The *Journal of Environmental Science and Engineering* is published quarterly. The Institute assumes no responsibility for the statements and opinions advanced by contributors. The editorial staff in its work of examining papers received for publication is assisted, in an honorary capacity, by a large number of distinguished scientists. Communications regarding contributions for publication in the journal should be addressed to the Editor-in-Chief, *Journal of Environmental Science and Engineering,* CSIR-National Environmental Engineering Research Institute, Nehru Marg, Nagpur – 440 020. All correspondence regarding reprints, journal copies, subscription renewals, claims for missing numbers and advertisements should be sent to the same address.

Annual Subscription (w.e.f. 1 January 2014) : Individual: Rs. 400/- (Inland) $200 (Foreign) and Institutions & Organizations: Rs. 2000/- (Inland) $600(Foreign). The subscription proforma is placed at our website www.neeri.res.in. You may use the same proforma for placing your orders for subscription. You are requested to kindly send the same along with Demand Draft by post to Managining Editor, Journal of Environmental Science and Engineering, Technology Development Centre, CSIR- National Environmental Engineering Research Institute (NEERI), Nehru Marg, Nagpur – 440 020. *The Demand Draft should be drawn in favour of Director, NEERI, Nagpur – 440 020.*

For further details, please write to: Dr. Sunil Kumar, Managing Editor, Journal of Environmental Science and Engineering, Technology Development Centre, CSIR-National Environmental Engineering Research Institute (NEERI) Nehru Marg, Nagpur - 440 020;
Phone : + 91 712 - 2249748; Fax : + 91 712 - 2249900; E. mail : jese@neeri.res.in
Website : www.neeri.res.in / neerijese.org

Printed & Published by : Dr. Rakesh Kumar, Director, CSIR-NEERI on behalf of CSIR-National Environmental Engineering Research Institute, Nehru Marg, Nagpur – 440 020 (India)
Registered with Registration of Newspapers of India (Reg. No. 6465/59)
Printed at : Mudrashilpa Offset Printers, Bajaj Nagar, Nagpur.

Journal of Environmental Science & Engineering

(http://www.neeri.res.in) ISSN 0367-827 X

Volume 59 No. 4 October 2017

CONTENTS

The journal is covered by the following leading abstracting, indexing and current awareness services:

- Chemical Abstracts Service
- Sci-Search – A Cited Reference Science Database
- Engineering Index
- Current Contents
- Research Alert
- Cambridge Scientific Abstracts
- INSPEC
- Biotechnology and Bioengineering Abstracts
- Biological Abstracts
- EMBASE
- Scopus
- IC Journals
- CAB Abstracts
- Elsevier Biobase -Current Awareness in Biological Sciences (CABS)
- Indian Science Abstracts
- BIOBASE
- BAILSTEIN
- IARAS
- Compendex
- ACM
- Ulrich's
- National Library of the Netherlands
- French National Library
- British Council Libraries
- German National Library of Science and Technology
- National Library

This issue is published in September 2020

J. Environ. Science & Engg. Vol. 59, No. 4 p. 401-406, October 2017

Waste Water Purification using Dual media Filter

PRANAT JAIN[1], DR.P.A. SADGIR[2]

Water is of vital importance and throughout history it has been considered as natural resource critical to human survival. Various technologies have been used or being recently developed for grey water treatment and its reuse. So, reutilization of wastewater by appropriate technique is the only way to conserve freshwater from forthcoming concerns of water shortage. This study aims to present the importance of waste materials(cocopeat, sawdust, rice husk) to purify and treat domestic waste water and reuse it. A column study is performed separately for each filter media and then arranged in series for assessing multimedia filter performance. Various physicochemical properties like pH, BOD, COD, TSS, Turbidity of water sample is evaluated. The column was operated for varying detention time and flow rate. The results obtained from this experimental study showed BOD removal efficiency as 75-84% and COD removal efficiency as 82-86% for cocopeat and rice husk both and turbidity removal is 80-88%.

Keywords:*Grey water, Media filters, Cocopeat, Domestic wastewater.*

1. INTRODUCTION

Water is one of the utmost necessary element that leads to development of heathy life. Water is essential for both plants and animal and it is the responsibility of human to take care of this resource, not only as a social, industrial and commercial good but also for a viable profit of all present and future living matter. The upcoming water demand could only be fulfilled by intensifying the water use efficiency and demand management.

Segregation of domestic sewage into black water and grey water is considered as a symbolic outcome of new visionary development proposing waste as a resource. The purpose of wastewater treatment is to remove pollutants that can harm the aquatic environment if they are discharged into it.

Grey water is defined as urban wastewater without any input from toilets and so includes sources from baths, showers, hand basins, washing machines, dish washers and kitchen sinks. Purification using media filter of this waste water is one of the best ways to deal with the upcoming disposal of grey water.

This paper presents a column study of dual media filters i.e., cocopeat and rice husk along with its ash. Research also shows that the cocopeat is extremely effective as a media filter as it is cost effective and easily available.

2. AIMS AND OBJECTIVES

The aim of the research is to treat and reuse grey water and upgrade conventional treatment processes by using combination of filter media for domestic waste water treatment. The main objective of this study is to endow in integrated water resource management to minimize the effect of water scarcity as water conservation in urban areas by treating domestic waste water through low cost, easily available waste material as filter media. The removal efficiency of parameters like BOD, COD, TSS, Turbidity were evaluated.

3. LITERATURE REVIEW

A short review of the work that is related to this research is presented Naofomi sato et.al.[1] in study of microcosm experiment assessed the effectiveness of coconut fibre biofilm on waste water treatment system. Water quality parameters were evaluated by both synthetic sewage and leachate with varying pollutant loads. The researcher in study used three coconut fibre conditions i.e., low fibre density, high fibre density and blank(no coco fibre). They concluded that removal efficiency of BOD and COD from synthetic leachate is more than that of blank specimen. Removal efficiency in low load condition is higher than high load condition indicating that the appropriate curb of pollutant load is helpful to enhance the treatment of leachate in COTS. It was observed that O_2 consumption of synthetic leachate was more than that of synthetic sewage. The study concluded that rate of O_2 consumption is directly proportional to coconut fibre density.

Gazala Sayed et.al.[2] tested and compared the treating efficiency of activated carbon, sand filter and dual media filter for waste water treatment. The study was carried out on a pilot plant and media filters were arranged. The effluent water from around 3056 industries including textile, paint, leather etc. was allowed to pass through media at a flow rate of 11.25 ml/min. It was observed that sand filter act as good filter for removing turbidity and reducing COD concentration.

[1] P.G. student, Department of Civil Engineering, College of Engineering Pune, India.
[2] Professor, Department of Civil Engineering, College of Engineering Pune, India.

J. Environ. Science & Engg. Vol. 59, No. 4 p. 407-420, October 2017

Removal of Organic Matter and Nitrogen using different Filter Media Packing in Recirculated Horizontal Subsurface Flow Constructed Wetland

ATUL S. SHINDE[A,*], MILIND L. WAIKAR[B]

A modified approach of recirculated horizontal subsurface flow constructed wetland (CW), vegetated with *Typha sp.,* is studied for three different filter media packing namely increased size filter (ISF), decreased size filter (DSF) and uniformed size filter (USF) media packing. The pathway of main CW reactor was increased from 1 m to 5 m by providing a baffle wall in it. Treatment performance of CW was judged based on the removal efficiency for biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), total suspended solids (TSS), Ammonium-Nitrogen (NH_4-N), Nitrate Nitrogen (NO_3-N), Nitrite Nitrogen (NO_2-N) and total nitrogen (TN). The sample was monitored after 24 hours, 48 hours and 72 hours from feeding. Recirculation of wastewater provided in three modes i.e. I-C-I, C-I-C and C mode (I – idle phase, C – continuous recirculation phase). Results indicated average removal efficiency for the entire system of 89.09% for BOD_5, 84.88% for COD, 89.50% for TSS, 97.58% for NH_4-N, 94.54% for NO_3-N, 66.99% for NO_2-N and 96.16% for TN. I-C-I mode has given more removal efficiency for USF media packing, only NO_2-N is removed in maximum level by USF media packing of I-C-I mode. This study reveals that the partial recirculation of wastewater and use of uniform filter media size of 4-5 mm (Õ - effective diameter) is effective for the removal of organic matter, solids and nitrogen.

Key words : *Constructed wetland, recirculation, nitrogen removal, filter media.*

Introduction

Increase in the living standard of people of developing countries like India has substantially risen the generation of wastewater. This wastewater contains more amounts of organic matter and also rich in nitrogen contents (De Rozari et al., 2018). Such wastewater is mostly treated by septic tanks and the effluent is discharged into the environment. However, the wastewater treated with this method still high in pollution load which may impose eutrophication and decline the water quality of discharging water bodies if discharged directly (Kill et al., 2018; West et al., 2017; Jong and Tang, 2016). Therefore, the appropriate treatment is must for this wastewater before discharging into water bodies.

Constructed wetlands (CWs) have been widely applied to treat various types of wastewaters due to their low energy consumption, easy operation and simple maintenance (Feng et al., 2020). Alongwith those CWs, plants are adding quality in treatment of wastewater by enhancing the processes like settlement of suspended solids, providing surface area for micro-organisms and releasing the oxygen which is promoting more decrease in organic matter (Ong et al., 2012). CWs technology provides a reliable environmental-friendly solution for wastewater treatment. Human beings are using CWs as a decentralized wastewater treatment facility where they do not have centralized wastewater treatment plants, especially in rural-urban fringe zones due to under-developed infrastructure or incomplete sewage pipelines makes wastewater treatment complex (Zhang et al., 2020). Operation and maintenance (O&M) is very simple for CWs than the conventional wastewater treatment plants also it keeps cost at lower side. Locally available materials can be used for their construction, and provides great adaptability and resilience, supplying multiple ecosystem services (Ávila et al., 2017).

In recent year's recirculation of wastewater has been used in CWs and shown increase in simultaneous nitrification and denitrification processes either in a single CW (i.e. horizontal CW or vertical CW) unit or in the hybrid CWs (i.e. horizontal CW + vertical CW) systems (Torrijos et al., 2016). The recirculation process enhance the purification process with reduction in pollutants level in effluent, leading towards minimum water usage and reducing the adverse impact on

[a] Research Scholar, Department of Civil Engineering, Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded - 431 606, India
[b] Professor, Department of Civil Engineering, Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded - 431 606, India
* Corresponding author (Atul S. Shinde): atul.88shinde@gmail.com

J. Environ. Science & Engg. Vol. 59, No. 4 p. 421-424, October 2017

Treatment of Wastewater from Dairy Products Processing Unit using immobilised *Bacillus Marisflavi* TF 11

SHALINI A. TANDON* AND RADHIKA DEORE

Wastewater from dairy products processing unit was treated with calcium alginate beads, immobilised form of *Bacillus Marisflavi* TF 11. The bacterial beads were in contact with the wastewater for 24 hours. Treatment of dairy wastewater with Ca-alginate beads efficiently reduced the levels of organic matter, sulphate, phosphate, nitrate and Total Suspended Solids (69% COD, 86% Sulphate, 80% Phosphate, 72% Nitrate and 33% TSS was removed). The removal of these parameters in the presence of the added immobilised bacterial species was significantly more than in control. Hence, this bacterial species can be used for enhancing the quality of wastewater from dairy products processing units.

Key words: dairy wastewater, *Bacillus Marisflavi* TF 11, immobilised

Introduction

India accounts for more than 13% of the total world milk production [1]and the dairy industry generates large amounts of wastewater (0.2–10 L of waste water/ liter of processed milk [2]. The generation of dairy wastewater and its characteristics are affected by the type of processing, efficiency of methods used for cleaning of equipment and methods used for effluent disposal. Dairy wastewater is considered as source of organic matter, nitrogen and phosphorus. In industrial dairy wastewaters, nitrogen is present as proteins, urea, nucleic acids (organic nitrogen) or as $NH4^+$, NO_2^- and NO_3^- ions. Phosphorus is found in inorganic phosphorus (orthophosphate and polyphosphate) or as organic phosphorus. The release of such nutrient rich wastewater in water bodies can lead to eutrophication [3].

Many technologies including aerobic and anaerobic processes have been used for treatment of dairy wastewater. Many microorganisms have been isolated and used for dairy wastewater treatment and have been reported with varying treatment efficiencies. Garcha et al (2016) isolated 10 microbial species for treatment of dairy industrial wastewater based on their efficiency in reducing pollution potential parameters i.e BOD, TSS and Oil and grease content. Two species could achieve Oil & Grease removal upto 90% (4). In another study, by Garcha et al (2014) used a microbial consortium for treatment of dairy wastewater. The consortium included *Saccharomyces fragilis, Bacillus coagulans,* and *Candida haemulonii* caused 65% BOD reduction with retention time of 72-96 hrs. [5] Microbial isolates from activated sludge has been used in a study carried out by Porwal et al, 2014.[6] Yeast isolates (DSI1) and two bacterial isolates (DSI2 and DSI3) were obtained from the dairy sludge. A mixed culture (DSI4) was prepared by taking 1:1, DSI1and DSI3 to treat the effluent and check its efficiency. After aeration for 48 hrs, BOD reduction of 47% was obtained using DSI. Fungal species have also been used for the treatment of Dairy Industrial effluent. Five fungal species were isolated from Dairy effluent and assessed for their efficiency in COD and TDS reduction.[7] Their efficiency were tested under aerobic as well as anaerobic conditions. Under aerobic conditions, maximum reduction in TDS (83.78%), COD (90%) was obtained whereas under anaerobic conditions, maximum COD reduction was 83.07%. In a study two yeast strains *Kluyveromyces marxianus* MTCC 3772 and *Candida intermedia* MTCC 1744 were employed for treatment of dairy wastewater and environmental conditions for maximum bioremediation were optimized (Kaur et al,(2013). *Candida intermedia* produce maximum bioremediation benefits at 37°C temperature, 5.0 pH and with inoculum level of 5.0% (v/v) and in case of *Kluyveromyces marxianus*, best treatment of effluent was achieved at 30°C temperature, 7.0 pH with inoculum level 6.0% (v/v). The retention time of 4 to 5 day was provided for the process.[8]

The present study aims to check the efficiency of *Bacillus marisflavi* TF -11 for treatment of Dairy wastewater in immobilised form.

2 Materials and methods

2.1 Bacterial species used

Bacillus marisflavi TF -11 was isolated and identified in our previous studies and has been tested for its use in the treatment of municipal wastewater[9]. In this study the same culture was immobilised as calcium alginate beads and used for the treatment of wastewater from dairy products processing unit.

Research and Innovation Centre of National Environmental Engineering Research Institute, 89-B, Dr A. B. Road, Worli, Mumbai-400018, India.
*Corresponding author: tandon.shalini@gmail.com

J. Environ. Science & Engg. Vol. 59, No. 4, p.425-432, October 2017

Effect of Different Operating Parameters on Enzymatic Hydrolysis of Alkaline Wet Air Oxidation Pretreated Rice Straw

AMRUTA MORONE[a], TAPAN CHAKRABARTI[b], ABHINAV SHARMA[c] AND R.A. PANDEY[a+]

Rice straw was selected as prototypical lignocellulosic biomass and was pretreated using an advanced oxidation process, i.e. alkaline wet air oxidation at 169°C, 4 bar, 18mins. The cellulose-enriched solid pulp was hydrolyzed enzymatically at various conditions in order to optimize the saccharification parameters and achieve enhanced convertibility and high sugar yield. The effect of enzymes from different sources on AWAO pretreated rice straw was studied so as to select appropriate enzyme mixture prior to optimization studies. The hydrolysis parameters were optimized by varying one parameter at-a-time while keeping other parameters constant. The effect of parameters *viz.* temperature, pH, saccharification time, cellulase loading, ratio of saccharification enzymes, agitation speed and solid loading was studied and optimized in the present study. The effect and outcome of the studies and its implications are presented and discussed in this article. The present study thus indicates the potential of AWAO pretreated rice straw as feedstock for bioconversion process at optimized saccharification conditions.

Key words : *Rice straw, alkaline wet air oxidation pretreatment, cellulases, â-glucosidase, saccharification, optimization*

Introduction

The depletion of fossil reserves and issues on environmental pollution have compelled a switch from petroleum-based products to renewable bio-based products (Morone *et al*, 2015)[1]. Lignocellulosic biomass (LCB) is regarded as one of the potential renewable raw material for bio-based chemicals and products. Among the widespread range of LCB, rice straw is considered as the potential feedstock for production of platform chemicals and biofuels through bioconversion processes owing to its renewable nature and surplus availability even after the competitive uses (Singh *et al*, 2016)[2]. In addition, rice is staple crop of Asia, leading in its higher production and rice straw has a limited use as fodder as a result of high silica content which leads to its burning in open fields, thereby, causing pollution (Zhu *et al*, 2015)[3]. Moreover, the higher carbohydrate content in rice straw makes it a suitable feedstock for bioconversion to different chemicals and products and would put it to proper use. Nonetheless, the recalcitrance of rice straw poses hindrance in the bioconversion process which compels its pretreatment. This necessitates an efficient pretreatment strategy which would fractionate the biomass into its lignocellulosic components i.e. cellulose, hemicellulose and lignin. These lignocellulosic components can be further converted into sugars through chemical or enzymatic hydrolysis. Advanced oxidation processes like alkaline wet air oxidation (AWAO) sound an interesting option for efficient fractionation of LCB.

Chemical hydrolysis generally employs acid as catalyst while enzymatic hydrolysis employs enzymes such as cellulase and â-glucosidase. Chemical hydrolysis often leads to undesirable sugar degradation and lacks specificity of action while enzymatic processes are highly specific, operate at milder conditions and do not pose corrosion problem. In addition, lower by-product formation makes enzymatic hydrolysis more favorable over chemical hydrolysis (Morone and Pandey, 2014)[4]. However, in order to efficiently hydrolyze the pretreated LCB, effective saccharification is a vital step.

Thus, it is imperative to evaluate the requirement for the plausible improvement of saccharification of complex LCB. Therefore, in the present study, saccharification enzymes from different sources were evaluated for their efficiency on the AWAO pretreated rice straw. The efficiency of the enzymes leads to higher sugar yields and cellulose convertibility. Consequently, this efficiency of enzymes is governed by the process parameters *viz.* temperature, pH, hydrolysis time, enzyme loading, ratio of saccharification enzymes, agitation speed and substrate loading. Further, in order to achieve higher process efficiency, it is essential to optimize the parameters involved in enzymatic hydrolysis. Moreover, the hydrolysis behavior of different LCB differs from one another, which

[a] Environmental Biotechnology and Genomics Division, CSIR-NEERI, Nagpur, Maharashtra, India
[b] Visvesvaraya National Institute of Technology, Nagpur, Maharashtra, India
[c] Cleaner Technology and Modeling Division, CSIR-NEERI, Nagpur, Maharashtra, India
[+] Corresponding author: ra_pandey@neeri.res.in

J. Environ. Science & Engg. Vol. 59, No. 4 p. 433-438, October 2017

Validation of Traffic Noise and Annoyance Response in Madurai City

SIVASUBRAMANIAN R[1], KRITHIGA S K[2] AND KEERTHINARAYANA S[3]

This paper attempts to substantiate the validation of vehicular traffic noise or 'traffic noise' in Madurai city, Tamil Nadu State, India, by simple, deterministic, and basic models, such as Kugler's nomograph for L_{10} assessment and Wesler's formula for L_{50} prediction (for traffic noise assessment); and Quis and Schultz-graph based models (for traffic noise annoyance response). For this, the traffic noise data were analyzed in 21 regions covering 3 school zones, 3 hospital zones, 3 commercial zones, 3 residential zones, 6 signalized intersections, and 3 bus terminals. Owing to the expected significant growth of traffic in Madurai city, although the recent past (August, 13 – February, 14) and previous (December, 09 – May, 10) traffic noise data indicated the slight variations between the respective L_{eq} at few locations, but a maximum deviation of about 8.3 dBA was noticed at Kalavasal interaction. On the other hand, the annoyance response of public exposed to traffic noise was assessed through the appropriate psychometric-based questionnaire-type social survey conducted during August, 2013 to February, 2014. The traffic noise pollution feedback consisted of Parts A and B, in which Part-A had thirty questions and Part-B had one major (i.e., objective) and another minor question. Further, Qs in Part-A and Q2 of Part-B were coupled with appropriate five alternative choices, except Q1 of Part-B which had four options. Based on Q2 of Part-B, the highly annoyed response in each location was appropriately evaluated by fairly lumping noisy, very noisy, and hazardous responses at that location. Considering all the 21 locations, it was observed that the respective ranges of deviations between the theoretical (as predicted from Kugler's nomograph and Wesler's formala) and prevailing L_{10} and L_{50} values were between 0.1 and 9.5 dBA; and 3.5 and 50.5 dBA. Hence, Kugler's nomograph is highly useful in predicting L_{10} values than the L_{50} values by Wesler's method. As for as annoyance response is considered, highly appropriate validation could be seen between the percentage highly annoyed and L_{dn} values as per Quis model than by the Schultz-based model. But, the assessed L_{dn} values of 55 and 58.5 dBA were less than the prescribed Indian standards of 65 dBA.

Key words : *Traffic noise annoyance, Kugler's nomograph, Wesler's formula, Quis model, Schultz model.*

Introduction

Strictly speaking, "vehicular traffic noise" is considered as "traffic noise" (from now onwards in this article) and is a serious chronic environmental issue not only in several Indian cities like Delhi, Mumbai, Kolkata, Chennai, Asansol, Agarthala, Bangalore, Nagpur, Vijayawada, Chidambaram, Kolhapur, and others; but also in other cities like Beijing (in China), Osho and Drammen (in Norway), Mashaad (in Iran), and others in the world (Baneerjee *et al*, 2008; Hunashal and Patel, 2012; Balashunmugam *et al*, 2013; Li *et al*, 2007; Klaebo *et al*, 2004; and Rahmanie *et al*, 2011). Owing to its diversified effects like physical, physiological, psychological, socio-well being, socio-economic, and performance-based on human beings, several national and international organizations have set an equivalent sound level-based (L_{eq}), a specific limit of 70 dBA (day-time) in UK and China (China EPA, 1995) and 45 dBA (night-time) in Siberia and USA (Directive, 2002). Therefore, it is highly necessary not only to understand or to assess the level of traffic noise prevailing in the urban environment, but also to effectively and efficiently mitigating it by planning and design methods. In this direction, this investigation was undertaken to assess the traffic noise annoyance in Madurai city, Tamil Nadu state, India, based on

[1] Asst. Director (Lab), Tamil Nadu Pollution Control Board (TNPCB), Madurai -625 008 and Part-time Research Scholar, Anna University of Technology, Coimbatore -641 056.
[2] Asst. Professor of Civil Engineering, Coimbatore Institute of Technology (CIT), Coimbatore - 641 014.
[3] Professor of Civil Engineering, Coimbatore Institute of Technology (CIT), Coimbatore - 641 014.
[+] Corresponding author: keerthihemmige@gmail.com

J. Environ. Science & Engg. Vol. 59, No. 4 p. 439-442, October 2017

Experimental Studies of Waste Minimization by using Marble Slurry for Brick Manufacturing

MOHAMMED ARIF KHAN[1]; NIZAMUDDIN[2]

Marble stone industry generates solid waste and stone slurry. The concrete industry is constantly looking for supplementary material with the aim of minimising the waste(solid) disposal problem. In this paper marble fine is replaced by fine aggregate(sand) and the study is carried out by using M25 grade concrete with replacement of ***0%,10%,20%,40%,*** *marble powder by sand* and is experimented to determine the optimum percentage of replacement and substituted at which maximum compressive strength and also tensile strength is achieved.

For once, utilization and scientific disposal of marble slurry on a properly selected dumping sight may be better solution of the problem. But now a day's the increased production day by day the Utilization is the only solution of the problem.

INTRODUCTION

Marble, with the increase in production, it increases the waste that obtained from it.

As marble powder is the waste product, the heavy metals obtained during the process of sawing and shaping of marble by parent marble rock, makes water unusable.

Marble powder possess environmental problems too. Due to this problem, to abate its great impact on human health as well as on nature, we have to utilise this waste as a substitute

The majaority Part(about 70%) of Marble is wastage in the industry and may results in many Severe environmental problems. The marble waste is rarely degradable. So it is a wider environmental hazard.

Marble fines present in the air may also result in air pollution. Fines of Marble slurry flew with air blows creating serious health problem by breathing. Deposition of marble fines over leaves of vegetation, plants and trees creating aesthetic problems. The loss of flora and fauna due to deposition of marble dust over leaf , vegetation, plants as well as on trees.

The most suitable and efficient way out of marble fines problem is the utilization in lot. Fineness modulus of marble slurry is 0.91 and it is cohesionlless material. Therefore Marble slurry can be utilized in finishing work as White wash with lime. Also it is 50% cheaper and also good Solar heat repellent which could be used as natural building cooling agent.

The increasing rate at which raw material are constantly been used and transformed into industrial products results in waste generation. Consequently, with the concept of sustainable development, recycling of industrial wastes and byproducts is becoming a crucial demand by the environmental laws in agreement.

Rajasthan is the leading marble producer in the country, i.e. 85% of India's production is received from Rajasthan and in it MAKRANA AND RAJNAGAR are the major mining sites where all the marble generatrion takes place, and where the proposed study is planned to undertake. The state (Rajasthan) has around1100 marble gang saws (processing units) and 4000 marble mines.

Marble is a metamorphic rock composed of recrystallized carbonate minerals, most commonly calcite or dolomite. Marble may be foliated. Geologists use the term "marble" to refer to metamorphosed limestone; however, stonemasons use the term more broadly to encompass unmetamorphosed limestone.

Marble slurry generation:-

Marble Slurry is a suspension of marble fines in water, that gets generated during processing and polishing process

Environmental Hazards due to waste

Nearly one thousand Gang saws and thousands of cutters are producing 15-20 lack tons of marble slurry waste which is indestructible waste and harm to general Public.

1. The waste is indestructible in nature.
2. Contamination of air
3. The idea of dumping the waste is limited in extent and further it results in unaesthetic and repulsive dirty look.
4. Risk of getting Top cover of soil (fertile soil) contaminated.

[1] Department of Civil Engineering, M.B.M. Engineering College, India
[2] Department of Civil Engineering,G.E.C. Banswara, India.