EFFICIENCY EVALUTION OF CARBONIZED RICE HUSK AND RAW GROUND NUT SHEEL POWDER FOR REMOVAL DIFFERENT PARAMETERS FROM WASTE WATER BY ADSORPTION USING LOW COST ADSORBENTS

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ABSTRACT

The study was aimed at efficiency evaluation of non-conventional low cost agricultural adsorbents by preparing carbonized rice husk, and use of raw ground shell powder for the removal of, PH, Turbidity and electrical conductivity from waste water discharged from the savitri and shivneri boys hostel. The efficiency of the adsorbents for the removal of pH, Turbidity and electrical conductivity was investigated. The efficiency of adsorbents used is found in the order of powder carbonized rice husk is more active than raw ground shell powder. The effect of waste water adsorbent thickness, were studied in a filtration batch experiment at different thickness of activated rice husk and groundnut shell powder. pH of carbonized rice husk was increases as the thickness of carbonized rice husk increases similar pattern was also observed in raw powder ground nut shell. Turbidity was found more in groundnut shell powder at all levels of thickness, whereas lower turbidity was observed in activated rice husk at all levels of thickness. low EC values observed in carbonized rice husk for levels 5.0,7.0,10.0cm. Whereas there is an increase in EC for the said levels from Groundnut shell powder.

(Key Words: *Cr(VI), low-cost adsorbents, carbonized rice husk, adsorbent, adsorption, waste water)*

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Introduction

Water plays vital role in human life. It is extremely essential for survival of all living organisms. Groundwater is ultimate, most suitable fresh water resource with nearly balanced concentration of salts for human consumption. Water is most important in shaping the land and regulating the climate. It is one most important compound that influences life. Groundwater used for domestic and industrial water supply and for irrigation purposes in all over the world. In the last few decades, there has been a tremendous increase in the demand for fresh water due to rapid growth of population and the accelerated pace of industrialization. According to world health organization, about 80% of all the diseases in human beings are caused by water. Once the groundwater is contaminated, its quality cannot be restored back easily and to device ways and means to protect it. Water quality index is one of the most effective tools to communicate information on the quality of water to the concerned citizens and policy makers. It, thus, becomes an important parameter for the assessment and management of groundwater. Waste water are essentially the water supply of the community after it has been fouled by a variety of uses from the stand point of sources of generation, Generally the wastewater discharged from domestic premises like residences, institutions and commercial establishments is termed as "Sewage/Community wastewater". The use of wastewater in agriculture is gaining importance because of its value as potential irrigation and a nutrient donor. Use of waste water for irrigation make it possible to conserve the limited water resources for crop production and also prevent pollution of water bodies, as soil is a very good sink. Application of wastewater to agriculture land may promote to growth of crops and conserve water and nutrients. However, the indiscriminate use of sewage effluents for irrigation to agricultural crops may cause soil and groundwater pollution problem in the end when they not properly handled before and after their application to land. Malik (2006) studied that the groundnut shell, an agricultural waste, was used for the preparation of an adsorbent by chemical activation using ZnCl2 under optimized conditions and its comparative characterization was conducted with commercially available powdered activated carbon (CPAC) for its physical, chemical and adsorption properties. The experimental results indicate that at a dose of 0.5 g l1 and initial concentration of 100 mg l1, GSPAC showed 94.5% removal of the dye in 30 min equilibrium time, while CPAC removed 96% of the dye in 15 min. The experimental isotherm data were analyzed using the linearized forms of Freundlich, Langmuir and BET equations to determine maximum adsorptive capacities. The results of comparative adsorption capacity of both carbons indicate that groundnut shell can be used as a low-cost alternative to commercial powdered activated carbon in aqueous solution for dye removal.

Isah and Yusuf (2012), conducted the experiment on the utilization of activated carbon prepared from groundnut shell for the removal of lead from water. The effects of temperature, contact time, and initial concentration of lead on the adsorption process have been investigated. Groundnut shell activated carbon was proven to be capable of removing lead from water with a very high efficiency under ambient conditions. Adsorption of lead onto groundnut shell activated carbon is best described by the pseudo second order kinetic model and the Langmuir adsorption isotherm model.

Adams et al. (2014) studied on characterization of rice hull ash and its performance in turbidity removal from water. Study characterizes the locally obtained samples of rice hull ash and investigates its performance on turbidity removal from water. Four samples of this material were studied, namely, unwashed parboiled rice hull ash (UPRHA), washed parboiled rice hull ash (WPRHA), unwashed unparboiled rice hull ash (UUPRHA), and washed unparboiled rice hull ash (WUPRHA). Scanning electron microscopy (SEM), x-ray diffractometer (XRD), and Fourier infrared spectroscopy (FTIR) were carried out to characterize these samples. A filtration process was carried out to investigate the effectiveness of the rice hull ash medium in removing water turbidity. Rice husk, which was a relatively abundant and inexpensive material, is currently being investigated as an adsorbent for the removal of various pollutants from water and wastewaters. Various pollutants, such as dyes, phenols, organic compounds, pesticides, inorganic anions, and heavy metals can be removed very effectively with rice husk as an adsorbent. The present investigation comprised the characterization of the wastewater from Savitri girl’s hostel and Shivneri boy’s hostel, Dr. PDKV, Akola, its treatment through low cost agriculture adsorbent of purification of wastewater for optimization of different parameters.

The very limited study is available regarding the Treatment of wastewater by using different Low Cost Agricultural Adsorbent. Therefore, the study taken to evaluate the water quality parameters of waste water filtering from Different Low Cost Agricultural Adsorbent.

Materials and Method

Study Area

The experiment conducted during summer season of 2017 at the field of the Department Farm Structures of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

Selection of Low cost Agricultural Adsorbent:

Selection of the Agricultural Waste for the development of low cost adsorbents depends upon many factors. The Agricultural Waste should be freely available, inexpensive and non-hazardous in nature. Moreover, for good adsorption results, high contents of carbon or oxygen in the adsorbent are very necessary. From ultimate analysis done by various researcher following agricultural waste Rice Husk contain about 40 % Carbon (Encyclopedia, accessed 2016) and Groundnut Shell Contain about 88.6 % (M. Kamaraj et al 2017).

a) Activated rice husk
b) Groundnut shell powder

Selection of Waste Water Sampling Sites

The wastewater samples was collected from two locations; Savitri girl's hostel and Shivneri boy's hostel and the wastewater samples filtered in morning (10 h.), afternoon (13 h.), and evening (16 h.) in a day and subsequently. The wastewater samples was pass through the filtering bed of Activated Rice Husk and Groundnut Shell powder in sequence as 2 kg, 2.5 kg, and 3 kg respectively.

Preparation of Activated Carbon from Rice Husk

Rice husk was obtain from mill located at Sakoli, District-Bhandara, Maharashtra State. The raw agriculture waste Rice Husk was wash with deionized water, dried at 100^o C for 24 h in an oven. Dried rice husk was place in a furnace and carbonized at 450^o C for 5 h. For all experiment, the heating rate will fix at 10^o C/min. After treatment samples was cool to room temperature, the samples was take in to a crucible and digested for 30 min with 50:50 (v/v %) of 69% HNO_3 .Then the samples will kept at 400^o C for 10 min followed by several washings with distilled water. Then the samples will dried at 120^o C in Hot air oven. These samples was stored in separate airtight containers free from moisture until further use.

Groundnut Shell Powder

Groundnut shell was obtain from mill located at Sakoli, District Bhandara, Maharashtra State. The Groundnut shell samples was weighed in12 kg after that it was wash with distilled water to remove dirt and other contaminants present in it. Then it was sun-dried for 3 days to remove any water content and again weighed, it was 10 kg 900 gm and then it was crushed with blender. The Speed of blender was kept in range of 550 to 650 rpm and the crushed sample was pre-treated with weak Acetic acid (CH_3COOH) 0.1 Normality (5.86 gm) for 24 hours and then treated with sodium hydroxide (NaOH) 0.1 Normality (4 gm) to remove any impurities and color pigments. Sample was wash with distilled water and kept for 24 hours to remove that lignin content.

Selection of Gravels and Sand

Gravels

Gravels were collected from construction site of CAET, Dr. PDKV, Akola. Gravels were passed through different sieves of 16 mm and 8 mm, then gravels retained on 8 mm sieve was taken as coarse gravel and those gravels passed through 8 mm sieve was considered as fine gravels and used as filtering material for waste water analysis. The coarse gravel and fine gravels were washed with distilled water for 3 times to remove dirt and dust particles attached to surface and then sun-dried in open condition.

Fine Sand

Sand was collected from construction site of CAET, Dr. PDKV, Akola. Sand was pass through different sieves and then sand retained on sieve 0.2 mm was taken as fine sand used as filtering material for wastewater analysis. The sand was washed with distilled water for 5 times to remove dirt and dust particles attached to surface and then sun-dried in open condition.

Fig 1. Set up of filtration for Activated Rice Husk

Fig 2. Set Up Of Filtration Of Groundnut Shell Powder

Collection of Wastewater Samples

The wastewater samples were collect regularly for one-month (8th May 2017 to 10th June 2017) in fixed time at 10 h., 13 h, and 16 h. each day. The samples were collect in cans of 5 litres capacity and those were use for filtration. There are different parameters of the wastewater.

Parameters of Waste Water

1. Turbidity (NTU)
2. pH
3. Electrical Conductivity (EC)

Result & Discussion

The quality parameters of wastewater

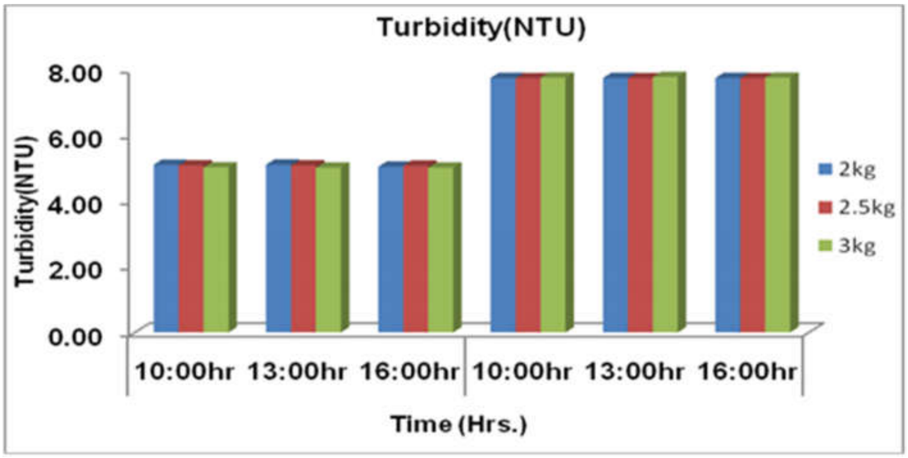
Important agricultural water quality parameters include some specific properties of water that are relevant to the yield and quality of crops, maintenance of soil productivity and protection of the environment. These parameters mainly consist of certain physical and chemical characteristics of water.

1) Turbidity (NTU)

It is a measure of cloudiness of water, i.e., higher turbidity indicates greater murkiness, which is a result of the presence of suspended solids in the water, could potentially shield microbes. Turbidity depicted in Graph 1 and 2 indicates that turbidity was found more in groundnut shell powder at all levels whereas lower turbidity was observed in Activated rice husk level for the said levels. However, in groundnut shell powder it was found insignificant in both Savitri and Shivneri hostel domestic wastewater.

Table 1: Turbidity (NTU) Of Activated Rice Husk and Groundnut Shell Powder For Savitri Girl's Hostel

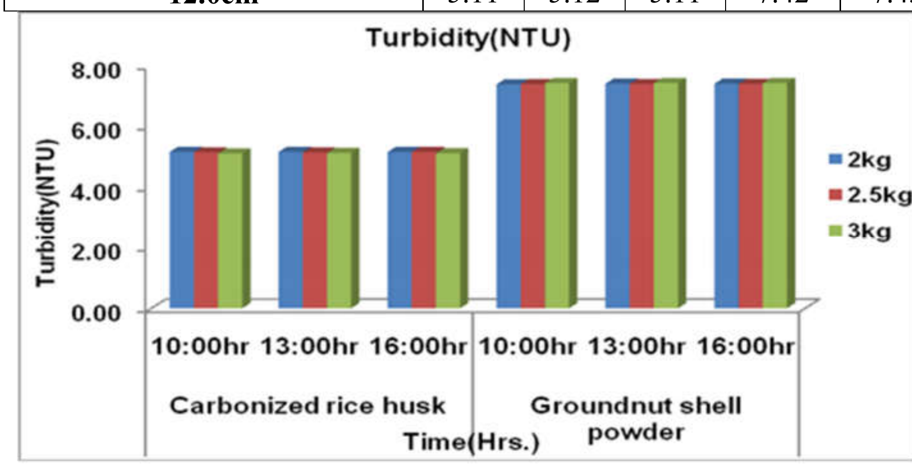
	Activated rice husk			**Groundnut shell powder**		
Level	**10 h.**	**1 h.**	**4 h.**	**10 h.**	**1 h.**	**4 h.**
2 kg 7.0cm	5.10	5.10	5.10	7.73	7.73	7.73
2.5 kg 10.0cm	5.08	5.08	5.07	7.72	7.72	7.72
3 kg 12.0cm	5.02	5.01	5.01	7.74	7.76	7.74



Graph 1: Turbidity (NTU) of carbonized rice husk and groundnut shell powder for Savitri girl's hostel.

Table 2: Turbidity (NTU) of carbonized rice husk and groundnut shell powder for Shivneri boy's hostel

Thickness of CRH &GSPlayer	Carbonized rice husk			Groundnut shell powder		
	10 H.	13 H.	16 H.	10 H.	13 H.	16 H.
2 kg 7.0cm	5.16	5.16	5.15	7.38	7.40	7.40
2.5 kg 10.0cm	5.14	5.14	5.15	7.39	7.39	7.40
3 kg 12.0cm	5.11	5.12	5.11	7.42	7.43	7.42



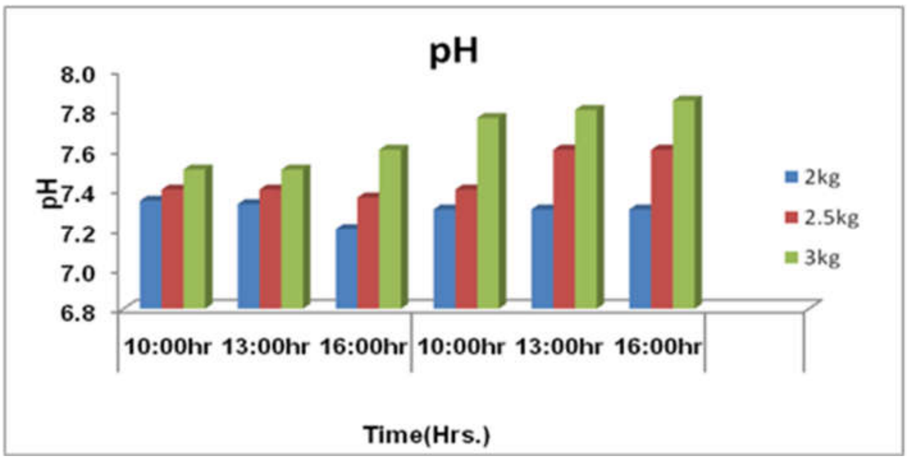
Graph 2: Turbidity (NTU) of carbonized rice husk and groundnut shell powder for Shivneri boy's hostel

2) pH

pH is an indicator of acidity or alkalinity of water. The normal pH range for irrigation water is from 6.5 to 8.4. The pH less than 6.5 are alkaline, and more than 8.4 is acidic. pH depicted in Graph 3 and 4 indicates that pH was found more in groundnut shell powder as the levels increases. pH was observed more in carbonized rice husk for the said levels.

Table 3: pH of carbonized rice husk and groundnut shell powder for Savitri girl's hostel

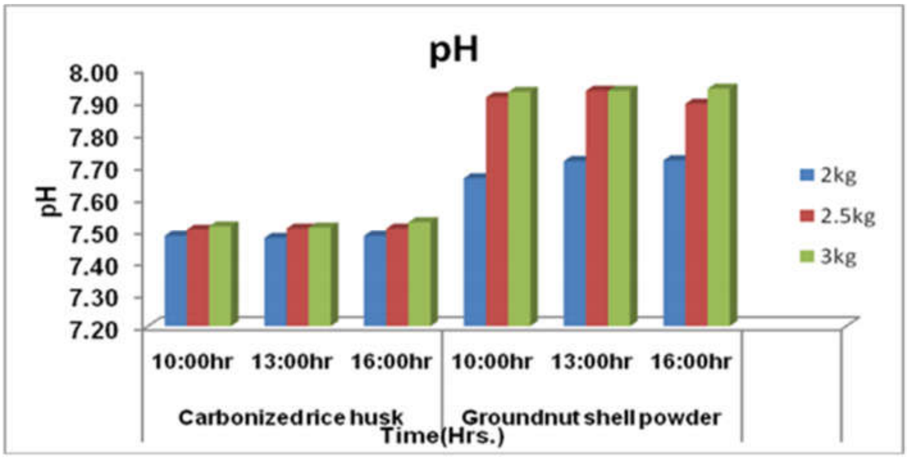
Thickness of CRH &GSPlayer	Carbonized rice husk			Groundnut shell powder		
	10 H.	13 H.	16 H.	10 H.	13 H.	16 H.
2 kg 7.0cm	7.3	7.3	7.2	7.3	7.3	7.3
2.5 kg 10.0cm	7.4	7.4	7.4	7.4	7.6	7.6
3 kg 12.0cm	7.5	7.5	7.6	7.8	7.8	7.8



Graph 3: pH of carbonized rice husk and groundnut shell powder for Savitri girl's hostel

Table 4: pH of carbonized rice husk and groundnut shell powder for Shivnenri boy's hostel

Thickness of CRH &GSPlayer	Carbonized rice husk			Groundnut shell powder		
	10 H.	13 H.	16 H.	10 H.	13 H.	16 H.
2 kg 5.0cm	7.48	7.47	7.48	7.66	7.71	7.71
2.5 kg 7.0cm	7.50	7.50	7.50	7.91	7.93	7.89
3 kg 10.0cm	7.51	7.51	7.52	7.93	7.93	7.94

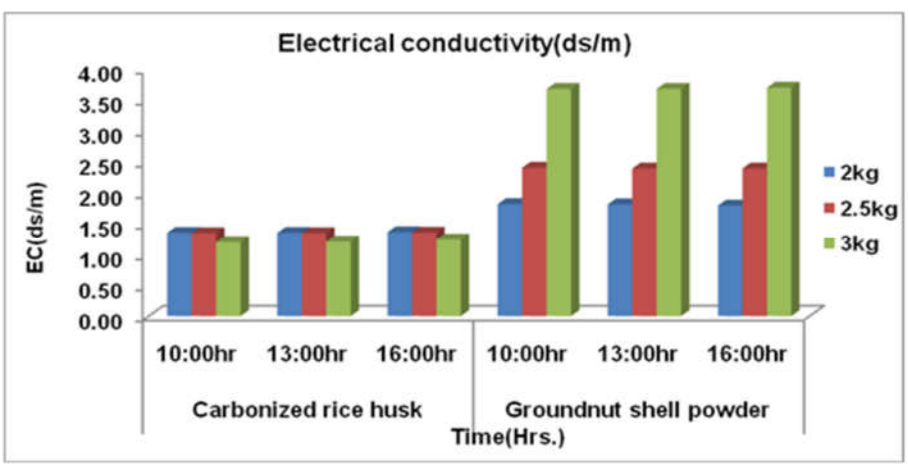


Graph 4: pH of carbonized rice husk and groundnut shell powder for Shivneri boys hostel

3) Electrical Conductivity (EC) Electrical conductivity widely used to indicate the total ionized soluble constituents of water. The presence of salt governs the electrical conductivity of water. It indicates a soluble salt concentration in water.EC depicted in Graph 5 shows the low EC values observed in carbonized rice husk for said level, and Whereas the in Graph 6 there is an increase in EC at a said level from Groundnut shell powder.

Table 5: EC (ds/m) of carbonized rice husk and groundnut shell powder for Savitri girl's hostel

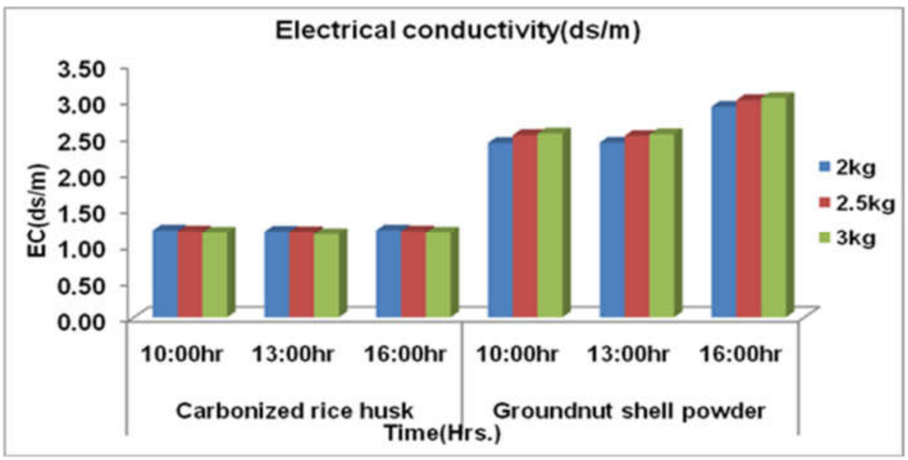
Thickness of CRH &GSPlayer	**Carbonized rice husk**			**Groundnut shell powder**		
	10 H.	**13 H.**	**16 H.**	**10 H.**	**13 H.**	**16 H.**
2 kg 5.0cm	1.35	1.35	1.36	1.82	1.82	1.79
2.5 kg 7.0cm	1.35	1.35	1.35	2.41	2.39	2.39
3 kg 10.0cm	1.20	1.21	1.24	3.68	3.68	3.70



Graph 5: EC (ds/m) of carbonized rice husk and groundnut shell powder for Savitri girl's hostel

Table 6: EC (ds/m) of carbonized rice husk and groundnut shell powder for Shivnenri boy's hostel

Thickness of layer	Carbonized rice husk			Groundnut shell powder		
	10 H.	**13 H.**	**16 H.**	**10 H.**	**13 H.**	**16 H.**
2 kg 5.0cm	1.20	1.18	1.20	2.41	2.41	2.91
2.5 kg 7.0cm	1.19	1.18	1.19	2.52	2.51	3.00
3 kg 10.0cm	1.17	1.15	1.17	2.54	2.53	3.03



Graph 6: EC (ds/m) of carbonized rice husk and groundnut shell powder for Shivnenri boy's hostel.

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