe storage level in 360 min at 0.160 m^3/min volume low rate. The effective moisture diffusivity of the mint leaves was found in the range of $2.07534 \times 10^{-11} m^2/s$ to $3.45817 \times 10^{-11} m^2/s$. The percentage of retention of ascorbic acid in dried mint leaves is increased by an increase in the volume flow rate of dry air and a maximum of 70.11% is achieved by 0.160 m^3/min. The colour measurement and chlorophyll content of the dried samples indicated that the desiccant dehumidified air dryers are suitable for heat sensitive green leafy vegetables.

Keywords Mint leaves · Drying · Ascorbic acid retention · Solid desiccants

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List of symbols

Adj SS	Adjusted sum of squares
m^3/min	Cubic metre per minute
°C	Degree celsius
D_{eff}	Effective moisture diffusivity (m^2/s)
DBT	Dry bulb temperature
DR	Drying rate (g water/g dry matter.min)
g	Gram
hp	Horse power
kg	Kilogram
lpm	Litre per minute
m/s	Meter per second
m	Metre
m_d	Moisture content on dry basis (g water/g dry matter)
m_t	Moisture content at any time 't'
MR	Moisture ratio
ppmv	Parts per million volume basis
%	Percent
R1	Replication 1
R2	Replication 2
R3	Replication 3
R^2	Regression
rh	Relative humidity
s	Second
t	Drying time (sec)
w_o	Initial weight of the product (g)
w_d	Weight of the dry matter (g)

Introduction

Mints (*Mentha* species) belong to the family of Labiate (*Lamiaceae*) and are widely cultivated in several countries like India, China, Brazil, Japan, France, USA and Thailand

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