

## TREATMENT OF PULP & PAPER INDUSTRY WASTEWATER

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### **Abstracts:-**

The objective of the study to assess the performance of the sequential batch reactor(SBR) for the aerobic biodegradation has been achieved by monitoring over a period of time. Parameters like, COD, MLSS, VSS, pH and total COD removal efficiency were considered. The influent COD was used in reactor 320,533,800,1000,1200 mg/l and removal efficiency was achieved up to 76% (maximum). The initial pH was 10.78 of influent, but it was decreased to 7.2 to safely dispose. MLSS & VSS was increased with respect to time.

**Keywords:-**Pulp & Paper Mill Effluent, SBR,COD, Aerobic Biodegradation.

**INTRODUCTION:-** The pulp and paper sector presents one of the energy intensive and highly polluting sectors within the Indian economy and is therefore of particular interest in the context of both local and global environmental discussions.

The volumes of wastewater from domestic and industrial sectors are increasing day by day. Pulp and paper industry is one agro industry that uses large amounts of water for washing, boiling. The wastewater from pulp and paper contains not only high COD concentration but also high color intensity. The quality of wastewater is generated different in each factory due to the raw materials and production processing. The wastewater treatment systems, used in the pulp and paper industry, are biological treatment process such as activated sludge system, oxidation pond,

combined system of activated sludge and oxidation pond and combined system of anaerobic pond and oxidation pond . But activated sludge system is one of selected system due to its high removal efficiency, suitable for this type of wastewater but, several problems would occur during operation such as sedimentation tank and volume of excess sludge. To solve the above problems, several researchers tried to use the sequencing batch reactor system (SBR). Then, SBR system was introduced for treating the pulp and paper industry wastewater. Ranta reported that COD removal efficiency was increased with the increasing of aeration period. The removal efficiency of the SBR system depended on the sludge age. However, by using the SBR system, color substances in the wastewater still remained. Additionally, it treatments by physical adsorption mechanism. Furthermore, activated carbon could be used together with the biological treatment processes to increase the removal efficiency and reduce HRT in biological treatment system. Rice straw, wheat straw, bagasse, gunny and jute cutting, kenaf (*hibiscus cannabinus*), sarkanda grass, a few other annual crops and grasses are proved suitable as raw materials for the manufacture of normal grades of paper and paper boards. Some of the small paper mills have been using these raw materials in a substant always and the upcoming small paper mills are also based on the use of agriculture residues and waste paper.

Pulp making in small paper mills involves chemical, chemo-mechanical and/or hydro pulping. Mills employing agriculture residues *Environmental impact:-*

The pulp and paper industry is a chemical process industry with major impact on the environment. The potential pollutants from a pulp and paper mill can be classified into four categories: *Liquid effluents, Air pollutants, Solid wastes and Noise pollution*

The environmental problems faced by large and small paper mills are entirely different. Pollution control is more difficult for small and medium size agro-based units. Chemical recovery in these units is not economically viable and therefore black liquor and lime sludge are not being burned for heat recovery. It is estimated that a 30 TPD small paper mill 10 can be almost three times as polluting as an integrated paper mill of 200 TPD.

**Sequencing batch reactor (SBR):-**

The Sequencing Batch Reactor (SBR) is a biological wastewater treatment process developed by the founders of SBR Technologies, Inc. The SBR is a time-oriented system where each tank is Filled for a discrete period of time and then operated as a batch reactor. Optimization of aeration and mixing strategies will lead to increased removal of carbon, nitrogen, phosphorus, and target organic compounds from industrial wastewaters. Since the SBR is a batch operation, it has significantly more flexibility than conventional systems allowing for more variances in the effluent levels. Given its structural simplicity, existing continuous-flow systems can be retrofitted to operate in batch.

mainly adopt alkali pulping and a few use chemo-mechanical pulping while those using waste paper or purchased pulp employ hydro-pulping process.

**Influent Characteristics (before treatment):-**

PARAMETERS	VALUE
<b>pH</b>	<b>10.78</b>
<b>COD</b>	<b>1,60,000 mg/l</b>
<b>MLSS</b>	<b>14,240 mg/l</b>
<b>VSS</b>	<b>10,348 mg/l</b>

**MATERIALS & METHOD:-**

**Pulp and paper industry wastewater:-** Agro based Pulp and paper industries waste water used for study which is situated in Sitapur near By Lucknow, Uttar Pradesh, India.

**Sequencing Batch Reactor (SBR) Setup:**

The experiment was conducted in lab scale SBR reactor. A column- type SBR 10cm dia and 70 cm height with a working volume of 5.50 liter was used as shown in **Figure**. the rector had a volume of 5.5L .effluent was drawn 35 cm from the bottom at a volumetric exchange ratio of 50%. The reactor was kept open so that a natural mixed population could develop. Two fine bubble aerator in the bottom of the column introduced air.

The reactor was seeded with 1 liter aerobic digested sludge; the sludge had a volatile suspended solids (VSS) content of 1600 mg/l. Reactors were operated sequentially in 24-hr

cycles. The experiments were performed at room temperature.

There were three sampling ports arranged along the height of the column type reactor, one at bottom of the reactor, second one is 17.5 cm, and third was at half of the reactor (35 cm). The effluent was collected and withdrawn from the port, which was at 35 cm height. The 17.5 cm height port was used for collection MLSS and periodical sludge wasting.



#### ***Feed composition:-***

Black liquor is used as a feed which is taken from the a Pulp & Paper mill, First feed is seeded with the influent COD 320 mg/l after dilution factor of

#### ***Acclimation period:-***

Batch studies were conducted to acclimatize the seed sludge to COD. Bacteria are required be adapted to the COD. During acclimatization process certain enzymes in the bacteria are induced so that they are available for taking part in the metabolism reaction. This is much more

500 times, because the COD of raw waste(Black Liquor) was 1,60,000 mg/l so it was feeded after dilution. The cod concentration is increased gradually 320 mg/l to 533, 800, 1000, 1200 mg/l.

#### ***Experimental set-up:-***

The reactor was operated with a cycle length of 24 hr. Aeration was on during influent adding and was off during effluent withdrawal and settling.

#### ***Analytical method:-***

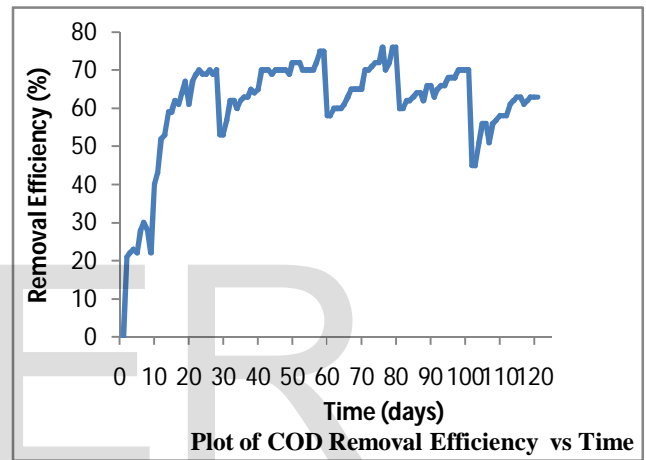
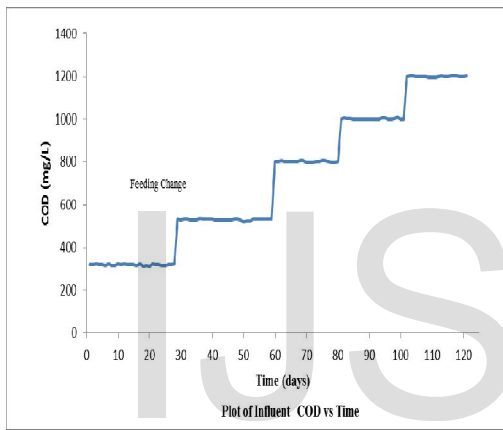
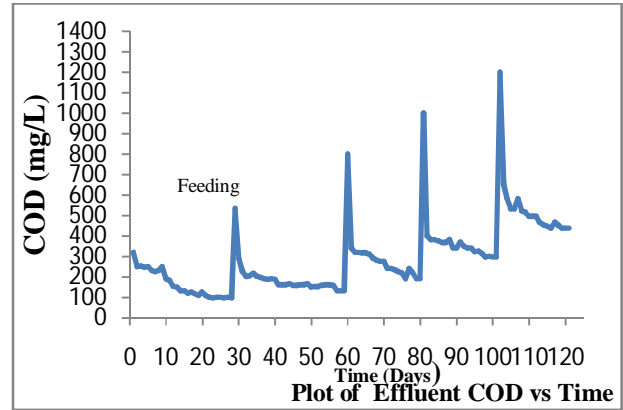
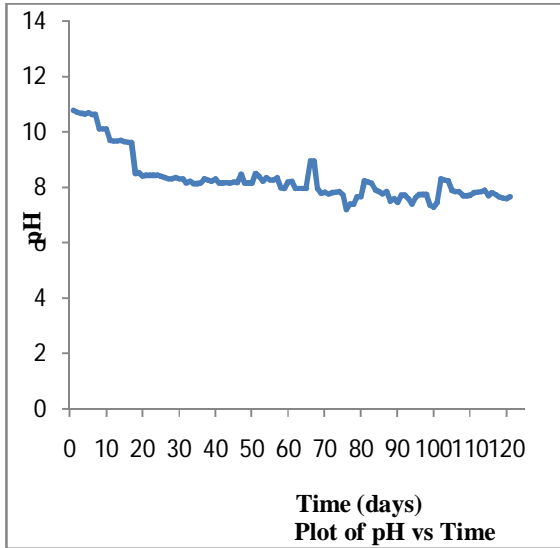
Waste water sample in the reactor were periodically analysed for pH, COD Concentration, MLSS, and VSS pH was measured by pH meter and COD of the wastewater sample from reactors was measured daily using standard methods (Close –reflux method)-Standard Methods 2005.

#### **RESULT AND DISCUSSION:-**

##### ***General:-***

The present study deals with the aerobic treatment of paper mill waste water. The study was carried out in a laboratory scale sequential batch reactor. The reactor was seeded with digested sludge obtained from Sitapur paper mill, sitapur-lucknow. Initially the sludge was acclimatized in batch studies. The COD concentration was increased gradually from 320 mg/l 533, 800, 1000; 1200 mg/l after 65 to 76 % of COD removal efficiency was reached in each stage.

important when dealing with toxic compounds. In order to establish a viable biomass and minimize any potential toxic effects due to the presence of the organic and in-organic compounds,



**DISCUSSION:-**

In this study the different assays performed in the sequential batch reactor under operating conditions demonstrate that high treatment efficiency can be achieved for the treatment of high strength organic compound in wastewater. Acclimatization of the study is the prerequisite for the proper functioning of the reactor.

- The COD removal efficiency is increasing with time. But after 65-76% it is not increasing, in paper mill waste water some organic compounds are very toxic and they do not degrade easily.
- MLSS & VSS is increasing with respect to time.

- pH was 10.78 of influent, but it was decreased to 7.2, so we can dispose safely in water streams or surface water.

**CONCLUSION:-**

The SBR process is a flexible and high-performance treatment technology for wastewater treatment, especially for the pulp and paper mill wastewater. During the 4-month studies, the stable performance of SBR was achieved. The effluent quality and treatment capacity were significantly improved after the adjustment according to the results of lab-scale experiments. Under the optimal condition of MLSS concentration at 4300 mg/L, at 1393 minute,

aeration time for 24 h per cycle, the high performance of SBR process with healthy SVI level was presented. The effluent quality remained stable and satisfied with the discharge standard (COD < 100 mg/l). In addition, no filamentous sludge bulking occurred during the 4-month study. This study provided some beneficial references for the effective treatment of paper making wastewater under the relatively high organic loading.

The results indicated that the SBR system could be adopted to treat pulp & paper mill wastewater. The SBR system had several benefits over the conventional activated sludge process for the treatment of the pulp & paper mill wastewater. It had a high organic loading rate, a much lower sludge yield, and a better sludge settling than those often occurred in activated sludge systems for pulp mill wastewater.

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