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Teerthanker Mahaveer University

Teerthanker Mahaveer University has been established by an 'Act' (No. 30) of 2008 of the Government of Uttar Pradesh and is approved by the University Grants Commission (UGC) vide letter No. F. 9-31/2008(CPP-1) dated October, 2008. The University is located on National Highway-24, barely 144 Km from New Delhi.

The University stands committed to the ideals of Lord Mahaveer – Right Philosophy, Right Knowledge, and Right Conduct – in all the spheres of activity and aspire to be recognized as the ultimate destination for world class education.

The multi-disciplinary University offers career oriented courses at all levels, i.e., UG, PG and Doctoral degrees across diverse streams, namely, Medical, Dental, Pharmacy, Nursing, Paramedical Sciences, Physiotherapy, Hospital Administration, Education, Physical Education, Engineering, Architecture, Polytechnic, Management, Law, Journalism, Fine Arts, Jain Studies, and Agriculture Science to meet rising aspirations of the youth.

Faculty of Engineering & Computing Sciences

The College of Engineering has emerged as a hub for academic excellence in engineering training. The college contributes to quality education in all major disciplines of engineering and technical education and helps meet the needs of industry for trained technical manpower with practical experience and sound theoretical knowledge.

The college was established by the university with the aim of providing relevant, essential, upgraded education to the young aspirants in the field of computer science and engineering, including computer applications. In recent times and the years to come there will be increasing demand of skilled manpower in the domain of Computer Science and Engineering because of the 'Digital India' mission projected around the globe by Government of India.

S & T Review is a **peer-reviewed**, and multidisciplinary **engineering journal** that publishes original research, case studies, & review articles of all major branches of Engineering, Science and Technology. The Journal does not charge for publishing any manuscript. The papers contained in the journal carry the opinion and view of the contributors and not necessarily of the editorial Board. The editorial Board as such shall not be responsible for the authenticity and legality concerns regarding the submission made in this journal. The entire responsibility shall lie with the author of the papers or case studies.



CHIEF PATRON

Shri Suresh Jain

Chancellor, TMU, Moradabad

I am extremely glad and feeling inner happiness for the vol-6 and issue-1 of S &T Review, an International Journal of Science and Technology, Faculty of Engineering and Computing Sciences, Teerthanker Mahaveer University, Moradabad in the Month of December, 2020. I say that the World is growing very fast and creative researches have changed the entire Technology in the field of Engineering, Medical Sciences, Computing Sciences and variety of industrial products. No doubt that research in any discipline is not one day job but it needs consistence and continuous efforts to do constructive work for the benefit of mankind. In the present Scenario the scientist all over the World has achieved wonderful Technology to make impossible task to possible through research only. Just see the defence technology, in medical the robotic surgery, in Engineering heavy duty working Machines, variety of Batteries, IOT, and Fuels etc. The dream of this University was completed in the year 2008 and since that day the teaching /research standard is getting advancement, and am ambitious to enhance research interest among the faculty members to grow vertically and horizontally for bright and successful endeavour in all Departments. This is true that any institution is recognized by research work, quality publications and patents which are usable by industries and not by colossal and huge towers. The faculty members may spare one /two hours per day for research. Everyone must have determination, confidence and research interest to produce quality research work. Now I express my happiness to publish this journal on regular basis. I am sure that readers of this message will take it very positive to move ahead among the best researchers. I trust that FOE & CS will definitely bring revolution through quality research work to give a good name and fame to Teerthanker Mahaveer University in India and abroad as prestigious institute in academics and research. My heartiest felicitation to Prof (Dr) R. K. Dwivedi, Director and Principal of FOECS, Editorin- Chief, Associate Editors, advisory committee to launch this Journal successfully up to the extreme satisfaction of research students, researchers and scientists.



CHIEF PATRON

Shri Manish Jain Group Vice Chairman, TMU, Moradabad

I take this opportunity to rejoice along with critical faculties and students, Faculty of Engineering and Computing Sciences for the smooth and efficient functioning of the college under the vigilant supervision of Professor R.K. Dwivedi, Director and principal, TMU, Moradabad. I am feeling immense pleasure that FOE&CS is publishing vol-6, issue-1 of S& T Review in the Month of December 2020, to boost the research environment in the college. I advice the learned faculties that develop addiction to perform research activities in your respective field. You may feel that it is a difficult task but this will add in your profile as an excellent researcher. This will be beneficial for the students also to show them right path for their professional and prosperous life in endeavour. Keep it up in doing constructive work to elevate the academic and research standard of this unique Teerthanker Mahaveer University, Moradabad. Though this university young in years, Second to none in this area as most popular interdisciplinary University. I am sure that fragrance of quality education, Research potential, variety of courses offered, is spreading through cooperation and perseverance.



PATRON

Prof.Raghuvir Singh

Vice Chancellor, TMU, Moradabad

I am very happy to announce the publication of a Journal of TMU, which is long overdue. The Journal is aptly titled "S & T Review, an International Journal of Science, and Technology-A TMU Publication", broadening the scope and coverage so that researchers across the University can contribute to the publication.

University education system, particularly technical education, requires a platform to encourage budding researchers for publishing their research output in the form of journal articles. TMU is largest Technological Universities in the country with a very large pool of faculty, research scholars, and post graduate and graduate students. As such the University would like to create a platform for its fraternity for publishing their research works by instituting a high quality technical journal covering all branches of Engineering and allied fields.

Starting a Journal publication is expected to benefit the University in many ways — it brings scholarly recognition to the University; it would also contribute for the career development of faculty and researchers through their participation in the creation and sharing of new innovations, research and development. These new ideas, research and development activities finally translate into the overall development of the community and society at large. These scholarly publications will be a medium for academic and scientific discussions and enrichment of research areas. Though there is a long list of advantages that an academic journal can offer to research community, primarily for a researcher an academic journal is a credible and authoritative source of information and offer platform and evidence for their research output.

I suggest and appeal the students, faculties to strengthen the quality of the Journal by performing quality research reviews, research papers.

Congratulations to Professor R.K. Dwivedi, Director and Principal, FOE &CS, Editor-in-Chief, Associate Editors, section Editors and Advisory committee to motivate a positive environment of research in the college.



Editor in Chief

Prof. (Dr.) R. K. Dwivedi

Principal & Director, FOE & CS, TMU, Moradabad

I take this opportunity to share my views for the smooth working of the Faculty of Engineering & Computing Sciences, Teerthanker Mahaveer University, Moradabad. Firstly I congratulate to team of learned persons in publishing the vol-6, issue-1 of S &T Review (Bi- annual Journal) in end of December, 2020. This an excellent approach to publish Reviews, research Papers, on regular basis. I always say, nature does not thrust potentials and accomplishments upon mankind. We are endowed with insipient powers and latent forces. This is our duty to develop them so as to master himself. To my mind, Faculty of Engineering & Computing Sciences is not just a building made of bricks, mortar and concrete, but It is a noble centre of education that help in building character, empowering minds and imparting rich and rewarding experience that last life time. Ultimately, this lead to realization of all cherished dreams. Try to know your potential yourself otherwise you will not value your time. My aim of life is, live with enthusiasm to go higher and higher and contribute for the welfare of the society. I express my heartiest gratitude and thanks to His eminence Shri Suresh Jain, Chancellor, Shri Manish Jain, Group Vice Chairman, most respected Vice Chancellor Prof. (Dr) Raghuvir Singh, the Editor-in-chief, Associate Editors, Section Editors, Members of advisory committee for their untired efforts to bring this issue in magnificent form.

S & T Review

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Experimental Investigation of Spray Tip Speed for Diesel Fuel under ambient conditions

Mahir Husain^{1*}, Anurag Srivastava², Manish Dhingra³

¹Assistant Professor, Department of Mechanical Engineering FOECS, TMU, Moradabad (UP), INDIA

²Assistant Professor, Department of Mechanical Engineering FOECS, TMU, Moradabad (UP), INDIA

³Associate Professor, Department of Mechanical Engineering FOECS, TMU, Moradabad (UP), INDIA

*mahirh91@gmail.com (Address for Correspondence), anuragsrimpec@gmail.com, dhingramanish2003@yahoo.com

Abstract-Fuel spray tip penetration is one of the most important fuel spray characteristics which is closely related to the performance and emission of the internal combustion engines. Length of penetration and time of penetration should be very precise because of very short time between start of injection and combustion. These two parameters can be studied combined as one parameter which is spray tip speed. Fuel spray tip is offered to a very large air drag in the cylinder due to compressed air. In order to penetrate small distance in highly compressed air, spray tip speed should be large enough. Spray tip speed depends on pressure drop across nozzle, density of air, density of fuel and nozzle geometry. In this study fuel spray characteristics has been studied. Spray tip speed has been measured using very fast response optical sensor whose accuracy is about 99.95 percent. Measurement has been taken for first 100mm penetration length at 100 bar, 150 bar, 200 bar, 250 bar and 300 bars for commercial diesel fuel. It has been measured in atmospheric condition i.e. without any chamber. Spray tip speed found for diesel are 69.44mm/ms, 83.33mm/ms, 111.11mm/ms, 125mm/ms and 125mm/ms respectively at different injection pressures and comparison of these values with that of theoretical results was carried out.

Keywords-Spray penetration length, Spray tip speed, Penetration time, Injection pressure.

1. Introduction

Fuel spray characteristics including droplet collision, breakup modeling, tip penetration length and penetration speed always have been of an important topic of studies among scientist and engineers because the atomization of fuel, breakup of droplets and penetration length in the fuel injection process has close relationship with the performance and efficiency of the engine and hence, the pollutant emission and fuel consumption control [1]. Among all the fuel spray characteristics Spray penetration or spray tip speed is one of the key characteristics that influence vapor distribution, vapor mixing in air and combustion chamber gas turbulence [2]. In a low-speed regime and light load conditions, the unburned hydrocarbon emissions are less if contact between the spray of fuel (liquid length) and the combustion chamber wall is avoided and at high-speed regime and heavy load, the emission of fumes is reduced if there is contact between the spray of fuel and the combustion chamber wall [3], to maintain the proper contact of spray with cylinder wall, the spray tip speed should be considered. Lots of work on spray tip penetration can be found in the literatures which deal with investigation of the effect of parameters on penetration length of a spray and optimization of combustion conditions to reach the optimum penetration length and deriving theoretical and impractical governing correlations. Hiroyasu [4] and Desantes [5] showed that the relative magnitude of two opposing forces, namely the kinetic energy of the initial liquid jet and the aerodynamic resistance of the surrounding gas, influenced the penetration length of a spray. Kawano [6] declared that increase in initial injected fuel temperature yielded the reduction in penetration length of the

spray due to evaporation of the fuel with low boiling point. Lefebvre [7] determined the best corresponding spray tip penetration to the size and geometry of the combustion chamber in a way that optimized the engine performance. Present experimental work deals with the observation of variation of spray tip speed (which is related to spray tip penetration) with the fuel injection pressure for diesel. Also, we observed the variation of spray tip speed with respect to the fuel metering.

2. Diesel Spray Characteristics

Diesel spray can be analysed in a macroscopic or microscopic point of view [4]. To understand the microscopic approach in detail, the various physical parameters involved during the transition of a diesel spray are expressed in the figure1; however, it is essential to know the systems that make possible for an injection process to take place. These are the injection nozzle, active fluid to inject (liquid), and the working fluid on which the liquid is injected, as can be seen in figure 1.



Figure 1: Meaningful variables of the injection process [4]

The Macroscopic point of approach deals with the interaction between fuel spray and the control volume in which the fuel is injected. Figure 2 shows the parameters which describe the physical behavior of fuel spray.



Figure 2: Physical parameter of a diesel spray [4]

3. Theoretical Models

Various empirical relations are available in the literature which deals with the effect of different parameters (like pressure, density, time) on fuel spay characteristics. In Present work correlations [8] and [9] are taken into account to measure the value of spray tip speed S and a comparison of

measured values with that of experimental results is carried out. Here Pl is the injection pressure and Pg is the atmospheric pressure, $\Delta P = Pl - Pg$, t=time interval and and is the density of surrounding medium and liquid fuel respectively.

4. Experimental Setup and its Components

This section gives a brief description about the experimental setup, its components, their functions, fabrication and schematic diagram of sensor arrangement. The schematic diagram with its components is shown in figure 3.



Figure 3: Schematic Diagram of Setup

Description of various components of experimental setup are given below

4.1 Manual fuel pump: A hand operated manual fuel pump is used which have a Bosch fuel pump is installed in the frame vertically. Hand lever is connected to the bottom of the fuel pump to operate it. This remains common for all injection studies on this experimental setup. Specifications are given in table 1.

Make	Bosch
Туре	Single Barrel
Length of Stroke	5 mm
Bore	9.5 mm
Max. Fuel Delivery/ Stroke	200 mm ³ (0.2ml)

Table 1: Specifications of Fuel pump

4.2 Fuel Injector: A single hole, Pintle type nozzle fuel injector has been used to obtain desired fuel spray for this study.

4.3 Sensor Arrangement: The sensor arrangement has been fabricated to measure the spray tip speed. It consists of a mild steel plate having three holes. One at the centre and two others at each side of center hole, 1 inch apart. A hollow tube of steel is welded to the plate concentrically. Two led sensors are placed in the steel tube 100mm apart to detect the signal of obstacle due the fuel spray. Least Count = 0.5mm.







Figure 5: Pictorial View of Sensors arrangements

Digital Oscilloscope: A portable FLUKE, Two channels Digital Storage Oscilloscope with 100MHz, 1GS/s capacity is used to measure the Responses of optical sensors.

5. Test Procedure

The line diagram of test procedure can be shown in the figure 4 in which two optical sensors are attached at station 1 and station 2 separated by 100 mm mounted on a steel pipe of diameter 16 mm. The sensors give signals when refractive index of medium changes in which light is passing. At the start of the injection, the spray first reaches at the station 1, change in refractive index of mean occurs at station 1 and a signal is obtained. Similarly when this reaches station 2 another signal is obtained. These two signals are recorded by the digital oscilloscope. The difference between these two incidents gives the time interval for travelling 100mm length by the fuel spray. At each injection pressure the readings are taken for five times and then there average is taken as experimental value of spray tip

speed at that injection pressure. In present study the commercially available Diesel fuel with Density of is used as a test fuel.



Figure 6: Line Diagram of Sensor Arrangement for measuring spray tip speed

6. Experimental Results

Theoretical results obtained from the correlations [8] and [9] are summarized in the table 2 and these results are plotted with experimental results. The comparison of theoretical results with that of experimental results can be seen from the plot shown in the figure 6.

Results From the penetration correlation: [8] Fuel: - Diesel.								
Injection pressure	Time of penetration t	Penetration length S	Spray tip speed					
(bar)	(ms)	(mm)	(mm/ms)					
100 bar	1.44	102.34	71.07					
150bar	1.2	104.47	87.06					
200bar	0.9	89.83	99.81					
250bar	0.8	89.18	111.47					
300bar	0.8	98	122.5					

Table 2: Theoretical results [8]

Table 3 Theoretical results [9]

Results From the penetration correlation: [9] Fuel: - Diesel								
Injection pressure (bar)	Time of penetration t (ms)	Penetration length S (mm)	Spray tip speed (mm/ms)					
100 bar	1.44	100.08	69.5					
150bar	1.2	102.32	85.26					
200bar	0.9	88.68	98.54					
250bar	0.8	88.18	110.22					
300bar	0.8	96.63	120.78					

Experiment was carried out as per the procedure given. Spray tip speed versus injection pressure are plotted using theoretical data and experimental data as shown in figure 6.



Figure 7: Comparison of Results

7. Discussion and Conclusions

It can be seen from the figure 6 that the results obtained from correlation developed by Payri R. [8] and by Naber J.D. [9] depicts the same trends for the given injection pressure ranges. Experimental results are also plotted on the same graphs which show that experimental values and theoretical values follows the same trends up to the injection pressure 100 to 150 bar but as the pressure rises experimental results shows more values than that of theoretical values and at high injection pressure experimental results achieve the constant trends. It can also be concluded from the above analysis that correlations fit always shows the increasing trends of fuel spray speed with increase in injection pressure while experimental results shows increasing trends up to a certain pressure values above which fuel spray speed becomes almost constant that can be seen in the graph.

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Wideband Sensing Antenna for Smart RF Sensors

Prempal Singh¹, Pankaj kumar Goswami^{2*}, Garima Goswami³

¹Department of Electronics Engineering, Jaipur National University, Jaipur, 302017, India

²Department of Electronics Engineering, TeerthankerMahaveer University, Moradabad, 244101, India

³Department of Electrical Engineering, TeerthankerMahaveer University, Moradabad, 244101, India

*1g.pankaj1@gmail.com (Address for Correspondence), 2grmsinha@gmail.com

Abstract-The association of quantum effect into microwave application has become protagonist of modern era of wave applications. The effective impedance variation may easily be encountered with respect to alteration into path distribution of E-M wave. The effect of quantum theory is directly affected with respect to band gap insertion in various materials with different dielectric constant. In this paper the antenna designed is constituted by band gap insertion, resulting in better trade off in size and bandwidth calculations. The antenna geometry is also modified to reduce overall captured area. The passive geometry with respect to patch gives reradiating current distribution and hence results in improved bandwidth of micro strip patch antenna about 32.05 percent at operating frequency 2.31 GHz. The Scattering loss parameter S11 is measured. The antenna is widely suitable for large number of advance applications such as cognitive radio sensing network, IoT and smart wide RF scanning devices as per FCC standard.

Keywords: EBG; Microstrip Patch Antenna; IoT; Slotted Strip; UWB

1. Introduction

The micro strip patch antenna is very simple in fabrication; it is a metallic patch on one side of thin grounded dielectric material may refer as substrate. With specific range of dielectric material, the antenna may be used for various microwave frequency range [1]-[3]. The various wireless applications has lot of advantages of using micro strip patch antenna as it may easily be installed , conformal to fabricate on any surface ,cost effective ,easy to feed etc. the scope of improvement is seen due to its low band width, low capacity of power handling, less effective polarization capacity[4]-[5]. It is really a part of ongoing research to enhance the parametric properties of micro strip patch antenna without putting any compromise in its dimensional characteristics. It shows the design of an efficient antenna with reduced size and enhanced bandwidth with effective radiation pattern is always a concentration of researchers [6]. To overcome the limitation of micro strip patch antenna the design aspect is revised, and the modifications are also done in substrate ground keeping other materialistic factors unaltered. The antenna is an impedance matching device between transmission lines [7] to free space hence the transfer of power completely depends upon the impedance synchronization, better the impedance matching better the power the transmission to the free space or from the free space. Therefore, an alteration in dielectric substrate structure results in tremendous variation in antenna parameters. This paper represents the effect of passive elements associated with active part of the micro strip antenna design. The feed current and the radiating current elements was seen very differently with improved radiation pattern. The electromagnetic band gap geometries have been taken up into consideration to change the impedance profile of micro strip patch antenna [8]-[10]. These structures may offer very high impedance regions for operating frequency rang chosen from microwave frequencies. The geometrical cut sections on the ground surface will turn up into combination of various passive reactive elements on excitation of antenna with feed current. This reactive part of surface geometry of dielectric substrate completely depends upon of the feed frequency. Hence the overall surface will form band gaps for electromagnetic waves.

These electromagnetic band gap structure in association with micro strip antenna results in reduction of surface wave and hence reduction in return losses [11]-[15]. By this way the voltage standing wave ratio is significantly low over the zone of operating frequency. There are various approaches to analysis micro strip antenna, having certain constraints with each of the antenna design modeling. Among all the method of moment is highly popular due to fast and accurate analytical capacity. It is basically consisting full wave model of surface wave current and polarization current [16]-[18]. All modeled transient integrals can be represented into polynomial of algebraic variable. By choosing appropriate constant in the equations, this can easily be turned into linear solutions for devising machines. It has low physical interpretation but high accuracy [19]. This method really helps in determination of typical parameters of antenna more precisely and effective conclusion can be obtained [20].

2. Proposed Configuration



Figure 1: Antenna Schematic front and bottom view

The proposed antenna geometry to its upper surface is shown in figure 1 and ground surface with deformities equivalent is depicted by figure 2.



Figure 2: Ground deformities equivalent diagram

The base antenna is taken up as simple square patch with basic ground properties. The dimension of the antenna is taken up from micro strip patch antenna mathematical equation for its length and width calculation using a dielectric substrate of dielectric constant 4.2. The material is commercially available as FR-4 material. The antenna geometry is modified with the fabrication of two passive patches in association of with active feed elements. The overall antenna geometry is also provided with the insertion of uniform deformation on ground plane. This deformation is an actual pathway for generation of electromagnetic band gap structure within the dielectric slab. The standard height of the dielectric slab is 1.6 mm and on excitation of antenna may result in virtual path variation for radiation current due to improved antenna geometry. The proposed configuration will lead various

enhancements in performance parameter with respect to conventional antenna structure of similar dimensions. The proposed antenna has the following design configuration shown in table 1:

Antenna	Design Parameters (mm)										
	r	S	t	u	d	q	Lg	Wg	a	d/u	
Design 0	8	2	6.5	1	1	3	7.5	18	1	1	
Design 1	8	2	6.5	5	1	3	7.5	18	1	0.2	
Design 2	8	2	6	6	1	3	7.5	18	1	0.16	
Design 3	8	2	6.5	7	1	3	7.5	18	1	0.14	

Table1: Antenna Configuration & optimization

The proposed antenna is designed with the ground deformities and studied for various parametric performances. The antenna design simulation is recorded for large range of frequency in GHz. The scattering loss parameters shows the proposed antenna may exhibits a usable band of frequency from 1.79 GHz to 2.59 GHz band with satisfactorily low return losses at cantered frequency around 2.31 GHz also, it exhibits VSWR<2 within matched bandwidth shown in figure 3.



Figure3: VSWR versus frequency curve

The Proposed antenna is fabricated to validate the simulation observations as shown in figure 4. The results give a tremendous move in the direction of design of new geometry and its further applications in wireless technology. The radiation pattern is more bidirectional and have broadside pattern. The gain of the antenna is also found suitable under the excitation at port one. The repeated structure of ground deformities could be able to enhance the bandwidth as depicted simulation results. The design architect with respect to dielectric medium has also become significant, the various parameters found appropriate over the effect of substrate properties. The impedance matching and reduction of surface wave is also seen while introducing EBG structure, these are periodic structure produced at the ground surface, the EBG structure enhanced the control on return loss at port one that is now the return loss parameter has more dip around centre frequency.



Figure 4: Fabricated antenna (a) Front view (b) Rear view

The antenna is absolutely resonating at 2.3 GHz and the -10dB cut off frequencies are more symmetrical around centre frequency. The antenna parameter is observed on full wave simulator, which works on method of moment. The modelling is found high accuracy with less physical insight. Antenna radiation pattern, return loss parameters, VSWR are shown in simulation results of MoM simulator. The process effectiveness is observed through the electrical equivalence of the slot strip as shown in figure 5



Figure 5: Equivalent diagram of slot

3. Results & Discussion

Now the various models are simulated on high frequency structure simulators and the effective parametric study is carried out here. With respect to variation in slot length, the multiple designs have different behavior for return loss characteristics as shown in figure 6. First reduction in the local coefficient d/u causes the design evolution of the design1, most suitable candidate under this category. While, further reductions may causes slight alteration of parameters to drastic change in the operating frequency zone as design 3. Hence, accepting design1 as good structure for further discussion under the current distribution and radiating parameter characteristics. As a matter of current distribution figure 5.30 gives the port field fringes in radiating patch. The simulated input impedance is also found matched over the operating frequency range in figure 6.



Figure 6: Scattering parameters for multiple designs

The confined parameters of proposed antenna are evaluated through empirical study of various class of antenna under characteristics mode. The design1 parameters of this class of antenna is fabricated using FR-4 material with substrate dimensions 21x18 mm2 and thickness 1.5 mm. Patch is fabricated as U-shape with slotted feed strip on EBG inserted optimized ground plane and its electrical equivalent diagram supports the functioning. The small deviation is seen between the measured and simulated result due to impedance variation at the connecting feed. The gain of the antenna is also analyzed over the frequency sweep and found good over the entire operating range. The prototype of proposed antenna is developed and the measured & simulated return losses are compared in figure 7.







Figure 8: 3D plot at 4.5 GHz and 9 GHz radiation pattern

The measured impedance bandwidth is found ultra large below -10 dB return loss from 3.5 to 11.1 GHz. The radiation pattern is measured at distinct frequency of operations is shown in figure 8, it is analyzed the radiation pattern has good dipole pattern like structure and respond for wider range of excitation with in operating bandwidth. In respect to multiple design aspects the optimized results are obtained for the proposed antenna geometry. The current distributiom is indicates the radiation distribution over the frequency sweep and shown in figure 9. The comparison among the various designs indicates that design 1 proves the best feasibility of the device for various smart sensing applications as shown in figure 10. The response are summarized in table 2.



Fig 9: Current density distribution



Fig. 10 Graphical representation of parameter variation

Parameters MSA	Square patch	Proposed Antenna
Bandwidth (MHz) S11< -10 dB	23%	32.3%
VSWR at port 1 (2.39)GHz	1.079	1.121 (2.3) GHz

4. Conclusion

The Proposed antenna design shows a good return loss more than -10dB. This indicates a good impedance matching is achieved in designing the patches and feed lines. The S11 < -10 dB comparison graphs show that the resonant frequency has a dynamic range movement in the magnitude of return losses over the band of designated frequencies range. Also, the design gives a better compromise between the enhancement of bandwidth with sustainability of antenna size and reduction in feed active area. Hence, the proposed antenna may become a high utility for smart wireless sensor networks for cognitive and IoT based wide band applications.

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Constructive Analysis of Computer Communicational Networking with Terminal Reliability

Vipin Kumar^{1*}, Pradeep Kumar Verma², Prashant Kumar³

¹Department of Mathematics, Faculty of Engineering, Teerthanker Mahaveer University, India

²Department of Electrical Engineering, Faculty of Engineering, Teerthanker Mahaveer University, India

³Department of Electrical Engineering, Faculty of Engineering, Teerthanker Mahaveer University, India

*drvipink.engineering@tmu.ac.in, (Address for Correspondence), pradeep.engineering@tmu.ac.in , prashant.engineering@tmu.ac.in

Abstract— CCN stands for computer communication network. It has the vital role depends on the reliability of the network element and structural design. The structural and graphically design is particularly concerned with location of computer and communication links connecting them so as to verify the performance requirements with minimum cost. In this paper we describe the problem of preparing a topological lay out of a CCN with optimum ST-reliability. The designer faced problem whenever a new network is set up or an old network is expanded. In the given paper, it is defined the mentioned problem by given a better approach for same, the target is achieved by deciding the physical location of computer & communication links in a manner that the network required for desired connectivity is optimized. Thus, the ST- reliability of a CCN with a fixed topology is optimized for a given set of link reliabilities. The results reported in this paper have been compared with those derived from exhaustive enumeration technique. It is observed that these results are very close to the true optimum results in all the cases.

Keywords-CCN, Reliability, ST- reliability, Topology, Optimization

1. Introduction: Computer industry is young compared to other industries (e.g. automobile and air transportation) computer have made spectacular progress in a short time. During the first two decades of their existence computer systems were highly centralized, usually within a single large room. Not frequently, thus room had glass wails, through which visitors could walk at the great electronic wonder inside. A medium size company or university might have had one or two computers, while large institution had to most a few dozen. The idea that within 20 years equally powerful computers than postage stamps would be mass produced by the million was pure science fiction.

Several issues arise with regard to topological design and operational procedure for computer communication network. The reliability of the network is one of the most important criteria for performance analysis of a CCN.

The ST-reliability of a CCN heavily depends upon the reliability of communication path between each node pair (2,3) as well as the topological layout of various computer systems, links and communication facilities. Various methods have been reported to evaluate the terminal reliability of a CCN (4-6). However, nothing significant has been reported for optimizing network. In this paper we present a heuristic approach for optimizing link reliability allocation in a fixed topology of a CCN so that, for the given source and terminal nodes, the resulting reliability is near optimum. The proposed technique uses minimal path finding process. The numerical values of ST-reliability are obtained by employing. The true optimum ST-reliability values have also been determined by exhaustive enumeration. It is observed that the optimum ST-reliability valued achieved through our method is very close to the true optimum values.

2. Notations:

- LS: Set of communication links
- Fi: Frequency of ith link
- LSi: Subsets of LS
- ALS: Arranged link set
- Ci: Path ordinates
- RAV: Reliability Assignment Vector
- SLR: Set of Link Reliabilities
- RST: St-reliability as obtained on the basis of the given Set of link reliabilities

ORST: Optimum ST-reliability calculated by employing the present technique.

OR True: True optimum ST-reliability determined by exhaustive enumeration.

2.1 The Present Technique:

The present approach first enumerates all minimal ST-paths and then arranges these paths in increasing order of their cardinalities. In the path of least cardinality, the occurrence of each link (frequency) is counted and the link set LS is arranged in the decreasing order of the frequency of each link.

Let L1 links have frequency F1L2 links have F2,....Lk links have Fk in the path of the least cardinality such that F1> F2 >Fk. In links set LS the links having the same frequency can be placed in any order. Further partitioning of link set LS result into Subset LS1, LS2.....Lks with cardinalities L1,L2,.....Lk respectively, each of which contains the links having equal frequencies. These subsets are rearranged in decreasing order of frequency of each link in the path of higher cardinalities. The concatenation of the arranged subsets Lsi (i=1,....,k) yield the finally arrange link set ALS. The reliability is obtained by employing [9].

The numerical values of ST-reliability are also determined by taking links reliabilities in the order as originally given. If this is higher than the previous value, it is considered to be the optimum value of ST-reliability otherwise; the former is taken is the optimum value. The algorithmic representation of the whole process described above is as follows:

2.2 Algorithm:

Step 1: Determine all minimal ST-paths by employing (16).

Step 2: arrange these paths in the increasing order of cardinalities say C1, C2,.....Cn.

Step 3: Organize LS in decreasing order of link frequencies in the paths of the least cardinally i.e. of C1.

Step 4: Partition LS into subsets LS1, LS2 ,..... LSn depending on the number of different link frequencies in the paths of cardinality C1.

Step 5: Count the frequency of each link in the paths of cardinality C2.

Step 6: Arrange the links in each of the LSi (i = 1, 2, 3, ..., k) in the decreasing order of their frequencies in the paths of cardinality C2 and if required further partition each of the LSi, according to steps 3 & 4.

Step 7: Repeat steps 4 to 6 till all the paths are taken care of.

Step 8: Concatenate all subsets of LS to form ALS preserving proper order of subsets.

Step 9: Determine the terminal reliability SRT on the basis of the given set of link reliabilities.

Step 10: Determine ORST on the basis of the heuristic link assignment implemented in step 8.

Step 11: If ORST <RST then ORST = RST

Step 12: Stop.

3. Implementation of the Algorithm

Consider the network given in fig.1 and a given set of link reliabilities

SLR= {94, 75, 88, 95, 89, 96, 93}.

Step 1: Taking node 1 as source node and node 3 as terminal node, the paths in terms of link indices are listed below in the increasing order of their cardinalities.

1	:	6	4	5	7
2	:	6	3	5	8
3	:	1	3	4	8
4	:	6	3	7	
5	:	1	5	8	
6	:	6	4	8	
7	:	1	7		
8	:	2			

Step 2: The number of occurrences of each link in the paths of different cardinalities is tabulated as follows:

Cardinality/ link>	1	2	3	4	5	6	7	8
1	1	0	2	2	2	2	1	2
2	1	0	1	1	1	2	1	2
3	1	0	0	0	0	0	1	0
4	0	1	0	0	0	0	0	0

Step 3: The arranged link set is given as

LS= {1, 3, 4, 5, 6, 7, 8, 2}

If we observed the frequency of 2 is 4 and all rest link are not presented in the route of order 4. Therefore, LS may be divided into two subsets LS1 & LS2 having links of equals frequency in the route of cardinality 4.

 $LS1 = \{1\}$ $LS2 = \{3, 4, 5, 6, 7, 8, 2\}$

Step 4 & 5: The link of LS2 is further rearranged and portioned according to step 3 in decreasing order of frequency of each link in the paths of cardinality and which produces.

$$LS21 = \{3, 8\}$$
$$LS22 = \{7, 2\}$$
$$LS22 = \{4, 5, 6\}$$

Similarly, considering the path of cardinality 3, we get subsequent partitions as:

$$LS21 = \{1, 7\}$$

 $LS22 = \{6, 8\}$
 $LS22 = \{2, 4, 5\}$

The link positions in LS2 are not changed as the frequencies of link 3 and 8 are same in the path of cardinality 3. At last, the path of cardinality 4 are considered which do not alter the order of any of the above link sets.

Step 6: Now finally arranged link set, ALS is given by,

$$ALS = \{LS1, LS2, LS222\}$$
$$= \{1, 3, 8, 4, 5, 6\}$$

Step 7: The corresponding reliability assignment vector is

RAV = {0.96, 0.93, 0.75, 0.95, 0.89, 0.88}

Step 8: RST = 0.9989541

Step 9: ORST = 0.9994758

Step 10: Here RST < ORST therefore final ORST remains unaltered.

4. Conclusion

A method is suggested in this paper to optimize ST-reliability in a computer's communication network. It can be used by a network designer as an on paper pre design exercise for preparing optimum layout of a CCN. Also, it would be helpful for the maintenance engineer to deciding as to which of the links is to be given the highest priority for maintenance purpose.

The algorithm introduced in this paper is coded into FORTRAN 77 and tested on several network topologies. The network topologies considered to illustrate the result.

For these CCNs, the three types of ST-reliability value are obtained and shown in tables 1, 2 &3 respectively. One can observe that in all the cases, ORST values are very close to ORTRUE values. Also, it is apparent from Tables 2 that there is significant difference between RST and ORST values which indicates that a better network layout into remarkably improved ST-reliability can be present heuristic technique provides tremendous saving in the computational times as compared to the exhaustive enumeration.

link>	1	2	3	4	5	6	7	8	ST-reliability
R _{st}	.93	.96	.98	.85	.95	.88	.75	.94	0.9989541
OR _{st}	.95	.96	.88	.85	.75	.93	.94	.89	0.9994758
ORTRUE	.94	.96	.85	.88	.75	.93	.95	.89	0.9995087

Table 1: One type of ST-reliability value

link>	1	2	3	4	5	6	7	8	ST-reliability
R _{st}	.85	.85	.85	.69	.62	.78	.72	.95	0.9989541
OR _{st}	.75	.72	.78	.89	.98	.75	.95	.69	0.9994758
ORTRUE	.75	.72	.95	.95	.98	.85	.78	.69	0.9995087

Table 3: Three type of ST-reliability value

link>	1	2	3	4	5	6	7	8	ST-reliability
Rst	.72	.69	.85	.98	.88	.79	.89	.96	0.9996176
OR _{ST}	.89	.88	.98	.99	.78	.72	.96	.75	0.9999599
OR _{TRUE}	.72	.78	.98	.89	.96	.69	.88	.98	0.9999657

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Parametric Studies of Partial Replacement of Cement with Combination of Fly Ash, Marble Dust and Brick Powder in Concrete

*R K Jain¹, Om Raj Shrestha²

¹Deptartment of Civil Engineering, FOE & CS, TMU, Moradabad

²Deptartment of Civil Engineering, FOE & CS, TMU, Moradabad

*ravi.engineering@tmu.ac.in (Address for Correspondence)

Abstract: The waste generated from the industries causes environmental problems. Hence, the reuse of such waste material in different possible sectors can be highly emphasized so that their harmful effects may reduce to minimum or zero.In this research, a combination of fly ash, marble dust and brick powder are used in different proportions (5%, 5%, and 10%) to replace the cement (20%) in concrete and their laboratory tests have been performed. The main purpose or aim of this study is to investigate the feasibility of using waste flyash, brick powder and marble dust in concrete as partial replacement for cement.The results of the project/ investigation confirmed the potential use of these wastes material in the production of the concrete.

Keywords: Partial replacement, fly ash, marble dust, brick powder, modified concrete, use of waste.

1. Introduction

1.1 Cement: Cement is a commonly used binding material in the construction. It is mixed with water to form mortar or mixed with sand, gravel and water to form concrete. Generally, its specific gravity lies in between 3.12 to 3.9 Now-a-days, the high amount of necessity and usage of cement increases its cost values and the consumption of natural resources and electric power.

MINERALS	PERCENTAGE
Lime (CaO)	60 to 67%
Silica (SiO ₂)	17 to 25%
Sulphur trioxide (SO ₃)	1 to 3%
Alumina (Al2O ₃)	3 to 8%
Iron oxide (Fe2O ₃)	0.5 to 6%
Magnesia (MgO)	0.1 to 4%

Table no. 1: Compo	sition of	cement
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1.2 Marble Dust: Marble dust is an industrial waste produced from the cutting process of marble stone. If it is disposed on soils, the porosity and permeability of topsoil will be reduced, thus reducing its fertility and increasing its alkalinity.

MINERALS	PERCENTAGE
Lime (CaO)	70 to 78%
Fluorine (F)	3 to 5%
Magnesia (MgO)	1 to 2%
Silica (SiO ₂)	0.3 to 1%
Sulphur trioxide (SO3)	0.1 to 0.2%

2. Table no. 2: Composition of marble dust

1.2 Fly Ash: Fly ash could be a major producer of greenhouse emission. One ton of Portland cement production discharges around 0.87 ton of greenhouse gas to the environment. Therefore, the usage of flash in concrete partially replacing cement minimizes the carbon-dioxide mission.

MINERALS	PERCENTAGE
Silica (SiO ₂)	50 to 55%
Alumina (Al ₂ O ₃)	15 to 20%
Iron oxide (Fe ₂ O ₃)	10 to 15%
Lime (Cao)	5 to 7%
Magnesia (MgO)	4 to 6%
Other	0.5 to 2%

Table no. 3: Composition of fly ash

1.3 Brick powder: Brick powder is the dust obtained from the disintegration of brick or produced as a by-product from brick factories. Dumping of brick powder or brick particles not only occupies the land but also degrades it creating environmental and agricultural problems. Its effects can be minimised by using it in concrete production.

MINERALS	PERCENTAGE
Silica	50 to 60%
Alumina	20 to 30%
Lime	2 to 5%

Table no. 4: Composition of brick powder

These wastes are collected from nearby factories and then made more-or-less powder fine, if they weren't. They are used in replacement of 20% cement in concrete in three different sets by interchanging the in proportion 5%, 5% and 10% each. The strength of concrete cubes so produced or casted are tested at the age of 7 days, 14 days and 28 days.

2. Experimental Results

2.1 Fineness Test:



Figure no. 1: Fineness test

Fineness test has been done using 90 micronssieve and the results found are as follows:

•Ultra tech OPC grade-53 cement (tested on 03/03/2020) 6%

•Brick Powder (03/03/2020) 78%

•Marble Dust (03/03/2020) 41%

•Fly Ash (03/03/2020) 50 %

2.2 Consistency Test:

Consistency test is used to find the amount of water to be mixed with cement. Consistency is indicated by the Vicat plunger reading 5 to 7mm from the bottom of the mould.

Setting Time:

Initial setting time of cement is the time lapse between the addition of water and the instant cement paste starts to lose its plasticity.

Final Setting is the moment at which the concrete completely loses its plasticity and be able to support its own shape and weight.

Standardcementpaste(tested on 11/10/2019) •Consistency:27 •Initial Setting Time: 37min. •Final Setting Time: 380min. 80% cement, 5% MD, 5% BP & 10% FA paste(22/11/2019) •Consistency:27 •Initial Setting Time: 41min. •Final Setting Time: 430min. 80% cement, 5% BP, 5% FA & 10% MD paste(22/11/2019) •Consistency:29 •Initial Setting Time: 39min. •Final Setting Time: 410min. 80% cement, 5% FA, 5% MD & 10% BP paste(22/11/2019) •Consistency:30 •Initial Setting Time: 38min.

•Final Setting Time: 400min.

2.3 Slump Test:

The slump test is carried out in the laboratory to determine the workability of theconcrete.



Standardcementconcrete(testedon 11/10/2019)

•True slump(6mm)

80% cement, 5% MD, 5% BP & 10% FA concrete(22/11/2019)

•True slump(14mm)

80% cement, 5% BP, 5% FA & 10% MD concrete(20/02/2020)

•True slump(13mm)

80% cement, 5% FA, 5% MD & 10% BP concrete(20/02/2020)

•True slump (17mm)

2.4 Compressive Strength:

Compressive strength test of concrete is used to determine the strength of the concrete as per Indian Standards (ACI standards use cylinder of diameter 150 mm and height 300mm.

Standard cement concrete

•7 days: 15.5 Mpa (18/10/2019)

•14 days: 21 Mpa (25/10/2019)

•28 days: 32.9 Mpa (01/11/2019)

80% cement, 5% MD, 5% BP & 10% FA concrete

•7 days: 12.7 Mpa(29/11/2019)

•14 days: 21.1 Mpa(06/12/2019)

•28 days: 29.6 Mpa(20/12/2019)

80% cement, 5% BP, 5% FA & 10% MD concrete

•7 days: 14.7 Mpa(27/02/2020)

•14 days: 20.44 Mpa(05/03/2020)

•28 days: 28.67 Mpa(19/03/2020)

80% cement, 5% FA, 5% MD & 10% BP concrete

- •7 days: 13.43 Mpa(27/02/2020)
- •14 days: 20.74 Mpa(05/03/2020)
- •28 days: 27.87 Mpa(19/03/2020)

3. Conclusion

On replacing the 20% cement by fly ash, marble dustand brick powder at different proportions as above mentioned, we came to the conclusions.



Figure no. 3: Compressive Strength

That all the three sets gained the desired strength of concrete. 25Mpain28days and hence, those waste can be used in concrete production without decreasing the strength of the structure, rather helps in promoting environmental health, which otherwise may get polluted and affected with the unmanaged disposal of such wastes.

4. Future Scope

Wastes like marble dust, brick powder, fly ash, etc. are causing serious problems in human health, animal health and environment health. If we can utilize these wastes in construction projects then we can not only create a pollution- free environment but also, we can make profit from that. Following are some of the future scopes of the project which we performed or investigated:

•These wastes will be the best option to be used as admixtures in the future for different construction projects.

•Natural resources are decreasing day by day and in near future, the government may also suggest to use some percent of these waste as a construction material to keep the environment clean as well as to reserve natural resources.

•We can minimize the cost of construction by the use of these wastes.

The logistics of implementing the use of these wastes in construction, especially in developing countries, should be investigated to ensure that this low-cost construction is helping the people who need itmost.

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Characteristics of Recycled Sand and Aggregate in Concrete

*Syed Rehan Ali¹, Haider khan²

¹Professor, Department of Civil Engineering, FOE CS, Teerthanker Mahaveer University, Moradabad, UP

²Student, Department of Civil Engineering, FOE CS, Teerthanker Mahaveer University, Moradabad, UP

*drsrali.engineering@tmu.ac.in (Address for Correspondence)

Abstract: With more and more construction activities and development, shortage of construction materials, especially aggregates, is increasing. Therefore, there is an urgent need of alternative sources. And recycled aggregate will then be used to conserve rapidly depleting construction material. The aggregates can either be reused directly by giving proper dressing or it can be combined with virgin aggregates in certain proportions and used for different construction activities especially in pavement constructions. The aim of this study was to evaluate the strength and economic characteristics of M25 concrete prepared by replacing natural aggregate with demolished concrete coarse aggregates. Each replacement mix was compared with characteristic properties exhibit by concrete mix prepared using virgin aggregate. In this study, recycled aggregate was used in place of fresh one in proportions 10% and 20% and then tested their compressive strength and compared with standard concrete for seven, fourteen and twenty-eight days. Each test was replicated with three samples.

Keywords: Construction materials, C & D waste, recycled aggregate, concrete, sustainable

1. Introduction:

Construction and Demolition (C&D) Waste consists of materials like concrete, wood, asphalt, metal, gypsum, plastic and salvaged building components, but the main component and the major part of C&D waste is "Concrete". Since the Concrete is heavy, bulk and inert material therefore it is challenging task for its disposal. Concrete is made up of various natural components therefore disposing this concrete waste by land filling will led to loss in following 3 different aspects:

- Extraction of construction material from natural resources for new construction.
- Wasting the used natural components obtained from C&D wastes.

• Due to land filling the concrete waste, the landfill area cannot be used for irrigation and will be not easy to remove because of its heavier weight.

Keeping in view the 3R's philosophy of Reduce, Reuse and Recycle, C&D waste is being started to recycle but a very few percentages is being recycled and majority of waste is still disposed by landfill method.

2. Methodology

Following tests have been performed in the laboratory:

Tests on Cement

2.1 Fineness Test: Fineness increases the strength development in the cement principally during its first seven days. Fineness test of cement has been done using 90-micron sieve and the results found are shown in Table 1

Sr.no	Wt. of cement sample	Wt. of Sample retained on sieve	Fineness of cement
1	100gm	8	8%
2	100gm	9	9%
3	100gm	7	7%
		Average	8%

Table 1: Results of Fineness of Cement

Fineness = 8 %

So, the cement can be considered as good because its fineness is less than 10%.

2.2 Consistency Test:

The consistency at which cement paste will permit penetration of Vicat plunger to a depth of 33-35 mm from top of the mould is defined as the Standard Consistency of cement. Consistency is indicated by the Vicat plunger reading 5 to 7mm from the bottom of the mould. From the result of this test, water content was found to be 27%.

2.3 Initial Setting Time:

Initial setting time of cement is the time lapse between the addition of water and the instant cement paste starts to lose its plasticity. Initial setting time is also calculated using Vicat apparatus and the results found were as follows:

The initial setting time of cement was found to be - 35 minutes.

2.4 Soundness Test:

This test is used to find the excess of lime in the cement. This test has been performed by using the Le-Chatelier apparatus and the result found to be within the limit. Soundness of cement was found to 8 mm which is less than 10 mm.

Tests on Standard Coarse Aggregate

Moisture Content

The total moisture content of an aggregate sample is computed and given below in table 2.

Table 2: The moisture	e contents of	coarse	aggregate
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Specimen condition	Fresh Aggregate	Recycled Aggregate
wet sample	156gm	180 gm
oven dried sample	154gm	172 gm

Moisture content of fresh aggregate = 1.2%

Moisture content of Recycled aggregate = 4%

3. Specific Gravity

Specific Gravity of fresh aggregate and that of recycled aggregate are compared in laboratory as the aggregate having low specific gravity are generally weaker than those with high specific gravity.

Specific gravity of fresh aggregate= 2.7

Specific gravity of Recycled aggregate= 2.53

3.1 Crushing Value:

Crushing value of the Aggregate was tested in the laboratory and found 20.86%.

Tests on Standard Fine Aggregate Moisture Content:

The total moisture content of an aggregate samples tested in laboratory is given in table 3.

Table 3: Moisture content of fine Aggregates

Specimen Condition	Fresh Fine Aggregate	Recycled Fine Aggregate	
Wt. of wet sample	170gm	200gm	
Wt. of oven dried sample	158gm	182gm	

Moisture content of Fresh fine aggregate = 7.7%

Moisture content of Recycled fine aggregate = 9%

3.2 Specific Gravity:

Specific Gravity is the ratio of the weight of a given volume of aggregate to the weight of an equal volume of water.

Specific Gravity of fine aggregate = 2.46

Specific Gravity of fine aggregate = 2.33

3.3 Test on Fresh Concrete Slump Test :

The slump was found to be 25mm for both fresh recycled aggregates. So, it is found that the concrete has low degree of workability.

4. Result and Observation

Compressive Strength

The compressive strength of concrete is tested as per Indian Standards (ACI standards use cylinder of diameter 150 mm and height 300 mm and the results are given below in table 4.

 Table 4: The average compressive strength of cube of fresh aggregate concrete

Age of cubes	7	14	28
Comp. Strength	21.35 N/mm sq.	24.55 N/mm sq.	27.37 N/mm sq.

Age of cubes	0%	10%	20%
7 days	21.35 N/mm sq.	13.50 N/mm sq.	16.25 N/mm sq.
14 days	24.55 N/mm sq.	21.25 N/mm sq.	22.55 N/mm sq.
28 days	27.37 N/mm sq.	23.0 N/mm sq.	24.20 N/mm sq.

Table 5: Compressive strength after the replacement of fine aggregate at different proportions

- After doing different test on the recycled aggregate we can say that the strength of the concrete is compromised about 20% only.
- We are getting almost 80% of the strength by replacing coarse aggregate only.
- So, we can also conclude that by using recycled aggregate we are reducing the cost of construction, mining and reducing environmental hazards.

5. Conclusion

On replacing the fresh fine aggregate with recycled fine aggregate at different proportions we came to a conclusion that at specific proportion of replacement we can gain the desired strength of concrete. From the above data it is clear that if the fine aggregate is at 10% replacement is not giving the desired strength but after replacing it with 20% in early stage the strength is desirably less but I later stage it almost gained more than 90% of the strength. Which in result gives the reduction of cost of the construction and the use of lesser fresh aggregate which directly reduces mining process of aggregates and will also conserve the energy along with conserving the nature?

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Energy Saving Analysis for Mud Wall Construction

Subhash Mishra¹, Shri Bhagman^{2*}, Prakash Mishra³

¹ Department of Mechanical Engineering, IPEC, Ghaziabad, (UP)

²Department of Mechanical Engineering, TMU, Moradabad (U.P)

³Department of Mechanical Engineering, GP, Dhanbad (Jharkhand) *shribhagwanme@gmail.com (Address for Correspondence)

Abstract: In building construction, the energy saving is very important for coming day. Energy saving is closely related with conservation of energy. The consequences of conservation of energy related to efforts reduce to consumption of energy. A certain amount of energy may be saved, when critical thickness of insulation is used in building walls. The purpose of thermal insulation is to keep the indoor temperature constant due to variation of atmospheric temperature. The main aim of mud wall construction is to save considerable amount of energy by providing a more stable temperature and reduces the heat losses through outer boundary of walls. Mud is act as a thermal mass due to it absorbs sun heat during day hours and keep the building warm during night.

The energy saving by using mud insulation and straw material for the analysing the mud wall constructed room dimension (10 m x 8 m x 7 m) situated at Ghaziabad near Salimar Garden has been selected. The studies are carried out for varied thickness of insulation mud dung slurry. In this study we found that mud wall insulation is most economic insulation. In this analysis, it is observed that 51 % of energy is conserved by the application of mud dung slurry insulation for mud wall construction. In our result, 0.068 m optimum thickness of mud wall construction has been calculated, when insulation is used.

Keywords: Energy conservation, Optimal insulation thickness, Mud dung slurry insulation, life cycle method.

1. Introduction

The energy requirement among four main sectors: industrial with any size from small scale industry to big scale industry, building construction, transportation and cultivation sector. Among the mention sectors, building construction region is highest energy consumption sector. In building construction, the most efficient method to save the energy is to use optimal thickness of insulation. The basic purpose of thermal insulation is minimizing the transfer of heat through outer boundary of building. Those insulation materials is more effective, whose thermal conductivity has less value. When we use the suitable insulation material, then heat losses through building wall will be decreased and space heating cost of building has been also decreased. Therefore thermal comfort will be increased.

Durmayazet al.[1] had used Degree-hours method to calculate the heating load requirement in building. Comakli and Yuksel[2] had observed that colder region require higher insulation as compaired to hotter due to higher value of Degree-dayse in cold climatic region.. Al-Saneaet al.[3] had investigate the significance of cost rate of electricity for different load condition in building wall after the application of insulation. IN this analysis the author used the economic model of heat transfer at the dynamic condition. Lu et al.[4] had determined the variation of outer boundary temperature and unsteady temperature in building by analytical method. Dombaycret al.[5] had determine the critical insulation thickness of building construction for various fuels and different insulating materials for city Denizli (Turkey). Mahliaet al.[6] had established the relation between thickness and thermal conductivity of selected insulating materials for construction of building . Yildizet al.[7] had determined the optimum thickness of insulation and heat energy for different construction of

building . During analysis, the author considered two different climatic zone in turkey. In this analysis, Extruded Polystyrene and Rock wool was considered as insulation materials. Chel and Tiwari[8] had investigated thermal aspect of mud wall construction with vault roof. Mud wall building act as pollution free and has less energy consumption. The author show that the Energy requirement for mud wall construction at New Delhi(India) is less as compared to red brick construction. Daouaset al.[9] calculated the of insulation at which the heat loss is minimum for outer surface of building walls in Tunisia. Mishra and Usmani[10] had calculated the thermal resistance of mud wall and brick wall and conculed that less energy is required in mud wall as compared to brick wall .

On the basis of literature survey, it is observed that brick wall building has been analysed by most of the authors. But in India, there are many places at which there are occurrence of building constructed by stone, brick and mud wall. Optimum insulation thickness and Energy saving has been determined by many of the author at different region of world (Turkey and China). In this paper, I have analyses the effect of insulation on mud wall construction. Hence the present work based on thermal behavior of mud wall building in the term of Energy application. In this study, Degree-days Method is considering for determination of the heating/ cooling load of mud wall construction. This study primarily emphasis on the thermal performance of mud wall building construction. The study has been carried out to know the variation of monthly cost with different insulation thickness and result show that at optimum insulation thickness, energy saving has maximum value. The energy saving has been calculated for different month of year in India for mud wall construction..

2. Importance of Energy Conservation

It is compulsory to conserve energy for India due to energy demand gradually increases in its developing process. Whether a household or a plant, a small shop or a large commercial building, a farmer or a office worker, every uses the energy in different form. Every day we have to use any kind of automobile for various purposes. In general for running of automobile any type of fuels like petrol, diesel or gas are used. We know that the petroleum resources are gradually decreases due to increase demand. So it is necessary to efficiently use of fuel. For doing any activity we depend upon any type of energy. For making our life comfortable and enjoyable, we need any type of energy. If there is variation of temperature as compared to comfort temperature, then we use air condition for cooling of the room. This incident is closely related with consumption of energy resources. Due to inadequate amount of energy resources, it is our duties to use the energy resources effectively.

We must uses energy efficiently, otherwise energy will not left for coming days. Energy conservation is also necessary when there is variation of climate condition. Presently, we are facing unpredictable climates changes. Hence there is need of energy saving. Benefit of energy saving are to wasting less money, wasting less primary fuel like coal, gas, oil etc. and producing less pollution.

3. Method of Optimization for Insulation Thickness and Energy Saving:

Heat loss will take place through outer surface of building wall and each wall surface due to temperature difference between atmosphere and inside room. For unit surface area, the heat loss through external surface is calculated by given equation,

$$\Delta Q = U \times \left(T_b - T_o\right) \tag{1}$$

Where U is overall heat transfer coefficient, Tb and T0 is the wall and ambient temperature respectively.

The total cost is mainly depending upon insulation cost and Energy cost at the times of estimation. The total cost consumption over the useful life of the building can be calculated as

$$C_{T} = PWF\left[\frac{C_{F}}{H_{LH}\eta_{H}} + \frac{C_{E}}{COP}\right] \times \frac{T_{o} - T_{b}}{R_{w} + \frac{x}{K}} + C_{i} \times x^{(2)}$$

CT, CF, CE and Ci are the total cost, cost of Fuel, cost of electricity and insulation cost respectively.Rw, x and K is the thermal rasistance of walls, thickness of insulation and thermal conductivity of insulation material respectively. COP, PWF, and HLH is the coefficient of performance, present worth factor and heating value of fuels respectively.

For obtaining the optimum insulation thickness (Xopt), the first derivative of total cost() with respect to x is taken as zero. The mathematical expression of opt can be written as

$$X_{opt} = \left[\frac{K \times PWF}{C_i} \left(\frac{C_F}{H_{LH}\eta_H} + \frac{C_E}{COP}\right) \times (T_o - T_b)\right]^{0.5} - KR_w$$
(3)

The expression of Pay-back period (pbp) is written as

$$\frac{C_{hs}}{A_s} = \frac{(1+R)^{pbp} - 1}{R(1+R)^{pbp}}$$
(4)

Simple pay-back period can be represented by CIns/As. Energy saving can be calculating as follow

The total cost for different thickness of insulation in the case of Mud wall construction is represented in Table 1.

Table (1): Total cost (yearly) for mud wall constructions in presence of mud dung slurry insulation

S. No.	Insulation thickness		Energy Saving(E _s) in		
	(m)	Fuel cost	Insulation cost	Total cost	Rs/m ²
01	0	1700	0	1700	0
02	0.02	850	120	970	730
03	0.04	555	240	795	905
04	0.06	390	360	750	950
05	0.068	332	408	740	960
06	0.08	305	480	785	915
07	0.10	225	600	825	875
08	0.12	175	720	895	805
09	0.14	150	840	990	710

In presence of mud dung slurry insulation for mud wall building, the calculated value of optimum insulation thickness is 0.068 m. From the above Table 1., it can be concluded that Energy saving will gradually increase up to certain stage(at the point of optimal thickness) and then after decrease. Therefore insulation thickness installation is more useful at Optimum insulation thickness.

3.1 Energy Saving In Different Month of Year for Mud House Construction

In year 2019, there are eight months in the region of Ghaziabad (India) in which cooling are required for comfort condition and rest of four month heating is required. Energy saving can be defined as the total amount of energy cost saving in the term of money, when the building outer surface has been covered with suitable insulation material at its critical thickness In this year, March month has least energy required and june month has more energy required as compared to other month . In such type of construction, the amount of heating and cooling load saved as 213 Kwh and 330 Kwh respectively. During the year 2019, Month biased energy scenarios are shown in Table 2. In this year, the energy requirement for such type of construction with and without the insulation is 484 Kwh and 1027 Kwh respectively. On the basis of above analysis, 51 % of the energy has been saved for such type of construction with mud dung slurry insulation.

S.No	Month	Energy potential(Kw) With insulation	Energy cost (Rs) With insulation	Energy potential(Kw) Without insulation	Energy cost (Rs) Without insulation	Energy Saving(Rs)	% Energy Saving
01	January(H)	40	200	105	525	325	12
02	February(H)	55	275	95	475	200	8
03	March(C)	25	125	45	225	100	4
04	April(C)	40	200	75	375	175	7
05	May(C)	45	225	100	500	275	10
06	June(C)	50	250	130	650	400	15
07	July(C)	52	260	85	425	165	6
08	August(C)	40	200	75	375	175	7
09	September(C)	35	175	65	305	130	5
10	October(C)	30	150	62	310	160	6
11	November(H)	42	210	100	500	290	11
12	December(H)	40	200	90	450	250	9

Table (2): Month biased Energy saving scenarios for Mud house

After analysis of energy saving for mud house, the heating and cooling energy saving is shown in Table 2. Thermal conductivity and thickness of insulating material has significant effect on Energy saving. When thickness of insulation material is increasing, then heat transfer rate will gradually decrease. But due to increase of thickness, insulation cost will increase. For compensation of increase of insulation cost, optimum thickness of insulation has been selected. It is observed that at optimum insulation thickness, energy saving has maximum c

4. Results and Discussion:

We all know that intensity of solar radiation will be changed from morning to evening of the days in any season like winter or summer. Atmospheric temperature is also affected due to solar radiation. Mud has specific properties like high resistivity, high heat capacity and higher value of thermal mass. So temperature inside the room of mud house is less as compared to ambient temperature and variation of temperature is also less i.e uniform temperature. Fig. 1 shows the variation of different cost with insulation thickness for such type of construction in the presence of insulation. With increase of insulation thickness, heat transfers across surface of wall will gradually decreases so less energy sources will required for comfort condition. At this instant insulation cost increase. For compensation of increase of insulation cost, we have to use optimum insulation thickness so that overall total cost is optimized. At optimum thickness, increase of insulation cost is balanced with decrease with energy cost.



Fig.1 The variation of Total cost with insulation thickness for Mud wall construction in the presence of insulation.

Fig. 1 illustrate that with the variation of insulation thickness, the different cost will be changed. Insulation cost is balanced with fuel cost. Total cost (i.e algebraic sum of fuel and insulation cost) is minimum at optimum thickness of insulation. The outcome of Fig. 1 is the total cost is Rs 740 at optimum thickness of 0.068 m for mud house.

Fig. 2 shows amount of Energy saving with the change of insulation thickness for Mud house with Mud dung slurry insulation. The energy saving firstly increases, reached to maximum value and then after decreases with increase of the insulation thickness.



Fig.2 Variation of energy saving versus insulation thickness for Mud house

From Fig.2, it can visualized that at optimum thickness, energy saving has maximum value. As seen from the figure 2, choosing a thickness other than optimum value, energy saving decreased. So it is benefited to apply optimum thickness of insulation across Mud wall. The outcome of Fig. 2 is the Energy saving is 960 Rs/m2 at optimum thickness of 0.068 m for mud house.

5. Conclusions

On the basis of results and discussion, there are following conclusions;

- 1. Mud has specific properties like high resistivity, high heat capacity and higher value of thermal mass. So it act as a insulation.
- 2. At 68 mm insulation thickness, the percentage of energy saving is 51%.
- 3. The study has been carried out to know the variation in annual cost by using variable insulation thickness and it is found that for mud house with 68 mm wall thickness, the maximum energy conservation is 51% approximately.
- 4. The Energy saving analysis was also carried out for the mud wall construction for different month of year 2019. And it is observed that 543 kWh/Year amount of energy conserved.
- 5. The heat transfer rate through wall surface is depending upon insulation material so for selection of insulation material, the cost and Thermal conductivity must be considered.

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Lethal impacts of pulp and paper discharged effluent on the biodegradable activity of Saprophytic and Nitrifying Micro-organisms

Asim Ahmad^{1*}, Harshit Mahandra²

¹Department of Chemistry, Faculty of Engineering, TeerthankerMahaveer University, Moradabad, Uttar Pradesh-244001, India

*drasim.engineering@tmu.ac.in (Address for Correspondence), punitdcy@gmail.com

Abstract: In this work, initially, the effluent of pulp and paper industry was subjected to analyze physical, chemical and physicochemical parameters and concentration of heavy metals. The detrimental effects of the effluent of pulp and paper industry on the biological activity of saprophytic and nitrifying bacteria has been studied using different volume percentages of effluent (0-6.67%). A concentration of 5.0 mg/L glucose was used as control and source of carbon for microorganisms. An increase in percentage inhibition of biological activity of microorganisms has been observed with the increasing concentration of the effluent in the proposed systems. The kinetic parameters i.e., rate constant (K) and ultimate biochemical oxygen (L) were also evaluated using first and second order kinetics. Overall study resulted in the high resistivity of nitrifying bacteria than saprophytic bacteria to the pulp and paper industry waste.

Keyword: Pulp and paper industry, Thomas method, Microorganisms, Biochemical oxygen demand, Rate constant, Effluent.

1. Introduction

In the present scenario, with the development in science and technology, environment is influenced by different activities such as domestic, agricultural and industrial due to release of toxic waste generated at the end into the environment. Pulp and paper industry found sixth rank in terms of largest environmental pollution (Ashrafi et al. 2015). Environmental Protection Agency (EPA) reported that the paper industries released around 79000 tons i.e. 5% of all industrial pollutants in the year 2015 (EPA. 2017). There are more than 500 paper and pulp industry in India (Kamali and Khodaparast 2015) which consumes lignocellulosicfeedstocks and wood as raw materials along with huge amount of different chemicals for manufacturing paper and releases potentially toxic effluent containing toxic chlorinated and sulphur compounds, resin acids, tannins, suspended solids and lignin withhigh biochemical oxygen demand (BOD) and chemical oxygen demand (COD) (Bonilla et al. 2015; Kong et al. 2016). The types and concentration of toxicants vary due to different nature of lingo cellulosic feedstocks, process conditions and water consumption in the process. High pressure, temperature and particularly chemical additions result in an increased release of organic matter and excess lignin solubilisation in to the process water. The toxicity of pulp and paper industry effluent (PPIE) can be attributed to a complex mixture of wood extractives which includes resins and fatty acids, tannins, some lignin degradation products and low molecular weight chlorinated lignin derivatives (Deeba et al. 2018). The discharge of untreated effluents causes considerable damage to water bodies and also influences the activity of aquatic organisms. Micro organisms possess a tendency to degrade many chemicals and remove them from the environment. Further, these waste water streams exert inhibitory effects on microorganisms which may disturb the biological treatment system also. These compounds are highly toxic to microorganisms even at a very low concentration. Heavy metals and inorganic components of waste water such as sulphate, sulphite, hydrogen peroxide and other chemicals added

during pulping and bleaching process also exert inhibitory effect on microorganisms and toxicity to aquatic life (Mittal and Ratra 2000).

Microorganisms are considered as recyclers for converting toxic organic compounds to harmless products. A number of studies have been done to explore microorganisms for the treatment of pollutants in highly polluted effluents (Dsouza et al. 2006; Minussi et al. 2007; Unal and Kolankaya 2001). However, the use of fungal systems for effluent treatment require pH 4–5 for their growth and enzyme production. It is well known that pH values of PPIEs are high (pH = 7-9), hence, additional cost is required to maintain pH for the application of these systems. On the other hand, for the bacteria growing at neutral to alkaline pH, there is no need for pH adjustment. A number of reports are available for the lignin degradation (Chandra et al. 2007; EL-Hanafy et al. 2007; EL-Hanafy et al. 2008; EL-Hanafy and Abd-Elsalam 2009) and for PPIE treatment (Raj et al. 2007; Singh et al. 2011; Singhal and Thakur 2009; Thakur 2004).

However, there was a gap in knowledge regarding toxic effect of PPIE on the bioremediation activity of Saprophytic and nitrifying bacteria. Activity of these bacteria in effluent treatment is influenced by pollution load in PPIE. Hence, in the present study we aimed to report resistivity of saprophytic and nitrifying bacteria towards PPIE and studied their suitability range for the detoxification of pulp and paper mill effluent.

2. Materials and Methods

2.1. Chemicals

All reagents used were of analytical grade and double distilled water was used for the preparation of solutions. The other reagents for bacterial culture media such as glucose and inorganic salts were procured from Hi-Media (Mumbai, India).

2.2 Collection and characterization of PPIE sample

The Representative grab samples of the untreated effluent were collected at every 8 hours interval for a period of 24 hours from the pulp and paper industry located in Uttar Pradesh, India and finally made composite in proportion to the flow at the time of sample collection. Polythene containers were used for sample storage and stored at 4°C.

The pH of the effluent was measured using pH meter (Model 744, Metrohm). The physicochemical characteristics of the effluent were determined according to American Public Health Association guidelines (APHA 2005). The amount of lignin present and color content of PPIE was estimated using the standard protocol (Chuphal et al. 2005). Concentration of heavy metals was determined using Inductively Coupled Plasma-Optical Emission Spectrometry, ICP-OES (Agilent 700, USA) after digestion of sample in a digestion mixture (5:1) of nitric–perchloric acid. Prior to the analysis of metal ions by ICP-OES calibration plots were drawn using closely matched standards. All experiments were performed in duplicate sets and standard deviation was found in the range of $\pm 5\%$ throughout the study.

2.3 Microorganisms

Continuous aeration method was used for the culture development of saprophytic microbial population with daily increment of sewage. However, the method adopted by Siddiqui et al. (1967) was explored for the production of nitrifying bacteria in columns filled with pea gravel and added inorganic nutrients.

Saprophytic bacteria were cultured in an Erlenmeyer flask using broth media (8 g/L) supplemented with 5 mg/L glucose at pH 7 with continuous aeration (0.1 mL/min O2) and daily increment of sewage (15 mL/L per day) for 3 days at room temperature. The pH was maintained constant using phosphate buffer (1.179 g KH2PO4 + 4.302 g Na2HPO4 dissolved in 1 liter of distilled water).

A column is packed with pea gravel for the growth of nitrifying bacteria. Nitrified effluent received from waste water treatment plant was seeded through the column. An inorganic medium containing 0.125 mg/L FeCl3.6H2O, 25 mg/L MgSO4.7H2O, 3 mg/L K2HPO4, 56 mg/L (NH4)2SO4, 50 mg/L CaCO3 and 250 mg/L NaHCO3 with pH 8.2 was used as a feed. After several weeks of growth, the nitrifying bacteria were harvested from column for further study.

2.4 Preparation of BOD sets

BOD bottles of 300 mL capacity were used throughout the experiments. The glucose (5.0 mg/L) synthetic medium (GSM) was prepared in deionized water. Three different systems based on saprophytic (SB) and nitrifying (NB) microorganisms (GSM+SB, GSM+NB and GSM+SB+NB) as control and having different percentages of PPIE i.e., 0%, 0.33%, 0.83%, 1.67%, 3.33% and 6.67% were prepared for the monitoring of biological activity of SB and NB. BOD bottles were filled up to mark and incubated for 15 days at 20°C.

The experiments were carried out at natural pH of the system. The BODs of various sets of three different systems were determined separately at different time intervals. The variation of BODS with the number of incubation days for the three controlled (without effluent) systems is shown in Figure 1.



Figure 1: Variation of BODs with incubation time for three different systems without PPIE

2.5 Calculation of kinetic parameters - ultimate BOD (L) and rate constant (K)

The BOD curve for GSM+SB and GSM+NB systems can be described by the following first-order kinetics equation (Cutrera et al. 1999)-

Y = L (1 - 10-Kt), where: y = amount of oxygen consumed (BOD) at time in mg/L t; t = incubation time in days; L = total amount of oxygen consumed in the reaction (ultimate BOD) in mg/L; K = reaction constant in day-1. The Thomas method was used for the determination of ultimate BOD (L) and rate constant (K) for various sets of three different systems containing varying percentage amount

of effluent. In this method, (t/y)1/3 is plotted as ordinate vs. t as abscissa, and fitting the points to a straight line with intercept A and slope B. This results in a straight line. The parameters K and L are then estimated using the slope (B) and the intercept (A) of this line using following equation-

$$K = 2.61 \times (B/A) \text{ day-1}$$
 (1)
 $L = 1 / (6A2B) \text{ mg/L}$ (2)

However, the BOD curve for GSM+SB+NB system is described by the following second-order kinetics equation-

$$\frac{t}{Y} = \frac{1}{L} t + \frac{1}{K L^2}$$
(3)

Where, K' = reaction constant in liter mg-1 day-1 and other symbols have their usual meanings. The parameters L and K' are then estimated using the slope (1/L) and the intercept (1/K'L2).

3. Results and Discussion

The different physiochemical parameters of PPIE were determined and are given in Table 1. The PPIE was dark brown in colour due to lignin and its derivatives and found to have pH value equal to 8.8. The nitrogen and phosphorous contents were found to be low. The data of BOD and COD revealed that the non biodegradable COD in the PPIE was found to be very high due to the presence of lignin. Concentration of different heavy metals in PPIE is shown in Table 2.

Physical Parameters	
Temperature	34.9° C
Colour	Dark Brown
Turbidity (NTU)	75.0
Chemical Parameters (in mg/L except pH)	
Dissolved Oxygen (DO)	Nil
pH	8.8
Total alkalinity (CaCO ₃)	512.0
Chloride	920.0
Sulphate	70.0
Sulphide	572.0
Calcium	48.0
Magnesium	38.9
Sodium	150.0
Potassium	49.0
Lignin	426.0
Nitrate-nitrogen	7.5
Organic-nitrogen	1.6
Inorganic-nitrogen (NH ₃)	4.2
Phosphate	3.9
Physiochemical Parameters	

Table 1: Physiochemical characterization of PPIE

Total solids (mg/L)	2,394.0
Suspended solids (mg/L)	498.0

Dissolved solids (mg/L)	1,235.0
Electrical conductivity (mhos/cm at 25°C)	1,900.0

Table 2. Concentration of heavy metals in PPIE							
Elements	Concentration (mg/L)						
Chromium	0.950						
Copper	0.298						
Iron	21.440						
Lead	0.909						
Mercury	0.065						
Manganese	1.320						
Nickel	0.298						
Zinc	0.118						

3.1 Effect of PPIE on GSM + SB system

The BOD of glucose substrate with saprophytic bacteria without waste, i.e., control [Figure 1] shows rapid stabilization (maximum rate constant, Kmax = 0.112 day-1 and ultimate BOD, L = 2.93 mg/L). It is clear from Figure 2 and Table 3 that the rate constant has decreased as the percentage of waste in the reaction mixture increased as compared to the control. It happens due to toxic effect of increasing concentration of PPIE leading to the retardation on the growth and oxygen uptake by saprophytic bacteria for their biological activity. Simultaneously, the ultimate BOD also decreases with increasing percentage amount of waste.



Figure 2: Effect of PPIE on the bioremediation activity of saprophytic bacteria

Percentage inhibition data in Table 2 also reveal that with the increase in effluent concentration, oxygen uptake by the SB decreases and percentage inhibition reaches to a maximum of 81.3% for 20 mL of the effluent taken. If percent inhibition in BOD is found to be less than 10% i.e., BOD greater than 90% of control then the condition is considered to be non toxic for the activity of micro organisms. It has been found that 0.83% of the waste in the reaction mixture showed no detrimental effect as the percent inhibition was found to be around 10% (K = 0.098, 87.5% of Kmax) where as 1.7% or more waste in the reaction mixture showed a detrimental effect (K = 0.087, 77.8% of Kmax). The complete inhibition (50% BOD or 50% Kmax) occurred at around 4% of the waste in the reaction mixture (K < 0.061 day-1, L < 2.54 mg/L). The increasing amount of waste (\geq 4.0%) will inhibit the biological activity of saprophytic bacteria leading to increase the pollution load of water bodies.

TEMP.	SET No.	Volume of	pH of the	BOD on given days (mg/L)						Rate Constant	Ultimate BOD
(°C)		waste (mL)	system	5 th Day	% Inhibition	8 th Day	% Inhibition	14 th Day	% Inhibition	(K , day ⁻ 1)	(L, mg/L)
	1										
20	(Control)	0.0	6.50	2.15	-	2.40	-	2.60	-	0.112	2.930
	2	1.0	6.80	2.0	6.90	2.30	4.16	2.55	1.92	0.100	2.864
	3	2.5	6.90	1.90	11.60	2.25	6.25	2.50	3.84	0.098	2.767
	4	5.0	7.10	1.70	20.90	2.05	14.58	2.40	7.70	0.087	2.687
	5	10.0	7.15	1.27	40.90	1.70	29.16	2.10	19.23	0.061	2.540
	6	20.0	7.20	0.40	81.30	0.60	75.00	0.80	69.20	0.039	1.137

Table 3. Rate constant (K) and ultimate BOD (L) data for SB at different concentrations of PPIE

3.2 Effect of PPIE on GSM + NB system:

A similar trend of inhibition was also observed in case of nitrifying bacteria with increasing percentage of PPIE. The results showed a gradual decrease in ultimate BOD and rate constant values [Figure 3 and Table 4]. The maximum values of ultimate BOD and rate constant in this system for control were found to be 3.669 mg/L and 0.113 day-1, respectively. It was observed that the system has no toxic effects up to 1% of the waste (% inhibition \approx 10). The complete inhibition was found to be at more than 6.5% of waste in the reaction mixture. It means that oxygen uptake capability or activity of nitrifying bacteria also decreases with increase in amount of waste but slower than saprophytic bacteria.



Figure 3: Effect of PPIE on the bioremediation activity of nitrifying bacteria

TEMP.	SET No.	Volume of	pH of the		BOD on given days (mg/L)						Ultimate BOD
(°C)		waste (mL)	system	5 th Day	% Inhibition	8 th Day	% Inhibition	14 th Day	% Inhibition	• (K, day • 1)	(L, mg/L)
	1										
20	(Control)	0.0	6.50	2.70	-	3.05	-	3.25	-	0.113	3.669
	2	1.0	6.80	2.60	3.70	2.95	3.27	3.15	3.07	0.112	3.598
	3	2.5	6.90	2.45	9.25	2.85	6.55	3.10	4.61	0.100	3,577
	4	5.0	7.10	2.25	16.66	2.70	11.47	3.00	7.70	0.095	3 4 2 5
	5	10.0	7.15	1.78	34.00	2.25	26.22	2.65	18.46	0.076	3.050
	6	20.0	7.20	0.89	67.00	1.25	59.01	1.60	50.76	0.050	2.056

Table 4: Rate constant (K) and ultimate BOD (L) data for NB at different concentrations of PP

3.3 Effect of PPIE on GSM + SB + NB system

In this system, equal amount of saprophytic and nitrifying bacterial culture was added in the BOD bottles in presence of glucose to prepare control as well as experimental sets with different amount of waste. The trend of inhibition was similar to that of observed in the above two systems but in presence of nitrifying bacteria, percentage inhibition (49.50%) was lowered in comparison to the individual percentage inhibition of saprophytic (81.30%) and nitrifying (67.00%) bacteria. The results obtained are illustrated in Figure 4 and Table 5. The detrimental effect started at a higher concentration of the waste (1.7%) in the system and complete inhibition was observed at 8% of the waste.



Figure 4. Effect of PPIE on the bioremediation activity of (saprophytic + nitrifying) bacteria

In all the systems studied it was also observed that percent inhibition decreased with increase in incubation time [Table 3, 4 and 5] which was most probably due to adaptation of microorganisms to the new environment.

TEMP.	SET No.	Volume of	pH of the	BOD on given days (mg/L)						Rate Constant	Ultimate BOD
(°C)		waste (mL)	system	5 th Day	% Inhibition	8 th Day	% Inhibition	14 th Day	% Inhibition	(K, Lmg ⁻¹ day ⁻¹)	(L, mg/L)
	1										
20	(Control)	0.0	6.50	2.95	-	3.40	-	4.35	-	0.031	5 924
	2	1.0	6.80	2.86	3.05	3.25	4.41	4.25	2.29	0.030	5 951
	3	2.5	6.90	2.70	8.47	3.10	8.82	4.10	5.74	0.027	5.851
											5.845
	4	5.0	7.10	2.55	13.55	2.95	13.23	3.95	9.20	0.024	5.949
	5	10.0	7.15	2.19	25.76	2.65	22.05	3.70	14.90	0.016	
	C	20.0	7.20	1.40	40.50	1 05	15 50	2.45	42 70	0.012	6.223
	0	20.0	7.20	1.49	49.30	1.65	45.58	2.43	45.70	0.015	6.402

Table 5: Rate constant (K') and ultimate BOD (L) data for (Saprophytic + Nitrifying) bacteria

4. Comparison of studied systems:

A comparative study of the results showed that a decrease in the rate constant as well as ultimate BOD and an increase in percent inhibition were observed in all the systems with the increase in concentration of the waste. In these systems, maximum inhibition reaches at a higher concentration of waste. It was observed that nitrifying bacteria retained their normal activity and growth even at higher concentration of the waste in comparison to saprophytic bacteria after which the activity of both bacteria was again decreased by an increase in percentage of waste in the system. These observed differences in toxicity were due to different responses of different bacteria towards the PPIE. However, combined resistance power of both the bacteria was found high in comparison to that of individual and complete inhibition occurs at 8% of the PPIE.

5. Conclusion

The effluent of pulp and paper industry showed detrimental effects on the saprophytic and nitrifying microorganisms. The effluent was found to be more toxic to saprophytic in comparison to nitrifying bacteria. The increase in the amount of effluent in different systems is found to be reciprocal to the bioremediation activity of saprophytic and nitrifying bacteria. This is probably due to the presence of toxic compounds which are harmful for living beings. The effluent has been found active in its inhibitory action towards microorganisms which results in causing high pollution load to the environment. Therefore, pre treatment of effluent before its discharge into water bodies should be at priority.

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Conflict of interest:

The authors declare that they have no conflicts of interest.

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Studies on the Hardness of Water by EDTA Method through Complex Formation

Asim Ahmad*

Department of Chemistry, FoE & CS, Teerthanker Mahaveer University. Moradabad

*drasim.engineering@tmu.ac.in (Address for Correspondence),

ABSTRACT: The hard water contains high concentration of calcium, magnesium chlorides, sulphates andbicarbonates. Due to high demand of water, it is considered as the essence of life. Buthard water causes adverse effect on human health and on industrial process. Various samples of hard water were collected from the surrounding of Moradabad. The analysis was carried out through complex formation. The results indicated that 33% samples were found moderate hard, 64 % showed hard water and rest were found very hard. Very hard water is very harmful to human health. It has been found that moderately hard water and hard water are not harmful to any extent but very hard water causes severe problems in our daily life and in industries. The various type of industries like sugar factories,Textile industries, paper industries do not consume hard water as it spoils the quality of paper, washing and no crystallization in solution. This is important to give training to people to know about the quality of water.

Keywords: -Titration method, hard water, EDTA, Calcium ions and Magnesium ions

1. Introduction

The presence of calcium and magnesium ions causes hardness of water. The OH, Carbonate Ions and bicarbonates ions cause alkalinity and pH of the water become alkaline. The other CationsikeAluminium and Iron also causes hardness. Some Zinc and strontium ions also contribute for the hardness of water. They exist in concentration (NRC, 1974). The mineral rocks dissolve in water and produce ions causing hardness. These ions also reach in soil and water. The calcium ions are mostly obtained from lime stone and chalk. The dolomite is the main source of magnesium. It also releases calcium ions. (Gumashta et al ,2012). The hardness of water is defined as the soap consuming capacity of water. When hard water is mixed with soap, the sticky scum of calcium Separate and magnesium stearate are produced and cleansing capacity become Negligible. The soap may be made up of palmitic acid or stearic acid. SometimesPolyvalent ions also cause obstruction in the quality of water. The determination has been carried out by EDTA titrimetric method. (Standard Methods, 1998). The Nature of anions also classify the types of hardness. On the basis of anions also

It is justified whether temporary hardness or permanent hardness. The temporary hardness Is also known as alkaline hardness or carbonate harness. The permanent hardness isKnown as non-alkaline hardness. The hardness is expressed in ppm or mg/l. Both Temporary hardness and permanent hardness is known as total hardness. Depending Upon the concentration of calcium and magnesium the water is of four types Namely soft (60mg/l), hard water (120mg/l), and very hard water (180mg/l).(Sengupta, 2013). Various scientist has suggested different scales to classify The water as very soft, soft, medium hard and very hard water. Very soft and very Hard water are not fit for drinking. Very soft water has no minerals and such water Is harmful for the body requirement. The very hard water may cause ex osmosis and Is very dangerous. (Kosisek,2003). The awareness of water quality was justified In the late 1950. The impact of water hardness has been studied on vascular System of human physiology. (Kobayashi, 1957). The both alkalinity and hardness Both are injurious to heath. The WHO studies state that there are no evidence To have adverse effect on human

physiology.(WHO,2003). The USA has studied that Hard water can cause dietary supplement for calcium and magnesium (NRC, 1974).Generally it has been found that hard water cause no severe impacts on health. Hard Water causes severe effects on industrial uses. The hard water has bad impact on Crystal formation of sugar . In paper mills hard water has bad impact on the Color of the paper and become yellow. In Textile industry the hard water OHas very bad effect and it causes wastage of soap. The clothes are not cleaned Very well and leave dark patches on the clothes. The ground water samples have Been collected from Moradabad, the villages on Sambhal road and Amroha.

2. Materials And Methods

The water samples approximately 120 were collected from sambhal and Amroha. The water samples were collected from fresh sources where people are Using water for their use. The hardness of water was determined by EDTA Method . The water samples were collected in sealed water bottles . The initial studies were carried out at spot and in the laboratory. The hardness of all water samples was tested by using EDTA titrimetric method by taking 50 ml of water sample into a conical flask along with 100ml of ammonia buffer solution and 100-200mg of EriochromeBlack –T indicator followed by titration with EDTA solution present in burette.End point is noted down by changing of the water solution color from wine to blue and expressed as CaCO3equivalent in mg/l (Standard Methods, 1998).amount of hardness in water was calculated by using the formula.Hardness as mg/l CaCO3 =ml of EDTA solution x1000/ volume of water sample taken.

Classification	Hardness in mg/l	Hardness in ppm
Soft	0-60	less than 60
Moderately hard	61-120	60-120
Hard	121-180	120-180
Very hard	≥181	≥180

Table1 : Hard and soft water, as per the table below

Table 2: S	howing the	results for	hardness	of different	ground	water san	nples
1 abic 2. 0	nowing the	results for	nai uncos	or uniterent	SIVullu	water ball	pico

S. No	Place of sample	No of samples	Showing degree of hardness	% of sample	
1	Moradabad	40	S-0	S-0	
			MH-17	MH-42.5	
			H-21	H-53.5	
			VH-02	very h-05	
2	Village sambhal	40	S-0	S.02	
			MH-12	MH—30	
			H-27	H-67.5	
			VH-01	2.5	
3	Village Amroha	40	S-0	S-0	
			MH-10	2.5	
			H-28	70	
			VH-02	0.5	

3. Result and Discussion

The water samples showed the concentration of calcium and magnesiumIons in varying concentrations. Two villages have high concentration of calcium and magnesium and the water was found hard. The villages, the present studies have revealed that out of three places, the two villages have shown high level of hardness as compared to the town. In Moradabad town, out of 40 water samples collected, almost all the samples were moderately hard (43.5%) and hard water samples (53.5%). Only few samples were very hard water (5.5%) Table. The results of villages were different from the results of town. Forty each number Of samples were collected from two villages. In Sambhalvillage, more number of samples have shown hardness between 150-300mg/IOf CaCO3 (68.5%) i.e hard water. Some of the samples have shown moderate hardness (30%) and very few of them have shown extreme hardness (3.5%) Table.

Altogether out of 120 samples, most of the samples are found hard water (63.33). There are only 5 samples (4.16%) which are found to be very hard water. According To Kozisek(2003) both the extreme degrees of hardness are dangerous to human Health i.e very hard and very soft water. The present study did not find any soft water. But it has been reported that there are few samples (4.16%) which are very hard and can be ignored. Water intake of cattle and milk production has been foundUnaffected by watercontaining up to 290 ppm of hardness (NRC, 1974). Hence the water is safe for cattle in the town and villages. Hard drinking water is generally not harmful to human health (WHO, 2003) but can pose serious problems in industrial settings

4. Conclusion

The present study has proved extreme degree of hardness in only 4.16% of the samples whichmay not be harmful to the people. Although majority of people dislike the use of hard water. It has been found that concentration of Ca and Mg ions show some protective effect on cardiovascular mortality. The use of hard water does not give any evidence to prove causality among those people who are using hard water. The required concentration of Ca and Mg are good for sound health but excess of Ca is not good for bones as it causes extra growth of bones especially in the back bone and become a big problem. Some people think that hard water is harmful to health . It has been found that extremely hard water is Ex osmosis of blood cells and theacquire small size. This is important to bring awareness among the people about soft, moderately hard , hard and very hard water.

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Design and Simulation of DCT Chip in VHDL and Application in Watermark Extraction

Sandeep Kumar^{1*}, Deepika Ghai²

¹Department of ECE ,Sreyas Institute of Engineering and Technology, Hyderabad, India

²Department of ECE, Lovely Professional University ,Punjab, India

*drsandeep@sreyas.ac.in (Address for Correspondence), deepika.21507@lpu.co.in

Abstract: The paper presented the design, modeling and chip implementation of 2D Discrete Cosine Transform (DCT) domain for copyright protection of images, as digital watermarking chip. Recent improvement in computational world and the proliferation of the Internet have facilitated and demanded the production and distribution of unauthorized copies of copyrighted digital contents. The research work involved simulations and synthesis of VHDL code utilizing recent FPGA families of Xilinx, SPARTEN 3E. It is achieving the most demanding real-time requirements of some standardized frame resolutions and rates.

Keywords: DCT,DIP, SBIR, TBIR

1. Introduction

Since a digital copy of data is the same as the original, digital watermarking is a passive protection tool [2, 3]. It just marks data, but does not degrade it nor controls access to the data. One application of digital watermarking is source tracking [3]. A watermark is embedded into a digital signal at each point of distribution. If a copy of the work is found later, then the watermark may be retrieved from the copy and the source of the distribution is known. This technique reportedly has been used to detect the source of illegally copied movies. It is difficult to model the distortions introduced by common signal processing transformations, which either intentionally or unintentionally affect the watermark detection or identification capabilities[1, 7]. Although very nice work exists in trying to understand the fundamental limitations of watermark embedding and detection, attack channels such as geometrical distortions cannot be described by these models. Other areas have not been resolved as well. Besides the obvious caveat of whether watermarking technology will be effective in a court of law, other questions remain.

2. Phases of Digital Watermarking:

Digital watermarking may be used for a wide range of applications, such as Copyright protection, Source tracking for different recipients get differently watermarked content, Broadcast monitoring for television news often contains watermarked video from international agencies.

General digital watermark life-cycle phases with embedding-, attacking-, and detection and retrieval functions. The information to be embedded in a signal is called a digital watermark, although in some contexts the phrase digital watermark means the difference between the watermarked signal and the cover signal. The signal where the watermark is to be embedded is called the host signal. A watermarking system is usually divided into three distinct steps, embedding, attack, and detection. In embedding, an algorithm accepts the host and the data to be embedded, and produces a watermarked signal.



Fig. 1 Phases of Digital Watermarking Life Cycle

Then the watermarked digital signal is transmitted or stored, usually transmitted to another person. If this person makes a modification, this is called an attack. While the modification may not be malicious, the term attack arises from copyright protection application, where third parties may attempt to remove the digital watermark through modification. There are many possible modifications, for example, lossy compression of the data (in which resolution is diminished), cropping an image or video or intentionally adding noise.

3. Classification of Digital Watermark

A digital watermark is called robust with respect to transformations if the embedded information may be detected reliably from the marked signal, even if degraded by any number of transformations. Typical image degradations are JPEG compression, rotation, cropping, additive noise, and quantization. For video content, temporal modifications and MPEG compression often are added to this list. A digital watermark is called imperceptible if the watermarked content is perceptually equivalent to the original, unwater marked content. In general, it is easy to create robust watermarks or imperceptible watermarks, but the creation of robust and imperceptible watermarks has proven to be quite challenging. Robust imperceptible watermarks have been proposed as tool for the protection of digital content, for example as an embedded no-copy-allowed flag in professional video content. Digital watermarking techniques may be classified in several ways.

3.1 Robustness

A digital watermark is called fragile if it fails to be detectable after the slightest modification. Fragile watermarks are commonly used for tamper detection (integrity proof). Modifications to an original work that clearly are noticeable commonly are not referred to as watermarks, but as generalized barcodes. A digital watermark is called semi-fragile if it resists benign transformations, but fails detection after malignant transformations. Semi-fragile watermarks commonly are used to detect malignant transformations. A digital watermark is called robust if it resists a designated class of transformations. Robust watermarks may be used in copy protection applications to carry copy and no access control information.

3.2 Perceptibility

A digital watermark is called imperceptible if the original cover signal and the marked signal are perceptually indistinguishable. A digital watermark is called perceptible if its presence in the marked signal is noticeable. A digital watermark that is perceptual, on the other hand, is imperceptible. It works context-sensitive/adaptive.

3.3 Capacity

The length of the embedded message determines two different main classes of digital watermarking schemes. The message is conceptually zero-bit long and the system is designed in order to detect the presence or the absence of the watermark in the marked object. This kind of watermarking scheme is usually referred to as zero-bit or presence watermarking schemes. Sometimes, this type of watermarking scheme is called 1-bit watermark, because a 1 denotes the presence (and a 0 the absence) of a watermark. The message is a n-bit-long stream (|| and is modulated in the watermark. These kinds of schemes usually are referred to as multiple-bit watermarking or non-zero-bit watermarking schemes.

4. Results and Discussion

The RTL view of the developed DCT chip is shown in figure 1 and internal schematic of the chip is shown in figure 2. The functional simulation of the developed chip is shown in waveform of Modelsim simulator in figure 3. The size of the watermark can be of ",N" bits. The watermark is extracted in ASCII code format. In the chip X0, X1, X2, X3, X4, X5, X6 and X7 are the input of the watermark and Y0, Y1, Y2, Y3, Y4, Y5, Y6, and Y7 are the outputs of DCT.



Fig.2 RTL View of DCT with Watermark Chip

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Fig.3 Internal Schematic of the Chip

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/dct_2d/x0 68	68
/dct_2d/x1 79	73
/dct_2d/x2 39	39
/dct_2d/x3 84	84
/dct_2d/x4 67	67
/dct_2d/x5 79	79
/dot_2d/x6 80	80
/dct_2d/x7 89	89
/dct_2d/y0 1881623241	1881623241
/dct_2d/y1 -736276501	-736276501
/dct_2d/y2 -1980973139	-1980973139
/dct_2d/y3 946139365	946139365
/dct_2d/y4 -1486124129	1486124129
/dct_2d/y5 -1933864373	-1933664373
/dot_2d/y6 1345742432	1345742432
/dct_2d/y7 112971081	112971081
⊡_ /dct_2d/watermark_in D0'TCOPY	DOTCOPY
□-, /dct_2d/watermark_ex/D0TC0PY	DOTCOPY
/dct_2d/k1 157	157
/dct_2d/k2 159	159
/dct_2d/k3 118	118
/dct_2d/k4 151	151
🔽 /dot_2d/k5 🛛 -21	21
/dct_2d/k5 -1	-1
/dct_2d/k7 -40	40
/dct_2d/k8 17	17
/dct_2d/temp1 316	316
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Fig. 3 Modelsim Simulation of the developed Chip

Conclusion

The chip can be easily integrated in any existing JPEG encoder to watermark images right at the source end. The implementation of a low-power, high-performance version is currently in progress, Low-power VLSI features, such as multiple supply voltages, dynamic clocking, and clock gating will be considered. High performance architectural implementations, such as pipeline or parallelism, are under research. The disadvantage of the watermarking algorithms implemented is that the processing needs to be performed pixel by pixel. The watermarks are tested with block by clock extraction with different test cases.

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Phone No	mobile no	Fax
E-mail		

Signature and date

Mail to: **Prof. (Dr) R. K. Dwivedi [Principal & Director, FoE & CS, TMU] Editor-in-Chief S & T Review - An International Journal of Science & Technology Faculty of Engineering & Computing Sciences Teerthanker Mahaveer University NH-24, Moradabad- 244001, U.P., India Emial Id: principal.computers@tmu.ac.in**

Placement@F0E&CS

To actively reach out to the corporate world for facilitating the best placements for TMU graduates, a full-fledged department, T&P Cell is maintained. This department has evolved a well designed concept of achieving this objective by closely working with the three stakeholders -- the students, the companies, and the university. Before bringing students and the companies face to face, the students are provided a number of services to groom them for enhancing employability.

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