WASTEWATER TREATMENT BY USING NATURAL ABSORBENTS

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Abstract- *Natural absorbents made from plants and renewable resources aid in the efficient and cost-effective purification of water. In comparison to traditional products based on metallic salts, natural absorbents reduce the volume of sludge and do not change the pH of the water being treated. Eco-products that are non-toxic and non-corrosive extend the life of machinery and improve operator safety; they are not listed on the UN registry of hazardous goods. Because no inhibitors of any type were present while providing organic material for the growth of microfauna, this contributed to the effectiveness of the subsequent biological therapy. The conductivity of the effluents does not vary, which is crucial in situations where the osmosis process is used and in closed-circuit water systems.*

Keywords- Using natural absorbents like orange peel powder, banana peel powder, coconut shell powder, heavy metals like iron, copper, zinc.

1.0 Introduction

Earth is referred to as the "Blue Planet" because water covers 71% of its surface. Water can be found both above and below the surface of the land. The supply of water is limited. It's possible that the water people drink from bottles now is the same water that once dripped down the back of a woolly mammoth. The remaining 99.7% is floating in the sky, on the soil, on the ice caps, and in the oceans. Even yet, a large portion of the 0.3% that is usable is inaccessible. Rivers provide the vast majority of the water that people utilise.

Wastewater

Wastewater is the water generated after the usage fresh water. for the different applications and processes, this may be of different types like domestic usage, commercial and agricultural activities.

In day-to-day life the wastewater is nothing but the sewage which is domestic wastewater or municipal wastewater that is produced by the peoples, the study says that 44% of the global household water is not treated safely this can leads to several water related diseases like cholera, schistomiasis and many other.

The people from the low and lower-middle income countries have a higher risk of exposure to the pollutants and the less treated water mainly because of the high population and the economic growth mainly the many countries in Africa which has lack of management systems for treating the wastewater.

Scope of work

1. Adsorption process is evolved as an effective method for the treatment for the industrial wastes which mainly contains heavy metals and dyes.
2. Adsorption process provides pliability in design and operation and in many times it provides the high quality effluent.
3. Amidst the practicable approaches for water treatment the adsorption process by the solid adsorbents exhibits likely as notably coherent method for treating and eliminating the organic contaminants in the treatment of waste water.
4. Adsorption has advantages compare to the other practices mainly because of its simple design and the cost efficient that is both initial and maintenance and the less area is required for the operation.

Impacts of Wastewater Treatment

1. The breakdown of the organic components in wastewater may result in significant volumes of foul-smelling fumes.
2. The biochemical oxygen demand (BOD) of untreated wastewater (sewage) containing a lot of organic matter will consume up the stream's dissolved oxygen to fulfil the wastewater's BOD, resulting in fish fatalities and other unpleasant impacts.
3. Nutrients in wastewater that can encourage the growth of aquatic plants and algal blooms can cause eutrophication of lakes and streams.

Advantages of wastewater treatment

- Initial cost is less.
- Removal efficiency of BOD is more..
- Effortless procedure.
- Less operational cost.
- Quantity of sludge generated is less.
- High water solubility.
- Toxic to pathogens.
- Low cost and readily available.
- Available in domestic to industrial scale.
- Simple operating system.

Disadvantages of wastewater treatment

- Rotating arms will be blocked at regular interval.
- Odour generation is high.
- For installation of this system large area is required.
- Concentration of the sludge to be monitor
- Operation cost

2. OBJECTIVES

1. To study the Characteristics of wastewater.
2. The analysis of the effects of changing the dosage of the adsorbent on the adsorption process.
3. To research the contact period, initial pH of metal ion concentration, and metal ion removal percentage.

4. Preparation of natural absorbents like Orange peel, Banana peel, Areca nut, Coconut shell.
5. To use natural absorbents to decrease the amount of metal ions in wastewater.
6. Adjusting the dose of natural absorbents to remove heavy metals like copper, zinc, and iron during the treatment of industrial waste water.
7. Determination of optimum dosage of absorbents.

3. MATERIALS AND METHODOLOGY

Materials:

Materials used for Absorption are:

1. Orange peel
2. Banana peel
3. Coconut shell

Collection of Distilled water for preparing wastewater using Heavy metal ions:

Water has been heated into a vapour in one container, then condensed back into a liquid in another. The original container still contains any impurities in the original water that do not boil at or below the boiling point of water. So, one kind of cleansed water is distilled water.

Fig No- 3.1: Distilled water

Collection of Natural Absorbents

The natural Absorbents used for study are. Orange peel powder, Banana peel powder, Areca nut powder, Coconut shell powder. These Absorbents are the good adsorption properties and economic in cost. Usually Orange, and Banana peels are collected from local fruit stall. Then Areca nut is collected from Areca trees near our surrounding and Coconut shell is collected from local market.

Preparation of Natural Absorbents

Orange peel and Banana peel powder:

In order to get rid of colloidal particles, orange peels and banana peels were obtained at a nearby Rasa sangama Juice stand in Davangere. Banana and orange peels were placed in the sun to dry for a week before being manually chopped into small pieces, ground into a fine powder, and sieved. It is a significant financial and ecologically beneficial product since natural absorbents contribute to the creation of an inexpensive absorbent agent in the wastewater treatment plant's absorption process.

Fig No- 3.2: Orange peel powder

Fig No- 3.3: Banana peel powder

Coconut powder:

The shells of fully grown nuts must first be scraped of any pithy material sticking to them and broken up into little pieces before being used to make coconut shell flour. The fragments are then repeatedly pulverised in grinding mills, and the ground mass is eventually pulled out in various mesh sizes after being processed via cyclones and vibrating sieves with phosphor-bronze mesh.

Fig No- 3.4: Coconut shell powder

Reagents used for preparing wastewater sample:

1. Copper
2. Zinc
3. Iron

Collection of Heavy metal ions:

Copper, Zink, and Iron, were collected from the Scientific supplies near Chetana hotel at Davangere.

Fig No- 3.5: Copper metal ion

Fig No- 3.6: Zinc metal ion

Fig No- 3.7: Iron metal ion

Preparation of Wastewater sample by using Heavy metal ions:

- In order to prepare a wastewater sample containing heavy metals, known quantities of heavy metal salts are routinely added to a clean water source. The general steps for creating such a sample are as follows:
- Gather the required heavy metal salts: Identify the specific heavy metals you want to include in the wastewater sample and obtain their corresponding salts. Common heavy metal salts used for preparation include copper sulphate ($CuSO_4$), zinc sulphate ($ZnSO_4$), Iron fillings ($FeSO_4$).
- Prepare a clean water source: Start with deionized water or distilled water to ensure the absence of any interfering contaminants. Thoroughly clean glassware and containers to avoid cross-contamination.
- Determine the desired concentration: Decide on the concentration of heavy metals you want to include in the sample. This can be based on regulatory limits or specific research requirements.
- Calculate the required amount of heavy metal salts: Use the molar mass of each heavy metal salt to calculate the amount needed to achieve the desired concentration. The equation C = (n/V) can be used, where C is the desired concentration, n is the moles of heavy metal salt, and V is the final volume of the wastewater sample.
- Weigh and dissolve the heavy metal salts: Accurately weigh the calculated amount of each heavy metal salt and dissolve them individually in separate containers using a small volume of deionized water. Stir gently until the salts are completely dissolved.
- Combine the heavy metal solutions: Pour the individual heavy metal solutions into a clean, larger container while maintaining proper proportions to achieve the desired concentration. Stir the mixture gently to ensure uniform distribution.
- Adjust the volume: Add deionized water to the heavy metal solution while measuring the volume carefully.
- Sample storage and preservation: Once the wastewater sample is prepared, store it in a clean, labelled container. If necessary, preserve the sample using appropriate preservation techniques (e.g., acidification or refrigeration) depending on the analytical methods and intended analysis timeframe.

4. METHODOLOGY:

Batch Studies

Batch studies involves following steps

- Analysis of Samples
- Weighing and adding of coagulants

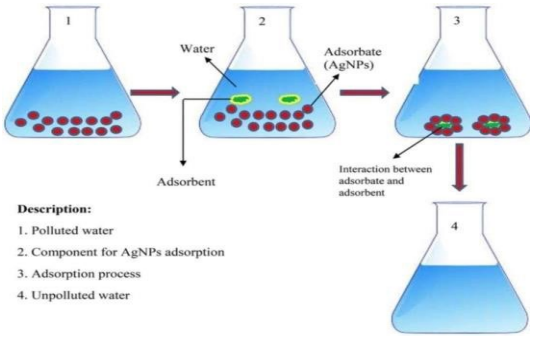

Fig No- 4.1: Batch studies

Analysis of Samples:

The samples were analyzed before and after treatment for various parameters such as Turbidity, Total dissolved solids, pH.

Weighing and adding of Absorbents:

Fig No- 4.2: Weighing balance

Testes Conducted for Wastewater Samples:

1. pH
2. Total dissolved solids
3. Turbidity

Fig No- 4.3: pH Meter

Fig No- 4.4: TDS and EC meter

Fig No- 4.5: Turbidity meter

5. RESULTS AND DISCUSSION

Study of absorbents for different dosages: Effects of natural absorbents on wastewater:

Orange peel powder:

Table No- 5.1: Parameters studied before and after treatment of waste water for orange peel powder

Sl. No	Parameters	Initial values	After treatment of orange peel powder sample (gm/L)				
			0.2	0.4	0.6	0.8	1.0
1	pH	6.61	6.62	6.55	6.38	6.35	6.3
2	Turbidity (NTU)	92.6	111.2	131.2	125.5	113.6	107.3
3	TDS(mg/l)	5.42	5.02	5.68	5.87	5.72	5.72

pH TEST:

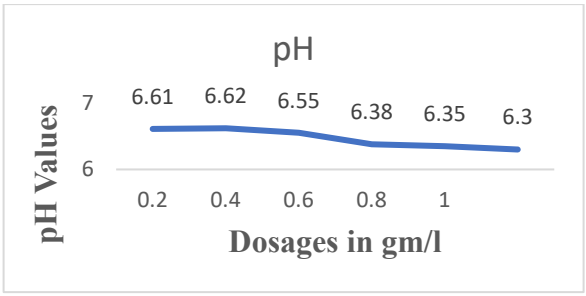

Fig No - 5.1: pH reduction by different dosages of orange peel powder

By using orange peel powder for absorption pH of the waste water is reduced from 6.62 to, 6.55, 6.38, 6.35 and 6.3 for dosage of 0.2 gm/L, 0.4 gm/L, 0.6 gm/L, 0.8 gm/L and 10gm/L respectively.

TURBIDITY TEST:

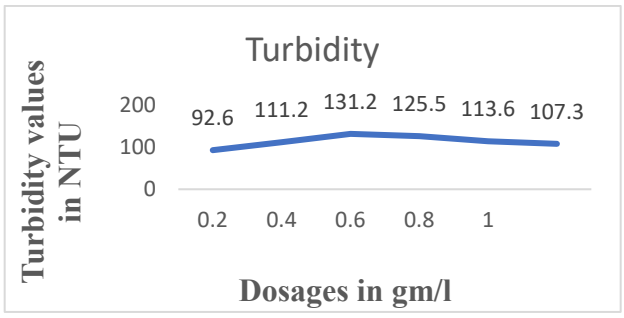

Fig No- 5.2: TURBIDITY TEST:

Turbidity reduction by different dosages of orange peel powder

Turbidity of the wastewater was reduced by 111.2, 131.2, 125.5, 113.6 and 107.3 NTU for 0.2, 0.4, 0.6, 0.8 and 1.0 gm/l of absorbent dosage. From the above chart we can observe that maximum removal of turbidity obtained from 0.4 gm/L of dosage.

TDS TEST:

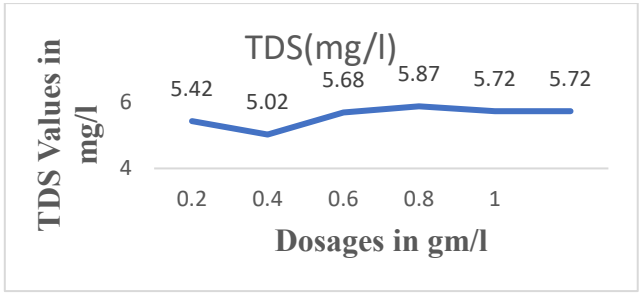

Fig No- 5.3: TDS TEST

Removal of TDS different dosage of orange peel powder

TDS of wastewater treated by orange peel powder for different dosages of 0.2 gm/L, 0.4 gm/L, 0.6 gm/L and 0.8 gm/L, percentage reduction of TDS is 5.02, 5.68, 5.87, 5.72 and 5.95 respectively.

Banana peel powder:

Table 5.2: Parameters studied before and after treatment of waste water for Banana peel powder

Sl. No	Parameters	Initial values	After treatment of orange peel powder sample (gm/L)				
			0.2	0.4	0.6	0.8	1.0
1	pH	6.61	6.60	6.45	6.37	6.36	6.4
2	Turbidity (NTU)	92.6	94.3	99.5	88.2	78.5	73.4
3	TDS(mg/l)	5.42	5.38	5.48	5.57	5.62	5.65

pH TEST:

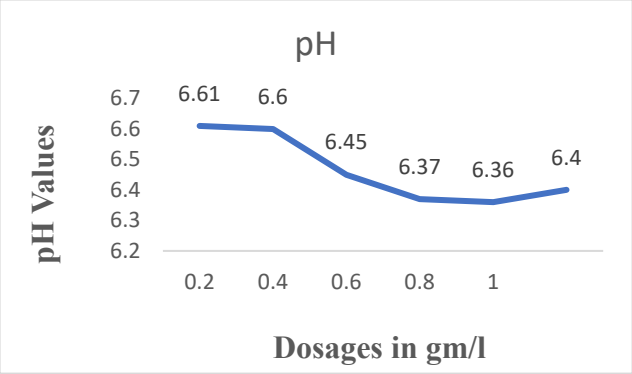

Fig No- 5.4: pH reduction by different dosages of Banana peel powder.

TURBIDITY TEST:

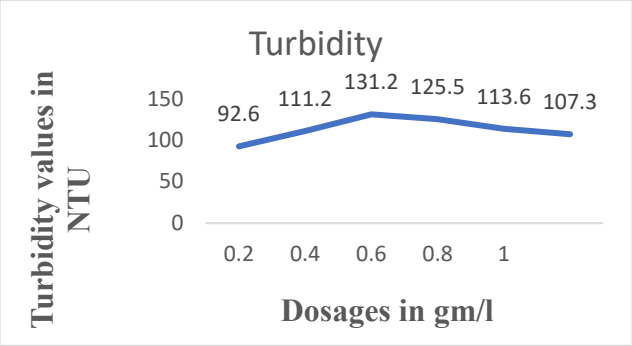

Fig No- 5.5: Turbidity reduction by different dosages of Banana peel powder.

TDS TEST:

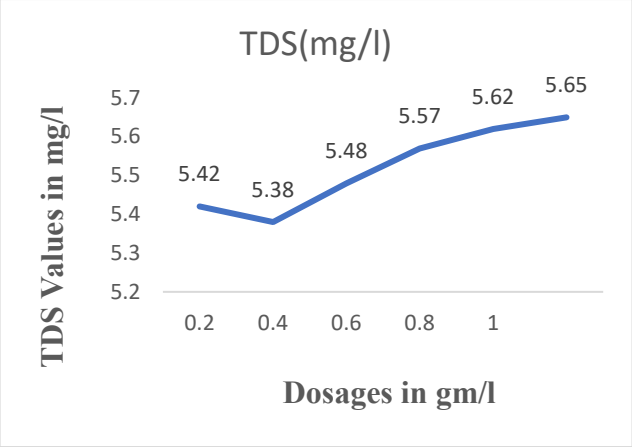

Fig No- 5.6: Removal of TDS different dosage of Banana peel powder.

Coconut shell powder:

Table 5.3: Parameters studied before and after treatment of waste water for coconut shell powder

Sl. No	Parameters	Initial values	After treatment of orange peel powder sample (gm/L)			
			0.2	0.4	0.6	0.8
1	pH	6.61	6.63	6.52	6.48	6.45
2	Turbidity (NTU)	92.6	110.5	121.10	111.5	107.4
3	TDS (mg/l)	5.42	5.41	5.56	5.76	5.75

pH TEST:

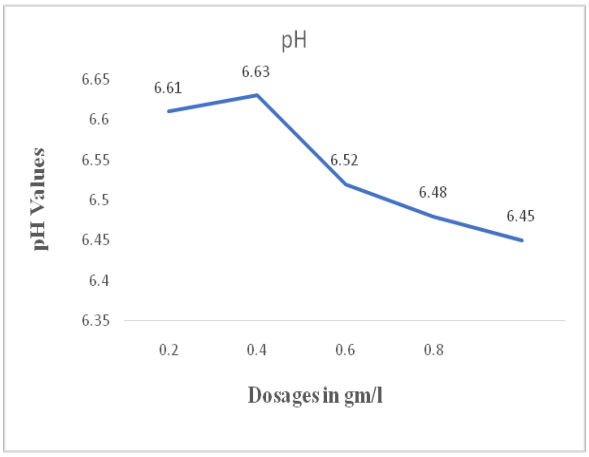

Fig No- 5.7: Effect of coconut shell adsorbent dose

TURBIDITY TEST:

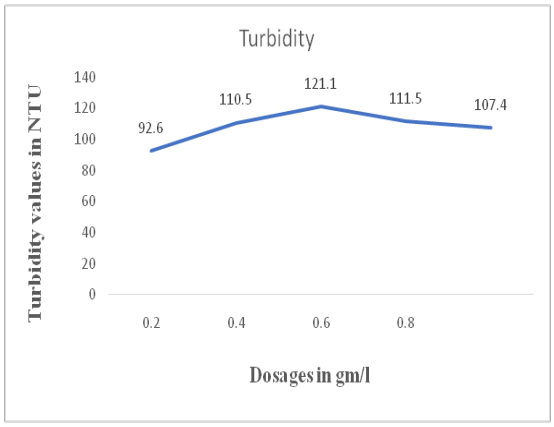

Fig No- 5.8: Turbidity reduction by different dosages of Coconut shell powder.

TDS TEST:

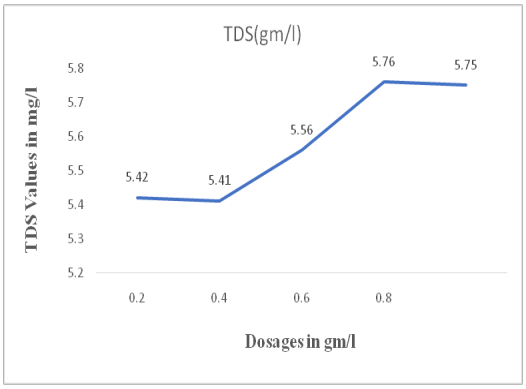

Fig No- 5.9: TDS reduction by different dosages of Coconut shell powder.

Column Studies:

At 3 cm, 6 cm, and 9 cm, downflow fixed-bed columns filled with activated carbon were used for column experiments. To stop activated carbon from leaching and clogging the drainage region, glass wool was placed at the base of the column. In order to gently spread the solution onto the adsorbent surface and to maintain a constant flow, it was also put on top of the adsorbent bed. Cadmium solutions' starting concentration was fixed. Sodium hydroxide (NaOH) and hydrochloric acid are used to adjust pH. In the column investigation, the ideal batch adsorption conditions were used. A peristaltic pump was used to pump the solution into the column at a constant flow rate and in a downward direction. For the first hour, effluents were collected every five minutes. Thereafter, they were collected at half-hour intervals until the exhaust point was reached in terms of the concentration of metal ions in the effluents. Utilising a spectrophotometer, residual concentrations were measured. All column experiments were carried out in triplicate, and the column investigation was carried out at room temperature.

Fig No- 5.10: Experimental Setup for Column study

Table No- 5.4: Removal efficiency in 1:1 ratio

Parameter	3min	5min	6min
pH(%)	3.44	5.74	6.89
Turbidity(%)	13.47	19.17	21.76
TDS(%)	16.45	22.66	23.94

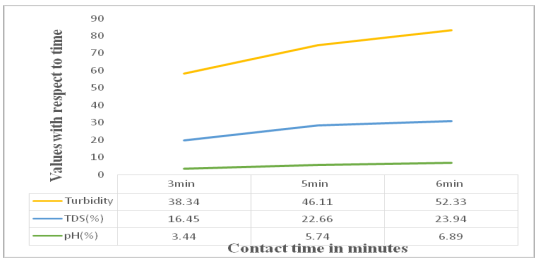

Fig No- 5.11: Comparison of various parameters in different contact time

Table 5.5: Removal efficiency in 2:1 ratio

Parameter	3min	5min	6min
pH (%)	10.35	13.79	14.94
Turbidity(%)	26.42	30.56	33.16
TDS (%)	26.14	29.98	31.99

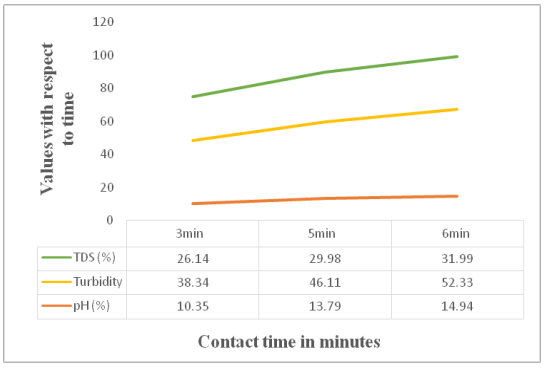

Fig No- 5.12: Comparison of various parameters in1: 2 ratios in different contact time

Table 5.6: Removal efficiency in 2:1 ratio

Parameter	3 min	5 min	6 Min
pH(%)	14.95	19.54	20.08
Turbidity(%)	38.34	46.11	52.33
TDS(%)	35.28	40.03	47.53

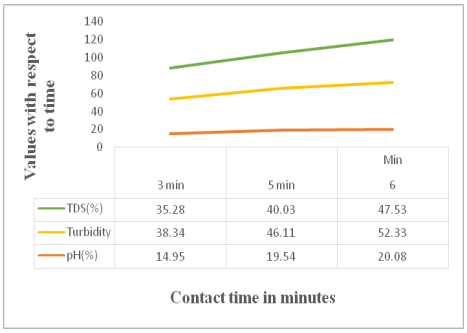

Fig No- 5.13: Comparison of various parameter in 2:1 ratio in different contact time.

8. CONCLUSION

- The effluent must be properly treated since it poses risks to human health and the environment.
- Natural absorbents are very effective for reducing the physical chemical parameters of the wastewater, such as pH, turbidity, TDS, and others. Activated sludge process, trickling filter, aerated lagoon, and other conventional methods, among others, are used to treat wastewater, but these methods are very expensive.
- Because the basic materials come from renewable resources, they are less expensive, safer, non-toxic, increase floc size, and are highly biodegradable.

For Orange peel powder

- In this investigation, we can see that utilising orange peel powder at a dosage of 1.0 gm/l, pH was decreased to a maximum.
- With a dose of 0.4gm, orange peel powder may remove up to 131.2NTU of turbidity.
- Utilising doses of 0.6 gm/land and 0.8 gm/l orange peel powder, respectively, results in maximal TDS reductions of 5.87 and 5.72, respectively.
- According to the study, orange peel powder is a more effective absorbent for handling wastewater.

For Banana peel powder

- In this study we can observe that pH was increased maximum up to 6.4 by using Banana peel powder of dosage 1.0gm/l.
- The maximum turbidity removed by Banana peel powder which is 99.5NTUfor dosage of 0.4gm/l,
- The maximum reduction of TDS is 5.62 and 5.65 by using 0.8 gm/l and 1.0 gm/l dose of Banana peel powder respectively.

For Coconut shell powder

- In this investigation, we can see that utilising coconut shell powder at a dosage of 0.8 gm/l, pH was raised to a maximum of 6.45.
- At a dose of 0.4gm/l, coconut shell powder may eliminate up to 121.10NTU of turbidity.
- When coconut shell powder is used at doses of 0.6 gm/l and 0.8 gm/l, respectively, the maximum TDS decrease is 5.76 and 5.75.

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