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Impact of Rainfall on landslides for Nilgiri District, Tamil Nadu, India

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Landslides arc frequently occurring natural hazard in hilly regions like Nilgiris. The past historical events reveal that copious rainy days have caused landslides. Thus, in this present study, impact of rainfall on landslide occurrence has been studied during 1996-2013 form the rainfall database collected form Indian Meteorological Department(IMD) and history of past landslides from geotechnical cell Conoor. Udhagamandalm, Conoor, Kothagiri blocks receives rainfall during North East Monsoon. While Gudalur from South West Monsoon . Even though only 30% of rainy days are during North East Monsoons with an average rainfall in a single day 90 — 150mm, landslides occurrence were 100% during November(North East monsoon). This is due to high pore water pressure in the soil due to prolonged rainfall from the month of June (south West monsoon) to November. The correlation coefficient for rainfall Vs landslides during the major landslide the year 2009 reveals 0.5. showing moderate relation between them.

Key words: *Rainfall, landslide occurrence, North East South West Monsoon, correlation coefficient*

Introduction

Landslide is one of the major natural disaster happening in hilly terrain all over the world (G.P Gapanath). et.al, 2008)."The downward movements of consolidated soils and rock mass matter from any geomorphic features due to natural or manmade activity are termed as landslides" (GSI,1982, C.J Vanes *et.al*). a landslide is " the movement of mass rock, debries or earth down a slope" (Cruden D.M 1991)In India natural disaster ranked as 7th in the list of major natural disaster by number of deaths reported (OFDA/CRED,2010). Mathur (1982) estimated the annual loss of nearly US $ 1 billion for the total 89,000 km of road in the landslide prone areas of India. Himalayas, north-eastern hill ranges, Western Ghats, Nilgiri ranges of Eastern Ghats and Vindhays are recorded with landslide incidences every year during the monsoon periods (Geological survey of India.P. Rajkumar, 2001).Building Materials and Technology Promotion Council (BMTC) ,Government of India has published landslide hazard zonation atlas of India, reveals Nilgiris District of Tamil Nadu as one of the severely to very highly affected landslide prone areas of India.

Trigger means single event that finally initiates landslides. The main triggering group of factors causing landslides are slope, geology, topography, soil, hydrology, geomorphology, land use and anthropogenic factors. Earthquake and volcanoes, weather and climate (J. Corominas et.al, Crostal *et. al*, 2012). Among all hydrological parameter namely rainfall is the most common trigger (Glade 1988) of landslides. Rainfall is a variable quantity which changes with respect to both location and time (A. Akbar, 2006), the critical rainfall condition inducing landslides is not the same for different types of landslides (J.L Zezere, *et.al*, 2007, Rodrigues, 2002). Rainfall drives increase in pore water pressure within soil. This in turn causes surface run-off, infiltration, depth of the saturated soil and influence soil-moisture condition, cohesion and angle of internal friction causing slope instability. For rainfall induced landslide to occur a threshold value would indicate rainfall, soil moisture, or hydrological conditions that, when reached or exceeded, would trigger landslides (J.Corominas et.al, David J.Varnes). When hilly regions receives heavy rainfall , the water entering into the soil particles exerts high pore- water pressure due to which the soils losses its shear strength causing landslides due to slope instability (Crozier and Eyles (1980), Crozier (1999) and Glade et al. (2000)). At least 90% of landslide occurrence can be prevented once the real cause of the problem is indentified (Brabb 1993). In this paper an attempt has been made to study the correlation between rainfall and historical landslides at Nilgiris.

2. Study area:

Nilgiri district is located entirely on Western Ghats. It is geographically located between 76.14 and 77.02 east longitude and 11.10 and 11.42 north latitude (soil atlas). Nilgiris covers about 2452.50 sq km total area of which 56.6% is forest.lt consists of six thaluks and four blocks as administrative boundaries It has Figure 1 study area two major roads NH67 connecting Nagapatinam — Udhagamandalam — Gudalur. lt has minimum of 900 mts and maxinnun of 2636 meters of altitude. Landslide is frequently occurring phenomenon in this

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Studies on Bioremediation of Waste Water Containing Lead by using Biosufactant from *Pseudomonas Putida.*

RAJSHREE SONDE AND D1VYA D1VAKARAN

The biosurfactant reported in the present study was obtained from the used vegetable oil (a domestic and the restaurant waste) under technically simple batch culture using *Pseudomonas putida.* Two different oils viz-palm oil and sunflower oil were used to obtain the biosurfactant. The biosurfactant was used to study it's role in the precipitation of lead using experimentally designed waste waters with known concentration of lead, to evaluate the potential of bioremediation of waste waters polluted with heavy metals. The present study showed that the rhamnolipid obtained from used sunflower oil was more effective in precipitation of metals than the one obtained from used palm oil.

Key words : *Biosurfactant, Bioremediation, Vegetable oil, Pieudomonas pzitida*

Introduction

Metals are unique environmental and industrial pollutants in that they are neither created nor destroyed. Since our civilisation is heavily dependent on the use of heavy metals, particular attention must be paid to control the contamination caused as the result of large dispersal of metal in the land and environment. If these metals are allowed to contaminate the soil, on a long term basis they will get biomagnified and get concentrated in the food chain. Increasing accumulation of toxic metals in soil and fresh water environment present a health hazard for humans.[5]

Solidification/stabilization for heavy metals is commonly carried out for industrial hazardous waste management. Different matrices used for the fixation and removal of metals are cement for arsenic, fly ash ,lime and kiln dust for barium, cement hydration process for lead, solidification stabilization matrix for zinc.[6]

Biological methods for removal or recovery of heavy metals, radionuclides and oxyanions, have been developed during the last three decades as polishing stage in a wastewater treatment scheme. Main advantages of these methods are: environmentally friendly concerning energy and material consumption, possibility of metal recycling and recovery, reduced amount of sludge production for disposal.

Bioremediation technologies are being looked upon as a natural process for the removal of metals from soil. Biosurfactant property of microbial products are receiving increasing attention as alternative technologies for immobilisation or removal of metals from soil!

In the present investigation, *Pseudomonas putida* was used for the production of biosurfactant using used vegetable oils. The aim of this study was to investigate the role of biosurfatant in the precipitation of lead .This method can then be used in the treatment of industrial effluents ,to bring down the levels of lead considerably so that it can then bedischarged into the open water bodies.

Materials and Methods-

1) Microorganisms-Pseirdontonas *putida* was obtained from NCL and the culture was maintained on Nutrient agar slant under refrigeration condition and transferred every month.

2) lliosurfactant production medium-Production was carried out in 100 ml of the Modified Basal Salt Medium (g/1)-K211PO4-4.8, K112PO4-1.54N114)2SO4-1.0. Na3 (C611507). 21120-0.5, MgSO4.71120-0.2,Yeast extract-0.I, Trace element solution and Used vegetable oils-1%

3) Development of an inoculums-1 8 hrs old culture of *Pseudomonas putida* from Nutrient agar slant was inoculated in 100m1 of Modified Basal medium with 1% Glucose in 250 ml of Erlenmeyer flask and incubated it on shaker at room temperature for 24 hrs.

4) Production of 13iosurfactant- Production medium used was the basal salt medium with trace element solution and 1% of used vegetable oils viz- the sunflower and palm oil. 5.0 ml of 24 hrs old culture of *Pseudomonas putida* with OD adjusted to 0.1 was used as inocu·lums for the production of biosurfactant, The flasks were incubated on shaker for 72hrs. After every 24 hrs, the aliquots were removed and surface tension determined.

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Study of settling Nature of Activated Sludge of Dairy Wastewater Using Sequential Batch Reactor (SBR)

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The purpose of this study is to determine the treatability of dairy wastewater collected from Aavin milk factory at Patchapalayam in Coimbatore District of Tamil Nadu by SBR and to evaluate (Standardise) the reactor parameters such as total cycle time, temperature and aeration rate for carbonaceous constituents removal efficiency and also to examine the settling properties of activated sludge from the SBR.The results of the study indicated that the effective reduction of influent parameters (COD, BOD and TSS) were achieved more than 94% within reactive parameter 8 hr of total cycle time, 32^0 C temperature, 7.5 pH and at an aeration rate of 3 L /min. Laboratory analysis of the sludge comprised such as sludge concentration, nature of settleability, sedimentation velocity and sludge volume index (SVI). The reactor sludge settleability was good with a sludge volume index (SVI) always under 100ml / g during all the test period. Low SVI of 60 ml/g of SS was responsible for an intensive and quick sedimentation which shortened the settling phase to less than one hour. Moreover, low SVI prevented the sludge from bulking.

Key words : *Sequential batch reactor (SBR), laboratory scale- SBR, reactor parameter, sludge properties, settleability, Sludge Volume Index (SVI), interface curve, settling column .*

Introduction

Biological processes based upon suspended sequential batch reactor (SBR) are effective for organic substances removal in domestic and industrial wastewater. The sequential batch reactor (SBR) is largely used in the biological wastewater technology (Andreottola et al.,1997; Chang and Hao,1996; Metcalf and Eddy, 2003., Ra et al.,1998; Yu et al., 1997). Sequential batch reactor (SBR) is considered to be an alternative of activated sludge process (ASP), which operates in fill and draw mode for treatment of bio-degradable organic substances. It is reported that the treatment in SBR is economical than conventional continuous mode activated sludge process for removal of organic substances (EPA 1985). SBR is a periodic fill and draw type biological process in which the reaction tank is filled with wastewater for a discrete period of time known as fill time. The liquid is then allowed to undergo biochemical reaction in the presence of active micro-organisms (Bio-mass) under aerobic and/or anoxic condition in a batch mode of operation, which is known to be react time. In the subsequent phase, the mixed liquor is allowed to settle and the clarified effluent is withdrawn after a time period known as settle period (Crites and Techobanocloas, 1998). Thus, each SBR encompasses the function of all in the same vessel, where as in continuous flow system the operations are conventionally done in separate tank.

The schematic diagram with dimensions of experimental setup of the lab-scale SBR used in the study is shown in **figure 1**. The SBR was operated at a constant temperature. The study was conducted to determine the treatability and also settling nature of dairy wastewater by SBR and to evaluate the reactive parameters, such as operation cycle time, temperature and aeration rate for organic substances removal efficiency.

Operation of the wastewater treatment plant with the activated sludge is related to a number of disturbances. Especially unfavorable are the processes causing turbid effluent, foaming in the aeration tank and secondary settling tank, and excessive hydration of activated sludge (HANEL K. 1988, JENKINS D. et al.,1993). Although the problem of sludge bulking has been reported by numerous authors, its scale and arduousness call for further study.

Sludge bulking can be avoided in a sequencing batch eactor (ALBERTSON O.E. 1983, SHEKER R.E. et al., 1993). In the SBR method the fill phase is commenced without astewater aeration.

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Methods for Cyanide Removal from Wastewater : A Review

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Cyanide is a potent toxic species mostly present in industrial effluents from gold mining and metallurgical operations. The strong binding affinity of cyanide for metal ions makes it as the most favorable laxative agent for metal extraction particularly gold. The exponential growth of manufacturing and mining industries has posed a threat to the environment and human health in the form of cyanide exposure. Therefore, stringent environmental norms have been framed for the treatment of cyanide-bearing wastewaters up to a safe limit before disposal in environment. In this context, development of a feasible treatment, technology is imperative to meet the stringent norms. In this article, we have briefly discussed and presented a research trend on various available methods for removal of toxic cyanide species.

Key words: *Cyanide, toxicity, wastewater, treatment methods*

1. Introduction

Cyanide is a carbon atom triply bonded to a nitrogen atom with overall surface negative charge. Cyanide and its derivative compounds have a lot of industrial applications in mining and metallurgical operations. Cyanide presents in many forms like free cyanide (CN^-), Metal-cyanide complexes (M-CN^-), Thiocyanate (SCN^-), Cyanate (OCN^-) and Organic cyanides (Nitriles). The relative abundance and stability of different forms of cyanide depend on the pH and hence their potential toxicity also varies accordingly[1]. Among all the forms of cyanide, free cyanide is considered to be the most toxic form. Toxicity of cyanide involves suppression of cytochrome oxidase c and subsequent cellular mortality[2]. Acidification of metal-cyanide complexes also releases free cyanide.

Considering the adverse effects on environment and to safeguard the human health many international regulations have been framed to regulate the limit of free cyanide in drinking water and industrial effluents. Most agencies like World Health Organization (WHO), United States Environmental Protection Agency (USEPA) etc. have restricted the norms of 0.05 mg/L and 0.2 mg/L for drinking water and industrial effluents respectively[3,4]. According to Resource Conservation and Recovery Act (RCRA), cyanide species are placed in hazardous P-Class wastes[5]. Therefore, it's very much essential to treat the wastewater and reduce the level of cyanide to safe limit before discharging.

2. Technologies available for cyanide removal

A wide range of methods namely physical treatments, chemical methods, electrochemical oxidation, electro winning, biological removal, photocatalysis, adsorption, ion exchange resins etc. have been reported for cyanide removal from wastewater[5-7]. The advantages and disadvantages of these

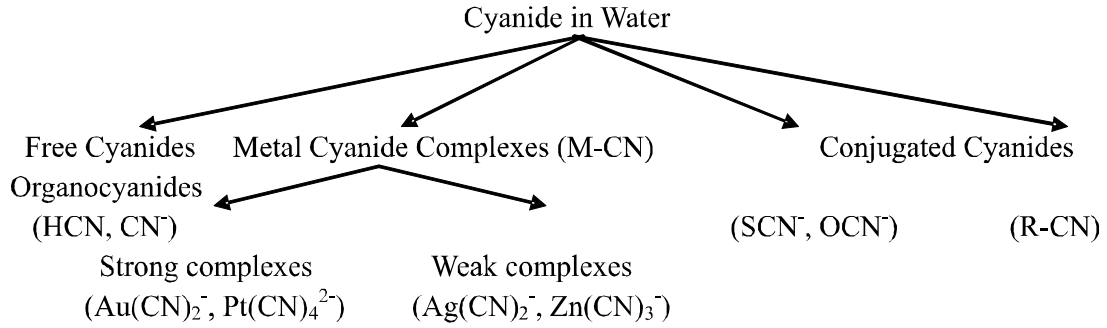

Fig 1: Forms of cyanide in water

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Effect of Industrial (Tanneries) Effluents to Certain Animals

PONNA SRINIVAS

Industrial effluents released from a tannery are studied for its effects on some animals. The effluents showed high amounts of BOD, chlorides besides total suspended solids, phenols and less amounts of COD. It also showed very high amount of arsenic compounds, mixture of dangerous chemicals and dyes. The toxic effects (mortality studies) on crab, unio, fish and frog are reported.

INTRODUCTION

The latest developments in science and technology favored the rapid industrialization in urban areas all over the world. The environmental factors are more affected by the pollution and especially the tanneries contribute to pollute the aquatic environment. The tannery wastes are ranked as the highest pollutants among all the industrial wastes (Camargo ***et al.,*** 2003). The pollution is further degraded by industries like textiles (Srinivas ***et al.,*** 1984), distilleries, coal washeries, petrochemicals, paper etc. The present paper deals with the toxic effects caused by tanneries situated in Warangal, an historic city of Kakatiya Rulers of Velangana state. The effects on aquatic animals ***ie.*** snail ***(Pilo globosa),*** mussel ***(Lamellidens marginalis),*** frog ***(Rana cyanophlyctis)*** and fish ***(Ophiocephalus punctatus)*** of unknown age are taken for study of lethal effects.

MATERIALS AND METHODS

The effluents from the outlet of the tannery are collected for every two hours continuously for 24hrs. each time a sample of 250m1 was collected in the sample bottle and kept in refrigerator. After collecting 12 samples a composite sample was taken for treatment of the animals and also for the analysis (APHA, 1998, 2005). A uniform number of 10 animals were released into two liters each of effluent in glass tubs besides a control batch with normal water. Mortality rates were counted upto 144 hrs. are presented in Table-1 as per corrected per cent mortality (Abbott, 1925).

RESULTS AND DISCUSSION

Since it is a tannery the effluents present are more. Arsenic is the common tannery chemical used in this industry. The chromium produces much solid waste such as hair, flesh and trimmings. Various chemicals, acids and dyes are found in the analyzed samples (reported else where). Tanning is a chemical process which releases 20-301it of effluent per kg of skin processes. The wastes generated from tanning generally contain much higher concentrations of total dissolved solids (TDS), suspended solids, phenols, chromium, chlorides, ammonia, lead, copper, sulphur, protein, hair, salt, lime sludge sulfides, acids besides a dangerous mixture of chemicals, acids and dyes. The effluents have relatively high pH (7.7 to 8.3), chlorides , manganese, copper, lead besides total suspended solids. The biological oxygen demand (BOD) and chemical oxygen demand (COD) are in the ratio of 2:1 which is a good indication of certain degree of pollution inherent in the effluent. The calcium and magnesium ions are high (8 milli equi/lit) implying the hardness of water (Brain, 1977).

Table 1 shows toxic effects on fish causing 100 per cent mortality in about 96hrs. followed by snail, unio in 120hrs.and frog in 144 hrs. The pollutants causing lethal effects on fish are in agreement with earlier reports that they will be affected

Table 1 : Percent Mortality Of Different Animals In Relation To Time Of Exposure To Effluents Of Tanneries

Test animals	Time in hrs.					
	24	48	72	96	120	144
Pita globosa	00	25	50	00	100	00
Unio, ***Lanzellidens marginalis***	00	25	50	00	100	00
Frog, ***Rana cyanophlyctis***	00	00	25	50	00	100
Fish, ***Ophiocephalus punctatus***	00	75	00	100	00	00

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Application of Biochar for Restoration of Mine Degraded Sites: A Review

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To fulfil the increasing demands of industries, many forests have been converted into degraded wastelands after mining. A unique challenge associated with rehabilitating mining-affected lands and how biochar can be used as a tool for mine land remediation has been discussed in this paper. Key findings from the various sources of literature based on biochar for environmental management are reviewed and primary data from several field trials of abandoned mine land reclamation through biochar application have been presented. A review on the optimum pyrolysis temperature and most importantly, the feedstock for biochar production is also reviewed. In general, the studies show that the application of biochar improves the soil pH, bulk density, cation exchange capacity (CEC), water holding capacity (WHC), microbial activity and many other properties related to it. Further, biochar is gaining increasing importance because of its cost-effectiveness and its environment friendly characters and serves as a means of carbon sequestration. Although there exists a challenge to increase its applicability the work should be continued in this field to bring the best out of it.

Key words: *Biochar, pyrolysis, feedstock, carbon sequestration, mine land reclamation*

Introduction

India has 308.8 billion tonnes of coal reserve and in the year 2015-16 it was the 3rd largest producer of coal globally (639 million tonnes MT) which meets 60% of total energy demands of the country. Out of the total coal production of 639 MT, 92.74 % are produced by opencast mines (593 MT) and 7.26 % from underground mines (46 MT). In India, majority of the new and unmined coal deposits are under forest cover; thus, complete degradation of land, destruction of forest ecosystem and fragmentation of habitat is inevitable, and the magnitude is so massive that the entire landscape has changed drastically. Fortunately, unlike other industries, mining is very temporary user of land, and proper scientific ecorestoration can restore the functioning of ecosystem and may rejuvenate the landscape. There is a growing concern to make the land useful for the community, therefore these degraded sites are being restored by afforestation and fertility is enhanced using different types of amendments. Biochar is one such amendment which not only enhances the fertility, but also increases the carbon sequestration potential of these degraded sites. Present review paper highlights on importance of feed stock, temperature and pyrolysis time. The paper sheds light on how different varieties of feedstocks can be used for biochar preparation (rice husk, bamboo, peanut shell, poultry litter, etc.). A number of laboratory and field experiments show that the mine tailing, availability of nutrients, water holding capacity, pH and electro-conductivity is improved by the application of biochar. USA, China and Australia are the leading countries where pioneer works have been done on the applicability of biochar. The underdeveloped and developing nations are also taking active interest in the field of biochar.

Biochar is a carbon(C)-rich product obtained by thermal decomposition of biomass at relatively low temperatures (<700^{O}C) and low oxygen concentration, in a process known as pyrolysis[1]. The International Biochar Initiative (IBI) was undertaken with interested parties around the world to develop a definition *viz.* biochar is a solid material obtained from thermo-chemical conversion of biomass in an oxygen-limited environment[2]. T*erra preta* soils can have carbon storage permanence in the soil for many hundreds to thousands of years[3]. Large amounts of carbon in biochar may be sequestered in the soil for long periods estimated to be hundreds to thousands of years[4-7].

A meta-analysis on the number of studies being conducted over the years shows that there has been a detrimental increase in the studies being conducted on biochar. The study gives an overview of the increase in the number of research works offering biochar applicability in coal mine degraded land from the year 2009-2017 (up to September)

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