International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 05 | May 2021 www.irjet.net p-ISSN: 2395-0072

QUALITY IMPROVEMENT OF INDUSTRIAL EFFLUENTS BY FRUIT PEELS

CHRISTEENA JOMON[1], ANJALI[2]

[1]P G student, Department of Civil Engineering, Malabar College of Engineering and Technology, Desamangalam, Thrissur, Kerala, India
[2]Assistant Professor, Department of Civil Engineering, Malabar College of Engineering and Technology, Desamangalam, Thrissur, Kerala, India

---

Abstract - *Rapid industrialization has resulted in the contamination due to toxic pollutants, which is a challenging problem for environment. Techniques used to remove these are namely physical, chemical and biological treatments. Biosorption is a recent eco friendly biologic technique which is gained importance in this decade. Peels which are the discarded fruits wastes that are readily available were used to prepare Biosorbents for the adsorption of impurities from the solution. The fruit peels were washed, dried and ground to fine powder, before being used for the treatment. In this project, Biosorbents such as orange peel powder, banana peel powder, coconut husk powder and arecanut husk powder were used in 2,6 and 10 g/l dosages for the removal of pollutants from the plywood industrial waste water samples. The samples were further analysed after the treatment process to study the changes in the water quality. Various tests were conducted and finally results were compared.*

Key Words: Biosorption, adsorption, plywood

1. INTRODUCTION

India is a developing country with an increasing population density. In order to develop its economy, India requires establishment of new industries. Due to unplanned industrial growth, much of the land and nearby water bodies is polluted by indiscriminate dumping of solid and liquid wastes generated by these units. The effluent from industries affects the surface water and ground water bodies adversely.

Over the last century, continued population growth and industrialization have resulted in the degradation of various ecosystems on which human life relies on .In the case of ocean and river quality, such pollution is primarily caused by the discharge of inadequately treated industrial and municipal wastewater. On initial discharge, these wastewaters can obtain high levels of inorganic pollutants which can be easily biodegradable, but whose impact load on the ecosystems, either in Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), or Chemical Oxygen Demand (COD), may be in the tens or thousands mg/L.

1.1 Objective of the study

To analyse the presence of chemicals present in the selected industrial waste water samples, To reduce the impact of industrial effluents using orange peel, banana peel, coconut husk & areca nut husk, To improve the quality of the released effluents to river discharge standards and propose to dispose them safely to inland water bodies,To analyse the effect of fruit peels on the various parameters of the selected industrial effluent.

1.2 Scope of study

Replace the chemical coagulants with natural materials for industrial waste water treatment, To propose an environmental friendly and cost effective treatment technique for reducing impact of industrial effluent on environment.

2. MATERIALS AND METHODS

3.2.1 Banana Peels

Out of the wide range,banana peel seems to be good adsorbents and can be used as valuable material. Also they have the property of absorbing materials like iron and arsenic etc. Fresh banana peels were collected from domestic wastes. Banana peels contains lipids (1.7%),proteins (0.9%), crude fiber (31%) and carbohydrates (59%). The various minerals present are potassium(78.10mg/g), manganese (76.20 mg/g), sodium (24.30mg/g), calcium (19.20mg/g) and iron (0.61 mg/g). Banana peels were collected and washed several times with tap water. The washed material was dried under sunlight till it turned blackish brown in colour.

3.2.2 Orange Peels

Orange peel acts as a natural adsorbent. They have a property to adsorb toxic metals like chromium. Orange peels contain moisture (40.7%), fat (1.85%), pectin (7%), lignin (6.4%), crude fibre (7.8%), total sugar (14.08%), reducing sugars (10.70%) and non reducing sugar (3.70%). Orange peels were collected washed several times with tap water. The washed material was dried under sunlight till it turned dry and hard.

3.2.3 Coconut Husk

Coconut husk peels are easily available as bio waste from food processing industries and they are biodegradable. Coconut husks can also removed a range of dissolved water pollutants through the adsorption process. Coconut husk has high amount of lignin and cellulose and that is why it has a high calorific value of 18.62 MJ/kg.The chemical composition of coconut husks consists of lignin (45.84%), cellulose

(43.44%), Hemi-cellulose(00.25%), Pectins and related compound (03.00%).

3.2.4 Arecanut Husk

Arecanut husks are effective as biomaterials to remove toxic metal ions and organic pollutants from water. It consists of moisture (5.5 – 14.3%), Total water extractives (19.6 – 72.4%), Polyphenols (7.3 – 55.2%), Arecolins(0.1 – 0.9%), fat (3.7- 24.4%),crude fibre (3.1 – 18.5%). Arecanut husks were properly washed and the peel was separated out into thin fibres. It was allowed to dry in hot sun till all the moisture content in them evapourated and turned hard. It was then ground into powdered form.

3.3 PRELIMINARY TESTS

An initial tests was conducted inorder to analyse the chemicals present in the industrial effluents. Various tests like physical, chemical, organic tests were conducted and finally results were compared.

3.3.1 Physical Tests

Physical characteristics of water (temperature, colour, taste, odour, turbidity, TSS) are determined by senses of touch, sight, smell and taste.

3.3.1.1 Temperature

Temperature may be measured with a caliberated thermometer.

3.3.1.2 Turbidity

Turbidity is the measure of resistance of water to the passage of light through it. Turbidity is caused in natural waters by finally divided suspended particles of clay, silt,salt sand or some organic materials. Standard unit for turbidity is that turbidity which is produced by mixing 1mg of finely divided silica(Sio2) in distilled water. The sample is checked for turbidity with a help of a turbidometre

3.3.1.3 Colour

The colour of the sample can be checked by our naked eye. Colour is due to the presence of colloidal and dissolved solids of certain organic and inorganics. The colour of water is expressed in hazen units which are the same as platinum cobalt scale.

3.3.1.4 Total Suspended Solids

Total suspended solids(TSS) gives a measure of the turbidity of the water. Suspended solids cause the water to be milky or muddy looking due to the lights scattering from very small particles in the water. Polluted waters are commonly turbid and improvement is usually marked by grater clarity. The quantity of suspended solids is determined by filtering the sample through a fine filter and thus weighing the residue left.

3.3.2 Chemical Tests

Chemical tests were conducted to analyse the chemical parameters of water such as total hardness, chlorides, alkalinity and residual chlorine.

3.3.2.1 Total Hardness

Hardness of water is that characteristics which prevents the formation of sufficient foam. The hardness is usually caused by the presence of calcium, magnesium present in water which form scum by reaction with flock. Hard water is undesirable because they lead to great soap consumption.Their are two types of hardness, temperory or carbonate and permanent or non carbonate hardness. Carbonate hardness is caused by divalent metallic ions principally of calcium and magnesium while sulphates, chlorides and nitrates cause non carbonate hardness. Hardness is determined by EDTA method in which water sample is treated against EDTA or its sodium salt until wine red changes to blue. Erichrome black T is used as the indicator.

3.3.2.2 Chlorides

Chlorides are present in combination with NaCl and to less with Ca and Mg. They are most stable compounds. Reasonable amounts of chlorides are not harmful though they cause a threat if the concentration surpasses 250mg/l. The presence of chloride may also be due to mixing of sewage or saline water. Chlorides are determined by titrating water with silver nitrate and potassium dichromate. This method is Mohrs method

3.3.2.3 Alkalinity

Alkalinity of water is a measure of its capacity to neutralize as its. The alkalinity of natural water is primarily due to the salts of weak acids, although weak bases or strong bses may also contribute. Bicarbonates represent the major of alkalinity, since they are formed in considerable amounts from the actions of carbondioxide upon basic materials in the soil.

3.3.2.4 Ph

The Ph value of the water sample is nothing but the logrithum of the reciprocal of hydrogen ions activity present in moles per litre. For neutral sample, it is generally found to be around seven. If it is less than seven the sample is considered to be acidic and for the opposite case, it is taken as basic. For general water, Ph ranges between 6.5 to 8.5

3.3.2.5 Residual chlorine

Residual chlorine is the amount of chlorine that remains in the water after a certain period or contact time. Concentrated levels of chlorine kill fish and other aquatic life forms. Chlorine is an oxidizer, which removes the necessary slime coat and other pond fish, causing stress and stress related illnesses. Chlorine damages the gill structure in koi and other pond fish, causing serious long term issues and making it difficult for the fish to breath. As the pond ph level go down, chlorine become more toxic. The presence of phenols, a toxic organic chemical found in some type of organic wastes can combine with chlorine to become extremly toxic.

3.3.3 Organic Tests

Organic tests is done to analyse the amount of organic compounds present in the water sample.The organic tests conducted are BOD, COD and ammonia.

3.3.3.1 Biochemical oxygen demand

Biochemical oxygen demand (BOD) is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. The term also refers to a chemical procedure for determining this amount. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20 degree Celsius and is often used as a robust surrogate of the degree of organic pollution of water.

3.3.3.2 Chemical Oxygen Demand

Chemical oxygen demand or COD is a measurement of the oxygen required to oxidize soluble and particulate organic matter in water. The chemical oxygen demand tests procedure is based on the chemical decomposition of organic and inorganic contaminants, dissolved or suspended in water. The result of a chemical oxygen demand tests indicates the amount of water dissolved oxygen (expressed as part per million or milligrams per litre of water) consumed by the contaminants, during 2 hours of decomposition from a solution of boiling potassium dichromate. COD is an important water quality parameters because, similar to BOD it provides an index to access the affect discharged waste water will have on the receiving environment. Higher COD levels mean a greater amount of oxidizable organic material in the sample , which will reduce dissolved oxygen(DO) levels. A reduction in DO can lead to an aerobic conditions which is deleterious to higher aquatic life forms. The COD tests is often used as an alternate to BOD due to shorter length of testing time.

3.3.3.3 Ammonia

Ammonia is a common naturally occurring substance. It is also manufactured by man. At normal environmental conditions pure ammonia is acolourless pungent smelling, caustic (corrosive) gas. It is highly soluble in water and reacts with acids to form ammonium salts. Exposure to high concentration of ammonia in air causes immediate burning of nose, throat and respiratory tract. The main local problem of ammonia released into air is the unpleaseant odour, which is detectable even at low concentrations at particularly high concentrations it can also harm vegetation.

Table – 1 General Discharge Standards according to CPCB

Parameter for inlet effluent quality of CPCB	Discharge Standards
pH	5.5 – 9.0
Colour	To be removed max. as possible
Total Suspended Solids mg/l, max	100
Temperature	45
Residual chlorine,mg/l	1
Biochemical Oxygen Demand,mg/l	30
Chemical Oxygen Demand,mg/l	250

3. CONCLUSIONS

In the present study experiments have been conducted to find out the efficiency of natural adsorbents like orange peel, banana peel, coconut husk and are canut husk in the removal of pollutants from industrial water. The efficiency was found out by conducting certain experiments on the samples collected from plywood industry. Parameters like pH, TSS, colour, temperature, hardness, residual chlorine, alkalinity, BOD,COD and ammonia tested. These parameters were tested both before and after the treatment with biosorbents and were analysed and compared with general discharge standards according to the CPCB. It was found that certain parameters which showed values beyond the limit of discharging before treatment were reduced and fall within the limit after treatment.

When the samples were tested with orange peel a tremendous decrease in the hardness with the increase in dosage of the peel powder was noted. Parameters like BOD, COD, residual chlorine, chloride and chromium were found to fall within the discharge limits with increase in dosage. But as the dosage of orange peels was increased a tremendous fall in the pH was observed. As the amount of orange peel was increased the samples turned acidic. It is more effective to treat the samples with dosage of 2g per litre as the samples remain less acidic and TSS is low. Other parametres fall within the discharge standards.

When the samples were treated with coconut husk it was observed that the amount of TSS is slightly lower. The acidicity of the sample is reduced by raising the pH of the sample. Parameters like BOD, COD, ammonium were reduced.Alkalinity was found to be increased. When samples were tested with arecanut husk, there was a good decrease in hardness, chromium content, BOD, COD, residual chlorine. Arecanut is good absorbents and amount of TSS was comparatively lower.

REFERENCES

[1] Jwan A.Abdul Sattar(2013) "Toxic Metal Pollution Abatement Using Sour Orange Biomass".,Journal of Al-Nahrain University

[2] Annadurai, G.,Juang R.S(2013)."Adsorption of heavy metals from water using banana peels and orange peels".Water Science and Technology,47(1),185-190

[3] Aakanksha Darge (2013) "Treatment of Industrial Wastewater by using Banana peels & Fish scales", international jounal of science and Research (IJSR)

[4] K.S. Low and C.K LEE(1990) "The Removal of Cationic Dyes Using Coconut Husk as an Adsorbents" Department of chemistry,Faculty of Agriculture University Malaysia