



Dairy Wastewater Treatment and Simultaneous Bio-electricity Generation Using Dual Chambered Mediatorless Microbial Fuel cell

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Abstract: Energy needs has been increasing worldwide exponentially. At present global energy requirements are mostly dependent on the fossil fuels, which eventually lead to foreseeable depletion of limited fossil energy sources in near future. Industrial wastewater treatment is also a big challenge the world is facing at the moment. Microbial Fuel Cells (MFC) can be effectively used to treat industrial wastewaters and also simultaneously generate bio-electricity out of it. This paper focuses on testing novel Dual Chambered Mediatorless Microbial Fuel Cell (DC-MFC) employing copper electrodes for its ability to treat dairy wastewater and simultaneous electricity generation during treatment. For all the trials conducted in the laboratory, considerable reduction in Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved Solid (TDS) and Oil and Grease has been achieved. The removal efficiencies ranged between 87.5% to 91.8% for BOD, 83.3% to 86.9% for COD, 80.28% to 83.94% for TDS and 93.59% to 94.22% for Oil and Grease. The maximum electricity generated was 378mV. Hence the overall efficiency is very encouraging and could be scaled up easily in the near future.

Keywords: DC-MFC, Dairy wastewater, Copper electrodes, Bio-electricity.

1. Introduction

Among all industrial activities, the food sector has one of the highest consumptions of water and is one of the biggest originator of effluents, besides to generate a large volume of sludge in biological treatment [1][2]. The dairy industry is an example of this sector. This organic load is basically constituted by milk (raw material and dairy products), reflecting an effluent with high levels of Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Oils and grease. In this paper the potential of Dual Chambered Mediatorless Microbial Fuel Cell (DC-MFC) in Dairy wastewater treatment and simultaneously electricity generation is evaluated.

1.1 Microbial Fuel Cells

A Microbial Fuel Cell (MFC) is a bio-electrochemical device that harnesses the power of respiring microbes to convert organic substrates directly into energy [3]. The Microbial Fuel Cell can divide into two chambers: aerobic and anaerobic chambers [4].

The aerobic chamber has a positively charged electrode and is bubbled with oxygen using an aerator. The anaerobic chamber does not contain oxygen, allowing a negatively charged electrode to act as the electron receptor for the bacterial processes [5]. The MFC is a fuel cell, which transforms chemical energy into electricity using oxidation reduction reactions [6].

2. Materials and Methodology

The sampled wastewater was a combination of Milk, Cheese and Whey processing units, collected from a local dairy industry. Fabrication of the DC-MFC was done with 6 mm thick acrylic glass material. The capacity of DC-MFC was designed to treat 6.25 liters of wastewater per day. An aerator was used to supply oxygen to the aerobic chamber. Copper electrodes were used for the study. 16-Strands Copper Wires were used to connect the electrodes to the digital multi-meter. Glass beads and glass wool were used as the separation media in the DC-MFC, unlike most of the researchers who employ Proton Exchange Membrane [7]. The dairy wastewater was seeded to the DC-MFC from a drip set with a controlled flow rate.



Plate 1: DC-MFC laboratory setup



A Remote Sensing and GIS Approach to Watershed Management for Phalguni River Basin

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Abstract:

The need of water for India's rapid development is growing day by day. Dry land farming in India accounts for 63% of the cultivated land of 144 million hectares. Different types of problems which are related to watershed like depletion in water table, depletion of sources, scarcity of water, floods, reduction in water carrying capacity of streams are the biggest challenge to an engineer. The main intension is to utilize the water resources of that particular area. Mapping is done using satellite images by remote sensing technique. The data which is used for the project work is of LISS-4 type. The topographical sheets and geological maps Gurupura river (D43U13) are used and processed using ArcGIS and ERDAS softwares. Special attention was paid to rich vegetation area and average vegetation area to know the ground water. The drainage maps, base maps, geology maps and geomorphology maps were prepared in ArcGIS. And the satellite images were processed to produce the different color combinations using ERDAS softwares. The land use and land cover map is prepared using satellite data which offers new opportunity for planning, design and management of water resources of the study area. The watershed management project will utilize the complete water resources of the study area.

Keywords: Remote Sensing (RS); Geographic Information System (GIS); Linear Imaging Self Scanning (LISS); Watershed.

I. INTRODUCTION

Water is an essential requirement for the living Organisms. It is very important for the agricultural, industrial and residential activities. Water covers for about 71% of the Earth's surface. It is vital for all known forms of life. On Earth, 96.5% of the planets crust water is found in seas and ocean. And about 1.7% as groundwater. Only 2.5% of water is freshwater. In that less than 0.3% of all fresh water is in river, lakes.

The human activities leads to the variation in the rainfall such as depletion in water table, scarcity of water, floods, reduction in water carrying capacity of streams. So we need to manage the resources for a particular watershed so that the nearby area of the watershed can be benefitted.

A watershed means an area of land that contains a common set of streams and rivers that all drain into a single larger body of water such as river, lake or an ocean. For the particular watershed we need to manage the sources. Watershed is not simply the hydrological unit but also socio-political-ecological entity which plays crucial role in determining food, social, and economical security and provides life support services to rural people. Management of natural resources at watershed scale produces multiple benefits in terms of increasing food production, improving livelihoods, protecting environment, addressing gender and equity issues along with biodiversity concerns.

Watershed management consists of those coordinated human activities aimed at controlling, enhancing, or restoring watershed functions. Management of a watershed thus results in rational utilization of land and water resources at a time.

II. OBJECTIVES

- Study land and Environmental changes in and around Moodbidri using RS and GIS Techniques.
- Find out Land Use, Vegetation and Built Up area using ERDAS Imagine & Arc GIS softwares.

- Generate the Land Use-Land Cover maps based on multi dated satellite images.

III. DISCUSSION OF STUDY AREA

A. General Discription:

Gurupura is a small town situated on the bank of Phalguni, or Gurupura River. It is located about 345 kilometers (214 miles) west of Bangalore, the state capital, and 13 kilometers (8 miles) east of Mangalore, Karnataka's chief port city. According to the records of the local temples, the town of Gurupura was once known as Gulipur. Being situated on the banks of the Phalguni River, Gulipur was a commercial town and was connected to other parts of the river. Banda Saale is a place on this river where goods are collected from many sources and distributed to other places.



Fig 1: Sand Mining in study area.

Gurupura is famous for its religious activities and the Phalguni River is also named Gurupura, after this town. It also

Laboratory Comparative Study on the Performance of Plain Bitumen and Crumb Rubber Modified Bitumen on DBM Grade 2

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Abstract: In the present study, the physical properties of aggregates and bitumen were determined. Rothfuch's method is carried out to obtain the proportion of aggregate mixing and Marshall Stability method is adopted for bituminous mix design. Then for the neat bitumen, Marshall Tests were conducted to obtain the OBC for DBM Grade II. The OBC of 5.2% is obtained for the mix. The present study aims in investigating the Marshall properties of the bitumen modified with 15% and 18% of crumb rubber mixed with 500g of bitumen i.e. (75g and 90g crumb rubber) is used for the preparation of CRMB. Two categories of the size of crumb rubber were used, having sieve size (3.35 mm–2.36 mm) and (2.36 mm – 1.18 mm). Penetration tests and Softening point tests were performed on the modified bitumen using various sizes of crumb rubber modified bitumen. For the molds prepared with CRMB and with neat bitumen, a comparative study is made among the modified bitumen samples using the various sizes of Crumb Rubber particles and the best size is suggested for the modification to obtain best results.

Keywords: Crumb Rubber Modified bitumen (CRMB), Crumb Rubber, Bitumen and aggregates

1. Introduction

Roads act as a communication link in serving millions of people in every part of the world. The roads serve traffic safely, comfortably and efficiently at an affordable cost. India being a developing country, the flexible pavement forms the major part of the roads in comparison with the use of other roads like Cement Concrete Road, Water Bound Macadam, Gravel road, earthen road, etc. The transportation problems faced by various nations have increased manifold, necessitating the search for alternatives that ensure efficient, feasible and faster means of transport. Over the past two decades, traffic volumes and the percentage of heavy trucks have increased. In recent years due to the heavy magnitude of wheel loads and tire pressure, the severity of rutting is increasing on Indian roads. Due to permanent deformation caused in the sub grade, other layers also contribute to the total permanent deformation. Also, the accumulation of permanent deformation in the bituminous pavement with traffic repetitions increases the roughness of the road surfaces resulting in loss of serviceability of the road. The rainwater accumulated in the ruts can be a cause for an accident. It also reduces the strength of different layers due to the ingress of water into the pavements. For a location where higher temperatures prevail, the rutting of the bituminous layer become more critical especially for pavements with a thick bituminous layer. The rutting mode of distress in bituminous pavement result from both densification and plastic flow caused by repeated application of axial loads. Bituminous pavement can also undergo permanent deformation when subjected to sustained (creep) loading for long periods of time in parking areas, bus terminals, intersections, and loading/unloading yards

1.1 Role of Crumb Rubber in Bituminous Pavements

Use of crumb rubber in road construction is not new. Some aggregates are highly hydrophilic (water loving). Like bitumen crumb rubber is hydrophobic (water hating) in nature. So the addition of crumb rubber to asphalt mix lead to improvement of strength, water repellent property of the mix. Crumb rubber get added to hot bitumen mixture and the mixture is laid on the road surface like a normal tar road. Crumb rubber modification can be considered as one of the solution to improve the fatigue life, reduce the rutting & thermal cracking in the pavement. Creating a modified bituminous mixture by using recycled tires which enhances properties of HMA mixtures would not only produce a more durable pavement, but also provide a beneficial way of disposal of a large amount of recycled tires.

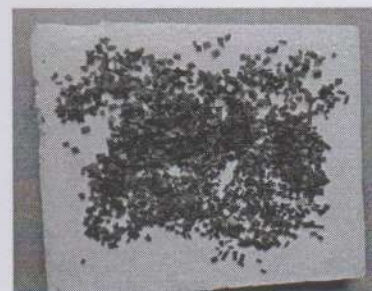


Figure 1: Shredded Crumb Rubber.

1.2 Objectives of Present Study

Basic intention is to efficiently utilize the waste tires in constructive way so that it can be beneficial to society however main objectives of current project work are:

Volume 8 Issue 5, May 2019

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Seismic Response of RC Framed Structures Resting on Sloping Terrain

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Abstract - Earthquakes are really nasty things, when earthquake was happened there was loss of lives, buildings damaged and even collapsed. Buildings constructed on the hilly regions show different structural configuration when compared to buildings constructed on flat ground. Structures on the hill slopes are unsymmetrical hence they grab large amount of shear forces and torsional moments, and also show uneven distribution due to differing column length. Stiffness is more in shorter columns, thus more force will be attracted by the shorter columns and are prone to more damage when subjected to earthquake [1]. This is the main reason for the damage during earthquake. In present study four models with different configurations are analysed using ETABS 2015 and the results in terms of story displacement, story drift, time period, story shear has been compared with step-back and step-back setback buildings and suitable configuration for hilly region has been suggested [2].

Key Words: step-back building, step-back setback building, equivalent static analysis, maximum story displacement, time period, story drift, story shear.

1. INTRODUCTION

Increase in the population leads to shortage of the plain land for the construction and thus it leads to economic development of hilly terrains and hence building design, usage of material for construction and even the construction techniques should be reconsidered. Construction of buildings on sloping ground provides excellent views, natural drainage and also provides additional space from lower floor levels. Slopes are high in case of Himalayan territory, if landslide happens then there will be loss of thousands of lives and property [3]. There is great demand for construction of multi-story buildings on hill slope in and around cities due to real estate development in hilly areas [4].



Figure 1: Buildings on sloping ground.

Past earthquakes happened in Sikkim (2011), Doda (2013) and Nepal (2015) caused more destruction of life and property. Earthquake appeared in Mexico city in the year 1985 also caused immense damage [5]. India is mainly divided into four zones depending on the intensity of earthquake (IS 1893 {Part 1}:2002).

1.1 Type of vertical irregularities

At the initial planning stage it is very important to design the configuration of the building resting on the hilly region. Simple configuration which gives the good result can be adopted. Therefore it is very necessary to analyse the 3D behavior of the buildings by using ETABS. There are mainly two types of building configurations on a sloping ground. They are

- Step-back building
- Step-back setback building

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DEVELOPING OF AN EQUIVALENT RECTANGULAR COLUMN FOR AN L-SHAPED RC COLUMN HAVING SIMILAR ULTIMATE LOAD MOMENT CHARACTERISTICS

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Abstract - The structural characteristics of rectangular and circular columns can be easily analysed because the axis of centre of gravity lies within the section of the columns, whereas the centroidal axis lies outside the section in case of L shaped columns. Due to this, the section characteristics of L sections vary when compared to the other type of normal sections i.e.; rectangular and circular columns. Therefore this work deals with the study and analysis of strength parameters and nature of L section with respect to the rectangular column. This is a work on L column, as there is a lack of adequate codal provisions of this type of columns. In this project the behaviour of L shaped Columns are interpreted in the form of **Interaction Diagrams**. In this work an attempt is made to obtain interaction curve for symmetrical L-shaped column and compare with that of equivalent rectangular column of different B/D ratio.

dimension and shape of column by evaluating strain at various locations within the column considered, there by evaluating stress that return provides load and moment values, such numerous values of ultimate load and moment resisting capacity could be evaluated at different locations once the set of ultimate load and moment resistance values are obtained it could be graphically represented as an **interaction diagram** where load moment envelop serves as a failure curve implying that any combination of load and moment that falls within the envelop is safe and the load-moment combination that falls on the curve as the maximum load-moment resisting capacity of the section. Therefore interaction diagrams are one of the importance factor in design of columns.

2. INTERACTION DIAGRAM

Interaction diagram shown in fig-1 is a graph illustrating the capacity of a structural concrete member to resist a range of combinations of moment and axial force. The interaction diagram of the columns is drawn with a view to determine if the maximum axial load and moment exceeds the strength of the column. By changing the location of the neutral axis, giving different size of compressive and tension zones, each case will lead to a different capacity calculated from the strain distribution. Each point on the curve show design strength values of P_u and M_u linked to a specific eccentricity of loading wherein;

P_u : ultimate load carrying capacity of concrete.

M_u : ultimate moment carrying capacity of concrete.

Key Words: Xu , Pu, Mu, NA, Interaction curve.

1. INTRODUCTION

Columns are important elements which support the structures. They are the compression members and their failure may cause damage to the whole building. A column located in the building corner. In recent days irregular shaped columns are providing at the building corners and at enclosure of elevator shafts. The column may be of the shapes rectangular, circular, square, L shaped, T (tee) shaped etc. The size and cross section of the column depends on structure, height of the building and the loads acting on the structural member. The main aim of providing column is to resist against axial compression(P) and bending moments(M_x , M_y). These load and moment develop due to external loads, such as dead load, live load, and lateral forces resulting from wind load and seismic action and by unbalanced moments at connecting beams, vertical misalignments. IS code (IS 456-2000) and design aid (SP-16) follows the strength criteria as a support for designing reinforced concrete columns wherein the failure is defined when it comes to a limiting strain and stress in concrete and the reinforcement. An interaction diagram may be plot for any column including given specifications such as grade, percentage of steel, reinforcement detailing pattern,



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STUDY OF STATIC AND DYNAMIC MODULUS OF ELASTICITY OF UHPC WITH AND WITHOUT COARSE AGGREGATES

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Abstract - Ultra high performance concrete leads to innovative aggregate rearrangements under its self-weight at initial semi-liquefied state. It allows the complete flexibility in the orientation of aggregates during mixing and placing. Aggregates play a major role in concrete mix because its general presence varies from 70% to 80%. In this research, a study has been made on mix properties of ultra-high performance concrete in the presence and absence of coarse aggregates with three different water-binder ratios. Elasticity properties of prepared mixes are evaluated at dynamic and static conditions. Comparison and co relations of these result reveals the 3% difference and it signifies the accuracy of the work. The overall study reveals that mixes with the presence of aggregates in concrete exhibits significantly improved results but workability is reduced.

Key words: Uhpc, Particle Packing Density, Static Modulus Of Elasticity and Dynamic Modulus Of Elasticity

1. INTRODUCTION

Concrete is the most consumed construction material in the world. With the advancing times and evolution of buildings, various special concretes have been developed to cater to the growing needs of the civil engineering fraternity. Ultra High Performance Concrete (UHPC) is one such material which exhibits high strength and durability properties and has been used in very significant structures like high rise buildings and nuclear power plants among others. The change from normal concrete to UHPC has resulted in less cumbersome sections and lighter structural components, resulting in lighter, more efficient and aesthetically pleasing structures.

The UHPC consists of combinations of different mineral admixtures, chemical admixtures which help in adopting low water binder ratio, fine aggregates, with or without well-graded coarse aggregates and discrete fiber reinforcement. The compressive strength of UHPC is greater than 120MPa

and tensile strength is greater than 5MPa. UHPC is not a self-compacting concrete but it shows the rheological properties namely fill ability, flow ability and segregation resistance of Self Compacting Concrete.

Modulus of Elasticity of concrete is a key property as its study will help in the better understanding of concrete as a material. Scientists have been conducting advanced research to understand the elastic behavior of concrete as an indicator for its strength and stiffness. In this paper, a study on the elastic behavior of six different mixes of concrete has been carried out.

2. MATERIALS

2.1 Cement

53 grade of ordinary Portland cement confirming to IS: 12269 – 1987. It has the specific gravity of 3.15.

2.2 Micro Silica

It is the waste product silicon metal or ferrosilicon alloy industries. It mainly consists of SiO₂ about 93.5%. The specific gravity of micro silica is 2.2. Chemical constituents are shown in Table 2.1

Table 2.1: Composition of Micro-silica

Name of the Composition	Contents
SiO ₂	93.58%
Fe ₂ O ₃	0.25%
Al ₂ O ₃	0.20%
CaO	0.38%
MgO	0.49%
Others	5.11%