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# A Study on Determination of Physio-Chemical Characteristics of Effluents

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***Abstract – Physico-synthetic parameters of the effluents from paper and mash industry had been examined. In this examination physico-substance parameters, for example, shading, smell, temperature, thickness, surface strain, consistency, alkalinity, acridity, chloride, hardness, absolute broke down solids, all out suspended strong, pH, conductance, sulfate, COD, BOD, had been dissected of the profluent gathered from the business ofpper and mash. Sodium and potassium components were broke down fire photometrically.***

***Key Words: Pulp and Paper Industries, Physico-Chemical Parameters, COD, BOD***

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## INTRODUCTION

Our Earth is unique among the other known celestial bodies, because it has water, which covers three-fourth of its surface and constitutes 60-70 % of the living world. But, only 1% of the world's water is usable to us. About 97% is salty sea water, and 2% is frozen in glaciers and polar ice caps. Hence open new water represents under 1%. 1% of the world's water supply is a valuable item important for our survival.Society uses water to generate and sustain economic growth and prosperity, through activities such as farming, commercial fishing, energy production, manufacturing, transport and tourism. Various form of water reservoir i.e., rivers, lakes, coastal and groundwater are available. These resources are valuable, and need to be protected.

Industries that consume large quantities of water include everything from textiles and garments to petroleum refining to automotive production, with agriculture and power-generation responsible for an estimated 90 percent of direct water withdrawals. Another industrial sector pulp and paper is especially vulnerable to pollution risks given its heavy reliance on water.

The paper industry holds a significant offer among the assembling segments. The sexual headings together are to balanced and female with the two posts of an elliptic field of attracting powers. The association between's the two shafts gives the creative power; no one post, male if female, can achieve anything without the dedication of the other.Raw materials, energy, chemical, labor and water are the major inputs for the production of paper. Raw material and energy constitute about 50-60% of the total cost of production and these are the major variables affecting the cost of production. The pulp and paper industry is water-intensive because water is needed in just about all the processes that are used. Such processes include digesting wood chips to form pulp, washing and bleaching the material to achieve whiteness, and generating steam as a means to dry the paper and a substantial volume of effluent is created as a result.(1)

The serious issue looked by mash and paper part is to discard the huge volume of waste water. This waste water is wealthy in disintegrated solids, for example, chlorides and sulfates of sodium and calcium and changing measures of suspended natural materials. Notwithstanding these constituents, effluents likewise contain some follow metals like mercury, lead and chromium and so on. The effluents are commonly soluble in response with high synthetic and organic oxygen requests. In this manner, the effluents release into the water frameworks make the water unfit for water system and consumable use and make wellbeing dangers (Kumar *et al.,* 2014)

## WASTE WATER TREATMENT

### Primary Treatment

This may comprise of balance, screening, sedimentation, and flotation/hydro-cycloning to evacuate suspended solids. Numerous mill work

essential clarifiers that can evacuate up to 95% of settleable solids in the process profluent.

**Secondary Treatment**

This stage essentially diminishes the natural substance and poisonous quality of the emanating because of dynamic biodegradation by microorganisms (i.e., bacteria, protozoans) living in the treatment plant and utilizing the profluent as a source of food (carbon). The most regularly utilized organic treatment frameworks in the pulp and paper industry are Aerated Stabilization Basins (ASB) and Activated Sludge Treatment (AST). A key component of these frameworks is air circulation by surface or submerged aerators, and the expansion of supplements (nitrogen, phosphorus) to keep up a sound populace of microorganisms. ASB and AST frameworks ordinarily lessen BOD5 by over 80% and COD by 50% to 90%.

**Aerobic Treatment**

Aerobic microorganisms expect$O_2$ to help their metabolicaction. Oxygen(O2) is provided as air by air circulation gear. There are various of high-impact frameworks accessible for corruption of oxygen requesting natural mixes in mechanical wastewater; circulated air through tidal ponds, enacted ooze frameworks, biofilm forms and so on (… ..).

**Aerated Lagoon**

A kind of organic process frequently utilized for pulp and paper effluents is the circulated air through tidal pond, which is an enormous, shallow (≈4m) lake where wastewater is dealt with organically with active microorganisms and mechanical air circulation. The circulated air through tidal pond is very space devouring in light of the way that it is dimension given for a 5-7 days residence time and expends a ton of vitality for air circulation. In any case, it is anything but difficult to work and keep up, and the stun load limit is high. As of late some circulated air through tidal ponds have been changed over into LAS-facilitates which are long haul circulated air through actuated pulp treatment for plants around a day as a habitation time. Portions of the old circulated air through tidal pond then it have been used in the air circulation and different partsutilized for temperature adjustment and hot wastewater cooling effluents. The circulated air through tidal pond will principally expel BOD yet can likewise diminish discharges of AOX somewhat. The evacuation effectiveness is reliant on living arrangement time, pH and temperature, measure of slime and level of air circulation. (… .).

**Tertiary and Advanced Treatment**

This includes compound precipitation to evacuate certain synthetic substances, diminish poisonous quality, suspended solids, and shading.

**Adsorption**

It is an adhesion process in which one molecular species deposited over another molecule. The molecular species which is adsorbed are adsorbate and the surface where it occurred is an adsorbent.

**Coaggulation/Flocculation**

The process by which the sedimentation of tiny suspended solids in a solution is done by adding some chemicals is called coagulation. In coagulation there is a neutralization of charge but flocullation is a physical process and no charge neutralization takes place. The most common coagulant is Alum.

**Electrocoagulation**

It's the method in which the electricity is passed to precipitate the dissolved and suspended solid. The electrocoagulation's percentage removal for TSS, BOD and bacteria is more efficient than chemical coagulation and sedimentation.

**Photocatalysis**

Photocatalysis, an improvement oxidation process, is a huge alternative since it can cause the supreme mineralization of a wide degree of organics with no perilous natural effect3. Precisely when a photon of light strikes the motivation surface, an electron is raised from the valence band to the conduction band (… ..).

**Chemical Oxidation**

Basically oxidation is the loss of electron. The main reason for chemical oxidation is to degrade the organic/inorganic pollutants and make it easy for biological degradation process. It involves addition or generation of oxidant (ozone, H2O2, Cl2O2, Cl2, O2, hydroxyl radical etc).

**Biological Approach by using Fungi and Bacteria**

Microorganisms with lignolytic properties can break down contaminants in squash and paper gathering plant effluents containing ruinous and resolute blends (..). Lignolytic microorganisms fuse parasites, actinomycetes, yeast, infinitesimal life forms, and green development, all of which can convey mixes responsible for lignocellulose debasement (..).Enzymatic treatment can be connected as a singular improvement or with other physical and compound systems5.

**Phytoremediation**

It is the technique in which we use living plant to degrade or remove contaminants of soil, water and air. It is an economical and solar energy dependent

technique. We only need to focus on the factors on which different plant can give us optimum results.

**Effect of Treated Effluent on Germination**

Starting late, broad thought has been paid to mechanical wastes which are all around discharged on strong land or into wellsprings of water. It is anticipated that the bleeding edge activities will vitalize with the pace of advancement. This would have foreboding impact on cultivating and would cause essential contamination. Then again, colossal extent of wastewater made from squash and paper adventures has a basic task to finish as for insufficiency of new water assets for submerging agribusiness land.6

The paper business is maybe the greatest business in India, exhausting tremendous proportion of water (… ). Just about 75 to 95% of the water was discharged by the organizations as radiating containing common, inorganic poisons and concealing materials. Closeness of these engineered mixes may impact soil and consequently the advancement and improvement of plants (… ). Spotlights on the impact of paper mechanical office profluent on different harvests have been done by different bosses (… .).

## MATERIAL AND METHODS

**Sample collection:**

The samples were collected from Pulp and Paper Board Industry. The collected sampleswere stored in sterilized plastic containers of 20 lt capacity.

**Estimation of Physicochemical Characteristics of effluent**

The various parameters (pH, temperature, Odor, Total suspended solids (TSS), total dissolved solids(TDS), Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Dissolved oxygen (DO)were dissected by utilizing standard convention referenced in standard technique of APHA (1998).10

**Measurement of pH**

pH meter was calibrated by using standard buffer solutions. After calibration the 100ml of sample was poured in the beaker. pH was estimated by dipping the electrode inside the sample and the meter readings were recorded. The electrode was washed with distilled water and wiped with filter paper.

**Measurement of Chemical Oxygen Demand (COD)**

(i) The collected COD tubes were washed using distilled water and dried in hot air oven prior to use.

(ii) The COD digester was adjusted to 150°C.

(iii) The tubes were arranged in COD stand and labeled accordingly.

(iv) 0.4 g of $HgSO_4$ was added to each tube followed by the addition 10 ml of $K_2Cr_2O_7$.

(v) 20 ml sample were added in all the sample tubes after rinsing the pipette with the same sample.

(vi) 30 ml of $H_2SO_4$ was added in all the COD tubes slowly followed by placing the condenser.

The COD tubes were kept in digester adjusted at 150°C for 2hr.

**Measurement of Total Dissolved Solids (TS)**

(i) Empty gooch crucible was taken, cleaned with distilled water, dried and weighed.

(ii) The weight was recorded for further calculations.

(iii) The collected sample was filtered through filter paper.

(iv) The remaining filtrate collected in the crucible was evaporated until constant weight was obtained.

(v) The crucible was again weighed and the difference was noted.

*Calculation:*

TDS (mg/l) = [(A-B) x 100] /S

*Where*,

A = Weight of the dried residue + dish (mg) and

B = Weight of the dish (mg)

S =Volume of Sample (ml)

**Measurement of Biochemical Oxygen Demand**

*Procedure:* Single distilled water was kept for aeration for 20-25 h. Following chemicals (0.1%) were added in the aerated DW in the given order:

a. Phosphate buffer

b. $MgSO_4$

c. $CaCl_2$

d. $FeCl_3$

e. Sewage

Samples were appropriately prepared depending on their COD values, using distilledwater. BOD bottles were rinsed with appropriate samples and filled up to the brim. The bottles to be used for the estimation of Dissolved oxygen (DO) of zero days were kept aside, while the rest of the bottles were incubated at 20°C for the 5 days in dark in a BOD incubator.

***Determination of initial DO:***

Fixation of the BOD bottles was done by adding 2.0 ml of $MnSO_4$ followed by 2.0 ml of alkali azide to the BOD bottles. Bottles were shaken and precipitates were allowed to settle down for 20 to 30 min. Then, 2.0 ml of $H_2SO_4$ was added bottles were shaken properly.100 ml of this reaction mixture was transferred to Erlenmeyer flask and titrated against freshly prepared 0.0125N hypo solution using starch as an indicator.

DO of the BOD bottles, which were incubated for 5 days for 20°C was measured again in the similar manner as mentioned above

*Standardization of Hypo:*

To 90 ml of TDW, 10 ml of $KIO_3$ was added followed by $H_2SO_4$. This was immediately titrated against 0.0125N hypo solution after the addition of 0.5 g KI using starch as an indicator. End point to be observed was blue to colorless.

*Calculation:*

$$\text{BOD mg/L} = (D_1\text{-}D_3)\text{-}(B_1\text{-}B_3)/\%\text{ of sample used}$$

*Where,*

$D_1$= DO of the dilute sample immediately after preparation (mg/l)

$D_3$ = DO of diluted sample after the incubation for 5 days (mg/l)

$B_1$ = DO of the blank immediately after preparation (mg/l)

$B_3$ = DO of blank after incubation for 5 days.

## RESULTS

**Physicochemical properties of untreated effluent from Pulp and Paper Industry**

The effluent was analyzed for various physiochemical parameters (total dissolved solids, chemical oxygen demand, biochemical oxygen demand, pH, temperature. The procedure was followed as mentioned in Standard Methods (APHA, 1998). The samples were collected from pulp and paper industry. The analysis shows that the range of pH was in between 6.5-7.0. Temperature of wastewater collected was measured at the time of collection it was observed that the samples temperatures varied between 32°C – 40°C. The biochemical oxygen demand and chemical oxygen demand are the primary indicators of pollution. The estimation shows that the range for chemical oxygen demand was 300 mg/l – 400 mg/l on the other side the biochemical chemical oxygen demand shows the variation in the range of 60 – 70 mg/l. Total dissolved was analyzed and the values shows the range in between 2000 – 2500 mg/l. Whereas the suspended solids shows the values in the range of 400 – 600 mg/l. All the parameters estimated showed that the values were towards the higher side.

**Table: Physicochemical Properties of Untreated Effluent**

| S. No. | Parameters | Results |
|---|---|---|
| 1 | pH | 6.5 – 7.0 |
| 2 | Temperature | 32°C – 40°C |
| 3 | Odour | Obnoxious odour |
| 4 | Total Dissolved Solids (TDS) | 2000 – 2500 mg/l |
| 5 | Total Suspended Solids (TSS) | 320 – 560 mg/l |
| 6 | Chemical Oxygen Demand (COD) | 300 – 400 mg/l |
| 7 | Biochemical oxygen demand | 60 – 70 mg/l |
| 8 | Dissolved oxygen | 2.5 – 3.5 |

Note: Results are the average of triplicates

All the values except pH and temperature are in mg/l

## CONCLUSION

In end it very well may be expressed that the diverse considered physico-substance parameters, for example, pH, temperature, Odor, TDS, TSS, COD, BOD and DO so forth are inside as far as possible. The present examination has driven us to infer that the nature of water tests exposed to study was adequate from greater part of physico-substance parameters while according to bacteriological benchmarks; the water should be treated before utilizing it in residential applications. In this way to the extent test water is concerned the potential danger of getting contaminated by water borne ailments is consistently there whenever utilized without appropriate sterilizations.

## REFERENCES

1. Yi-Hsuan Chi, Tso-Fu Mark Chang 2,*, Chun-Yi Chen 2,*, Masato Sone, and Yung-Jung Hsu (2019). Mechanistic Insights into Photo degradation of Organic Dyes Using Hetero structure Photo catalysts. Catalysts, 9, 430; pp. 1-32. 2.

2. Nancy A. ElNaker, Ahmed F. Yousef, and Shadi W. Hasan (2018). Effect of hydraulic retention time on microbial community structure in wastewater treatment electro-bioreactors. Microbiology open. 2018 Aug; 7(4): pp. e00590.

3. Parveen Kumar, Satish Kumar, Nishi K. Bhardwaj + and Ashutosh Kumar Choudhary (2014). Advanced Oxidation of Pulp and Paper Industry Effluent. International Conference on Environmental and Agriculture Engineering, pp. 170-178.

4. Grijspeerdt, K., Bogaert, H., and Verstraete, W. (1996). "Design and verification of a model secondary clarifier for activated sludge," J. Chem. Technol. Biotech. 67(4), pp. 404-412.

5. Sevimli M.F. (2005). Post-treatment of pulp and paper industry wastewater by advanced oxidation processes. Ozone: Science and Engineering 27: pp. 37-43.

6. Singh P., Jain P., Verma R., Jagadish R.S. (2016). Characterization of lignin peroxidase from Paecilomyces species for decolorisation of pulp and paper mill effluent. J of Scientific and industrial research 75: pp. 500-505

7. Hubbe, M. A., Metts, J. R., Hermosilla, D., Blanco, M. A., Yerushalmi, L., Haghighat, F., Lindholm-Lehto, P., Khodaparast, Z., Kamali, M., and Elliott, A. (2016). "Wastewater treatment and reclamation: A review of pulp and paper industry practices and opportunities," BioRes. 11(3), pp. 7953-8091.

8. Kismat Diru, 2Ambika Thakur (2018). ANALYSIS OF PULP AND PAPER INDUSTRIAL EFFLUENT AND ITS TREATMENT A REVIEW. International Journal of Creative Research Thoughts, Vol. 6 (2) pp. 1452-1454.

9. Kismat Diru, 2Ambika Thakur (2018). ANALYSIS OF PULP AND PAPER INDUSTRIAL EFFLUENT AND ITS TREATMENT A REVIEW. International Journal of Creative Research Thoughts, Vol. 6 (2) pp. 1452-1454.

10. Apha, Awwa (1998). "Wef." Standard methods for the examination of water and wastewater 21: pp. 1378.

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