Comparative Studies on Various Activated Carbons in Waste Water Treatment

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Abstract: In the Present Technologically fast changing situation related to waste water treatment practices, it is desirable that disposal of waste should be done in a scientific manner by keeping in view economic and pollution considerations. This is only possible when the plant waste has potential to be used as raw material for some useful product. In the present study, Rice husk, Orange peel and Sewage sludge was used for the preparation of an adsorbent under optimized conditions and its Comparative Characterization was conducted with prepare activated carbon for its physical, chemical and adsorption properties.

Keywords: Activated Carbon, Rice husk, Orange Peel, Sewage Sludge, Dye water, Domestic waste water, Sewage Water

1. INTRODUCTION

The rate at which industrial, domestic and sewage effluents are disposed into the aquatic environments has increased due to rapid growth of cities and human populations in the world. Currently the world is almost populated by seven billion inhabitants (CNN ,2011).In developing countries like India, industries cannot afford to use conventional wastewater treatment chemicals like alum, ferric chloride, polymer flocculants and coal based activated carbon because they are not cost- effective. An inexpensive and more easily available adsorbent would make the removal of pollutants an economically viable alternative. C.Namasivayam et al.(2002).Activated carbons are extensively used as efficient and versatile absorbents for purification of water, air and many chemical and natural products..R.Malik et al.(2007). Thus the use of material such as Rice husk, Orange peel and sewage sludge, as adsorbent. These metals are easy available and low cost. Activated carbon also Referred to activated charcoal as a form of carbon that has been processed to make it extremely porous and very large surface are available for adsorption.Azza Khaled et al.(2009),V.K Gupta et al.(2012).,Ibrar Zahid et al.(2016).Activated carbon has been used to remove organic and inorganic metals. Adsorption process offers some flexibility in operation, design and in some cases. It can produce in high quality treated effluent. In this study Rice husk, Orange peel and sewage sludge activated adsorbents are to treat municipal sewage, domestic water and industrial water.

2. EXPERIMENTAL SETUP

2.1. Adsorbent preparation

Activated Carbon prepared from Rice husk, Orange peel and Sewage sludge as adsorbents. Rice husk and Orange peel waste were collected from agricultural processing unit. Sewage sludge was collected from klu treatment unit. These materials were used to prepare activated carbons using concentrated sulfuric scid.

2.2. Experiment procedure

First, the Rice husk, Orange peel and Sludge was kept in a three different pressure cooker. The vent tube was removed from the pressure cooker to make an opening for the smoke during the burning of the rice husk. The pressure cooker was placed on a stove to burn the rice husk. The color of smoke was initially black. The pressure cooker remained on the stove until the color of the smoke changed from black to white. After the smoke color changed to white, the cover of the pressure cooler was removed. Also, the pressure cooker was left uncovered overnight. After that, the Rice husk, Orange peel and Sludge were grinded and sieved in order to obtain particles size up to 180 and 300 μm. Then these raw materials were washed with distilled water. To activate them chemically a solution of sulfuric acid was prepared. The raw materials were soaked for 16 to 18 hours in the solution. The activated carbons were washed again with distilled water, to remove the free acid, and then dried on a hot plate.

Experimental setup consists of inlet chamber and outlet chamber with lid. The activated material was filled at inlet chamber at height of 5cm. The activated carbon was prepared from Rice husk, Orange peel and Sewage Sludge. The activated carbon was taken in an inlet chamber and then passed waste water of municipal sewage, domestic, industrial water (dye water) passed through the activated carbon. Then, treated water from the outlet chamber.

3. RESULTS AND DISCUSSION

Each sample filtrated was analyzed for different results in table 1 to 9 & Figure 1 to 9.

4. CONCLUSION

These are natural activated carbons, which do not have harmful effects on human beings. These adsorbents have the potential to become a source of the environment-friendly and for the treatment of wastewater. The Selected low cost activated carbon Rice husk, Orange Peel and Sludge are promising starting materials for the preparation of activated adsorbents by using Sulfuric acid as Chemical activated agents. It is observed that, to identify the effectiveness of activated carbons for the removal percentage of pH, COD, BOD, TDS, Fluoride, Sulphate, Iron, Nitrate and Chloride in table10.The maximum percentage removal of pH, COD, BOD, TDS, Fluoride, Sulphate, Iron, Nitrate and Chloride is rice husk absorbent with Dye water.

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Table 1: Characteristics of pH

Analysis	**Untreated waste water**	**Treated water using Rice husk adsorbent**	**Treated water using Municipal sewage sludge absorbent**	**Treated water using Orange peel absorbent**	**Standard limit (allowable limit)**
Municipal sewage water	11	7.5	8	7.5	8.5
Domestic water	13	8.5	8.5	7.5	8.5
Dye water	12	7	9	7.5	8.5

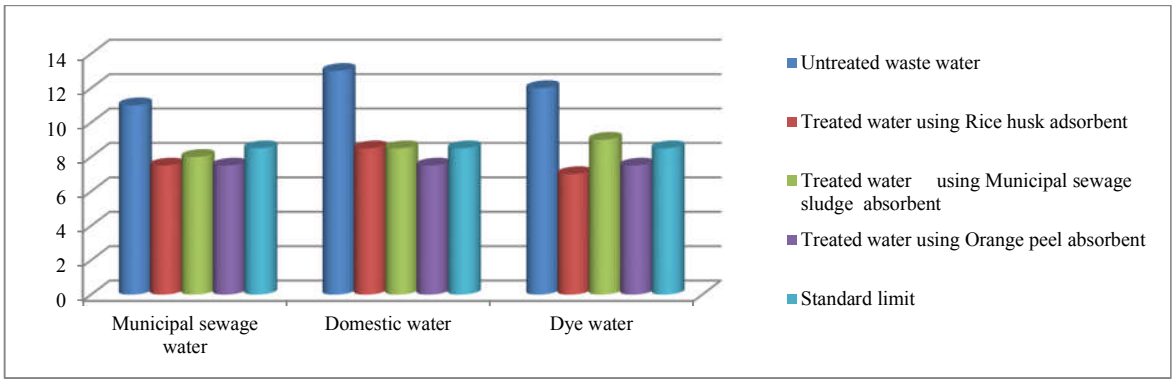

Figure 1: pH Analysis

Table 2: Characteristics of COD

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	1000	238	1000	500	250
Domestic water	1200	250	1200	1000	250
Dye water	2000	248	2000	1800	250

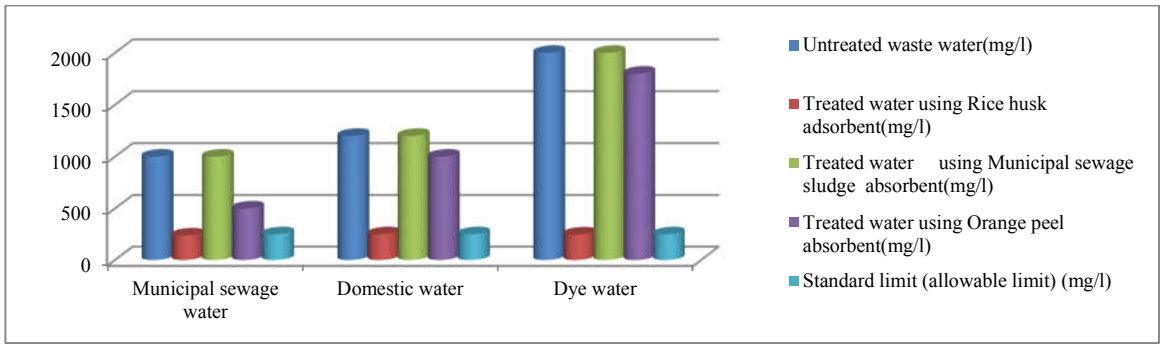

Figure 2: COD Analysis

Table 3: Characteristics of BOD

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	700	350	700	700	350
Domestic water	900	350	900	900	350
Dye water	1200	345	1200	900	350

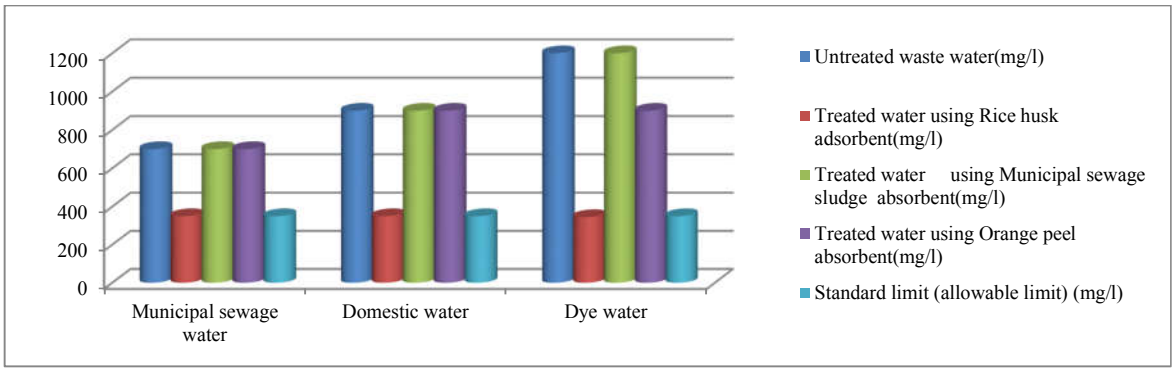

Figure 3: BOD Analysis

Table 4: Characteristics of Fluoride

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	25	15	25	17	15
Domestic water	30	15	30	30	15
Dye water	25	15	25	17	15

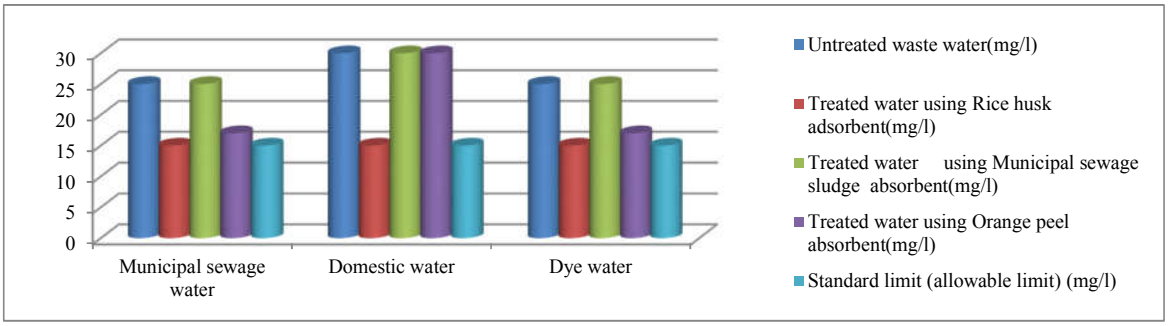

Figure 4: Fluoride Analysis

Table 5: Characteristics of Sulphate

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	6	1.89	6	6	2
Domestic water	6	1.29	6	6	2
Dye water	10	2	10	10	2

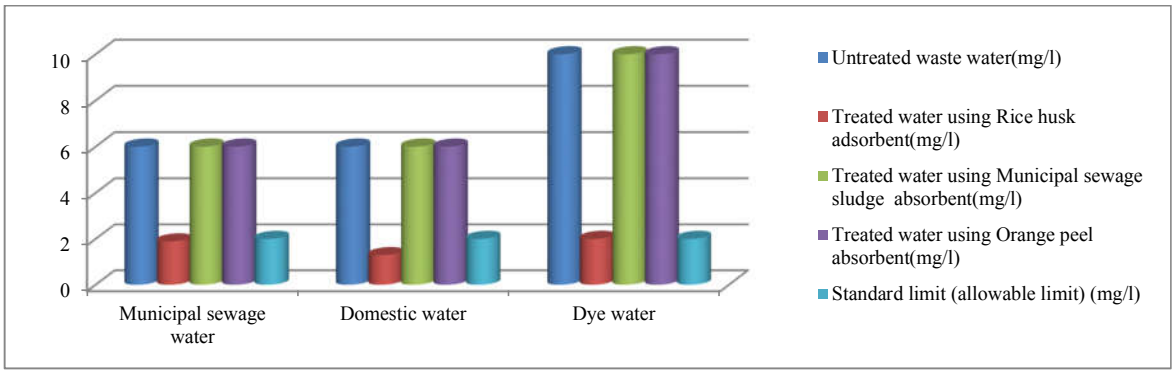

Figure 5: Sulphate Analysis

Table 6: Characteristics of Iron

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	8	2.58	7.5	8	3
Domestic water	8	3	8	8	3
Dye water	8	3	8	7	3

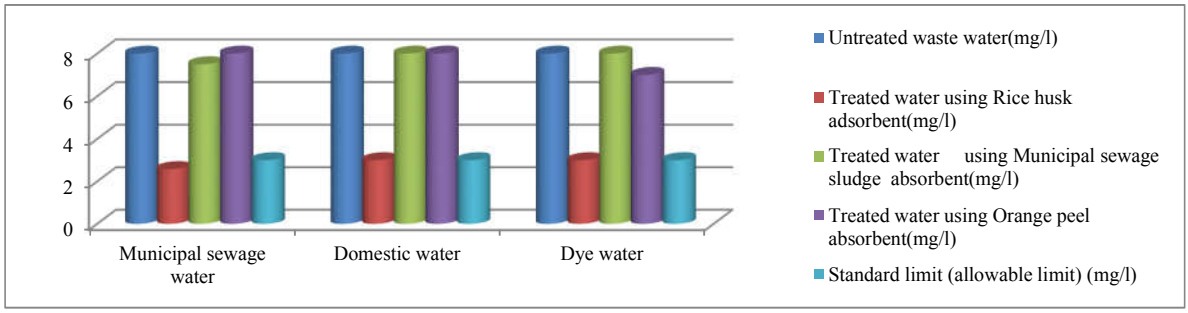

Figure 6: Iron Analysis

Table 7: Characteristics of Nitrate

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	15	8.59	13	15	13
Domestic water	17	9.29	17	17	10
Dye water	20	10	20	20	10

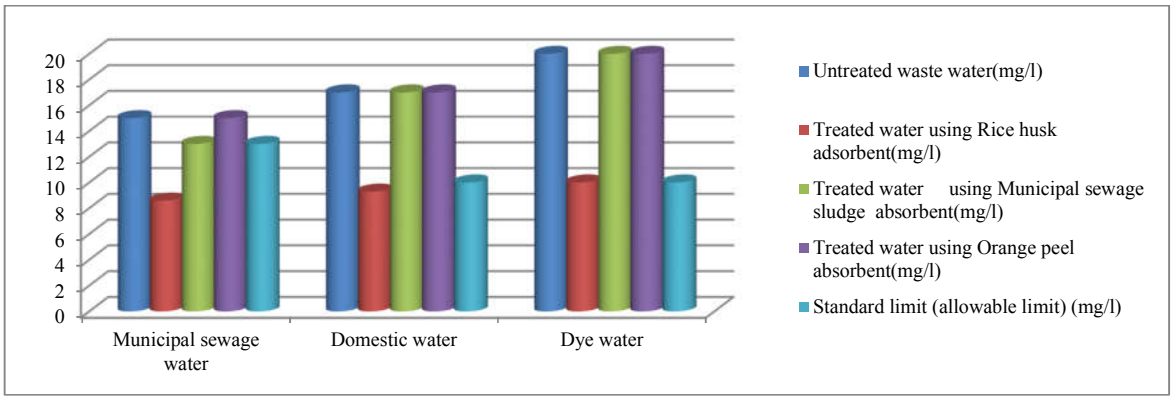

Figure 7: Nitrate Analysis

Table 8: Characteristics of Chloride

Analysis	**Untreated waste water(mg/l)**	**Treated water using Rice husk adsorbent(mg/l)**	**Treated water using Municipal sewage sludge absorbent(mg/l)**	**Treated water using Orange peel absorbent(mg/l)**	**Standard limit (allowable limit) (mg/l)**
Municipal sewage water	800	500	800	800	600
Domestic water	650	585	650	600	600
Dye water	750	600	750	700	600

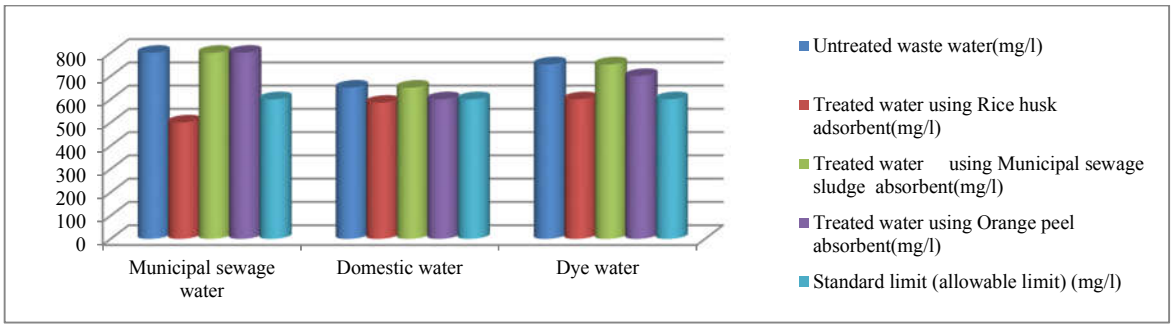

Figure 8: Chloride Analysis

Table 9: Characteristics of TDS

Analysis	Untreated waste water(mg/l)	Treated water using Rice husk adsorbent(mg/l)	Treated water using Municipal sewage sludge absorbent(mg/l)	Treated water using Orange peel absorbent(mg/l)	Standard limit (allowable limit) (mg/l)
Municipal sewage water	3500	2000	3000	2700	2100
Domestic water	2900	2100	2900	2700	2100
Dye water	3500	2058	3500	3200	2100

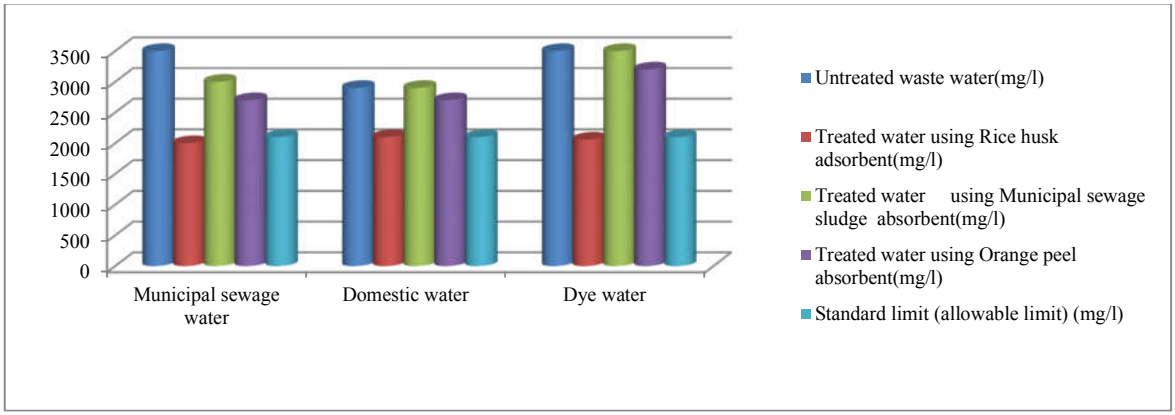

Figure 9: TDS Analysis

Table 10: The Percentage of Removal Rice husk, Sludge waste and Orange peel Adsorbent

Parameter	Rice Husk Adsorbent			Sludge waste Adsorbent			Orange Peel Adsorbent		
	Municipal sewage water	Domestic water	Dye water	Municipal sewage water	Domestic water	Dye water	Municipal sewage water	Domestic water	Dye water
pH	31.82	34.62	41.67	27.27	34.62	25.00	31.82	42.31	37.50
COD	76.20	79.17	87.60	0.00	0.00	0.00	50.00	16.67	10.00
BOD	50.00	61.11	71.25	0.00	0.00	0.00	0.00	0.00	25.00
Flurodie	40.00	50.00	40.00	0.00	0.00	0.00	32.00	0.00	32.00
Silphate	68.50	78.50	80.00	0.00	0.00	0.00	0.00	0.00	0.00
Iron	67.75	62.50	62.50	6.25	0.00	0.00	0.00	0.00	12.50
Nitrate	42.73	45.35	50.00	13.33	0.00	0.00	0.00	0.00	0.00
Chloride	37.50	10.00	20.00	0.00	0.00	0.00	0.00	7.69	6.67
TDS	42.86	27.59	41.20	14.29	0.00	0.00	22.86	6.90	8.57
% Removal	50.82	49.87	**54.91**	6.79	3.85	2.78	15.19	8.17	14.69