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Effect of Different Ashes on the Properties of Turbid Water

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Abstract - ***In this paper, the effect of different types of ashes namely cow dung ash, rice husk ash and saw dust ash on turbid water are evaluated. The turbid water is collected from the suburbs of Tirupati. The properties of the water sample is tested for both physical and chemical properties like pH, turbidity, TDS, chlorides, DO and BOD are estimated by suitable laboratory procedures. Suitable quantities of cow dung, rice husk and saw dust are collected and are converted to ash. These ashes are added to the water sample in varying proportions (0.5gm, 1.0 gm and 2.0gm) and the changes in the sample properties are recorded. Also, the properties of the samples are evaluated allowing different settling times (15min, 30min, 1hr and 2hr). Later the filtered water is tested for the physical and chemical properties. The variations in the properties are represented by means of suitable graphs. Comparative analysis is done by studying the variation in the properties by the addition of different ashes with different settling times.***

Key Words: *cow dung ash, rice husk ash, saw dust ash, raw water, settling time, dosage*.

1. INTRODUCTION

Water is the most common substance on Earth. It covers more than 70 percent of the Earth's surface. It fills the oceans, rivers, and lakes, and is in the ground and in the air. Water helps to keep Earth's climate from getting too hot or too cold. The demand for water is constantly increasing. Factories turn out more and more products, and need more and more water. Only about 3 percent of the world's water is fresh (unsalted). In spite of the recent urbanisation leading to efficient water treatment and water supply to all, there have been circumstances which put this arrangement at stake. Natural calamities can be cited as one of the potential sources leading to the shortage of water supply over a particular region endangering the lives of the people there. Hence, treatment of water is become essential and people need to use the treated water either for drinking or for irrigation purposes. This paper presents the usage of waste materials (ashes) to treat the turbid water for safe drinking for reuse.

Tont Flynn developed simple new technology and prepared water filters to be made from commonly available materials. The filters have been tested and shown to remove common pathogens including E-coli. Unlike other water filtering devices, these filters are made up of crushed clay with organic material such as used tea leaves, coffee grounds or rice hull. According to Mr Flynn, used coffee grounds have given the best results to date.
Alfred Rossnera et al. (2009) studied the effective removal of emerging contaminants of concern (ECCs) such as endocrine disrupting chemicals, pharmaceutically active compounds, personal care products, using one activated carbon, one carbonaceous resin, and two high-silica zeolites.

Pravin Nemade, Avinash M. Kadam (2009) prepaered constructed soil filter (CSF) used for water renovation. CSF combines sedimentation, infiltration and biodegradation processes to remove oxidizable organics and inorganics of wastewater in a single facility. The results show increase in dissolved oxygen levels, COD removal (from 352 mg/l to 20 mg/l); BOD removal (from 211 mg/l to 7.0 mg/l); suspended solids removal (from 293 mg/l to 16 mg/l); turbidity reduction (from 145 NTU to 5.3 NTU); iron (from 5 mg/l to 0.3 mg/l); arsenic (from 500 microg/l to 10 microg/l); total coliform and fecal coliform removal with desired pathogen levels.

Recently, Chairman of Tata Group, Ratan Tata, unveiled a water filter called 'Swach' (2009) (re.indiaenvironmentportal.org.in/files/tata-purifier.doc) which uses nano technology to purify water. Tata Research, Development and Design Centre (TRDDC) and Tata Chemicals have jointly developed the core technology. Swach is an advanced version of Sujal, launched around 2001-02 as a part of corporate social responsibility for Tsunami affected areas. Swach uses Rice Husk Ash (RHA) impregnated with nano (1×10^{-9}) silver particles for safe and clean water. Sujal also used RHA in combination with pebbles and cement.

Pankaj Singh et al (2014) studied on Fly ash which is used as adsorbent for the effective treatment of domestic wash water waste. They concluded that fly ash is a better option for the treatment of domestic wash water treatment and presented that the ideal dosage and time for the treatment of domestic wash water waste is 40g/L and 6 hours. A

considerable reduction in the TSS, BOD, Soap content and pH has been seen in the treated water is observed.

FV Adams and AF Mulaba-Bafubiandi (2014) carried out experiments using rice hull ash in removal of turbidity of the water. It is found from their studies that the turbidity has been removed up to 96% using rice hull ash.
Obiora-Okafo Ifeoma A. and Onukwuli O.D (2013) investigated on the effectiveness of granular activated carbon made from agricultural waste (sawdust) for the removal of Total Dissolved Solid Particles (TDSP) in wastewater from a brewery industry. They found that the sawdust activated carbon in acid (SACA) was found to be effective and economically viable adsorbent for TDSP adsorption.

Rice-husk-ash is used as the base material for developing novel compositions to deal with the challenge of purifying drinking water in low-income households in India. For example, rice husk ash cast in a matrix of cement and pebbles can be formed into a filtration bed which can trap up to 95% of turbidity and bacteria present in water. This innovation was proliferated in villages across India as a do-it-yourself rural water filter. Another innovation involves embedding silver nano-particles within the rice husk ash matrix to create a bactericidal filtration bed which has now been commercialized in India as a low cost for-profit household water purifier. Other innovations include the impregnation of rice husk ash with iron hydroxide for the removal of arsenic from water and the impregnation of rice husk ash with aluminium hydroxide for the removal of fluoride ions from water which together have the potential to benefit over 100 million people across India who are suffering from the health effects of drinking groundwater contaminated with arsenic and fluoride. Also, rice husk Ash has been widely used as an efficient filter aid to assist filtration of difficult to filter solid-liquid systems such as colloids, fine, highly compactable particular solids, or hard to be deliquored materials. Recent research on RHA showed very good adsorption properties of RHA regarding colour, odour, COD, BOD, and iron, copper, arsenic removal in certain water and wastewater applications.

2. RESULTS AND DISCUSSION

The water samples used in the present investigation were collected from water treatment plant at Mangalam in Tirupati. Six parameters have been used for assessment of the water quality before and after the addition of ashes. They are pH, Turbidity, Chlorides, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Total Dissolved Solids (TDS). These parameters are initially determined for the raw water sample without any treatment. Later, the required dosage of ash is added to the sample of 500ml of water and allowed the ash to dissolve for a stipulated time. Then, the water sample is filtered by means of a filter paper (Whatman filter paper grade 1). The insoluble material is filtered and the filtered water is consumed to conduct experimental verification. The preliminary results obtained for the raw water sample are given in Table 1.

	Domestic raw water standards	Raw water sample values
pH	6.5-8	8.2
Turbidity(NTU)	5-10	84
Chlorides(mg/l)	Upto 250	110
DO(mg/l)	5-6	8
BOD(mg/l)	0	161.2
TDS(mg/l)	500	460

Table 1 Parameters of raw water and standard drinking water samples

It is observed from the table 1 that the raw water sample has high amount of turbidity, DO and BOD. As explained earlier, the cow dung ash is added in turbid water (500ml) in different quantities i.e., 0,5gm, 1.0gm and 2.0gm. The ash mixed water allowed for 4 different retention timings such as 15min, 30min, 1 hour and 2 hours. Later, the ash mixed water is filtered. The filtered water is tested and the results are given in Table 2 for the cow dung ash.

Table 2 Variation of parameters for different dosages of cow dung ash

	0.5 gm				1.0 gm				2. 0gm			
	15min	30min	1hr	2hr	15min	30min	1hr	2hr	15min	30min	1hr	2hr
pH	8.6	8.6	8.4	8.58	8.6	8.8	8.81	8.7	9.10	9.12	8.80	8.85
Turbidity(NTU)	6.2	6.6	5	8.5	20	14.5	18	17	15	5.8	15	4.9
Chlorides(mg/l)	111.69	136.4	92.1	99.28	106.38	101.06	106.38	109.93	102.83	111.70	118.30	106.38
DO(mg/l)	8.3	8.5	8.7	8.4	7.7	8.2	8.3	8.3	8.3	8.7	8.1	8
BOD (mg/l)	13.2	1.2	12.2	0.2	38.2	48.2	32.2	30.2	30.5	29.5	51.8	31.5
TDS (mg/l)	280	300	260	250	434	446	460	420	476	442	368	294

Table 3 Variation of parameters for different dosages of saw dust ash

	0.5 gm				1.0 gm				2. 0gm			
	15min	30min	1hr	2hr	15min	30min	1hr	2hr	15min	30min	1hr	2hr
pH	8.54	8.45	8.38	8.45	8.7	8.72	8.58	8.57	8.6	8.64	8.57	8.55
Turbidity (NTU)	3.9	2.9	1.4	2.9	7.1	4.2	4.7	5	5.1	4.6	10	6.6
Chlorides (mg/l)	106.38	106.38	99.4	99.28	108.15	90.42	99.28	113.6	111.69	136.4	92.11	99.28
DO(mg/l)	8.9	10.2	8.9	8.9	9.5	9.5	8.8	8.6	8.3	8.5	8.7	8.4
BOD (mg/l)	0.5	21.5	4.5	0.5	8.5	26.5	1.5	9.5	0.5	5.5	11.5	10.5
TDS (mg/l)	532	432	306	322	480	446	414	409	364	442	400	420

Table 4 Variation of parameters for different dosages of rice husk ash

	0.5 gm				1.0 gm				2. 0gm			
	15min	30min	1hr	2hr	15min	30min	1hr	2hr	15min	30min	1hr	2hr
pH	7.5	7.37	7.36	7.51	6.67	6.62	6.54	6.68	8.3	8.43	8.5	8.2
Turbidity (NTU)	2.1	2.5	2.9	2.4	2	3.2	3	3.7	6.8	6.8	7	6.5
Chlorides (mg/l)	115.25	134.74	118.8	115.2	120.1	135.6	130.5	130	115.2	120.3	110.5	108.6
DO(mg/l)	8.9	9.6	8.6	7.9	8.6	7.5	8.3	8.5	8.5	8.2	7.9	9
BOD (mg/l)	20.5	25.5	25.5	16.5	18.5	14.4	17.5	12.5	18.8	8.2	7.9	9
TDS (mg/l)	282	426	392	264	600	540	500	450	442	426	370	295

From the above table 2, it is observed that with the addition of cow dung ash, there is a reduction of BOD and TDS. It is also found that the turbidity levels have been reduced drastically and near to standard value. But, the pH values slightly increased with the addition of cow dung ash dosage with respect to retention time. The turbidity values are increased with the increase in the dosage of cow dung ash. Not much variation found in the values of DO. It is found that there is no effect of dosage and retention time of cow dung ash on the chlorides. The reduction in turbidity is around 93% for 0.5gm and 15 minutes settling time. Similar result is observed for other dosages with change in settling time. BOD is also reduced effectively by the addition of cow dung ash and around 96% reduction in BOD is observed. Around 50% reduction is observed in the case of TDS on addition of cow dung ash.

From the table 3, it is observed that the turbidity levels have been reduced for one hour retention of 0.5 gm. Also it is observed that the properties of water such as chlorides, TDS have been reduced compared to the raw turbid water. But is found that the saw dust ash reduced the BOD values but not in the limits prescribed in standards. The reduction in turbidity is around 95% for 0.5gm and 15 minutes settling time. Similar result is observed for other dosages with change in settling time. BOD is also reduced effectively by the addition of saw dust and around 97% reduction in BOD is observed.

Table 4 shows the variation of properties of turbid water due to addition of rice husk ash. It is found that the turbidity drastically reduced and the pH values are in the standards. But found that the BOD values are slightly higher when compared the effect of other ashes. Not much variation in the properties is observed with the retention time of the ash with the turbid water. The reduction in turbidity is around 94% for 0.5gm and 15 minutes settling time. Similar result is observed for other dosages with change in settling time. BOD is also reduced effectively by the addition of cow dung ash and around 83% reduction in BOD is observed. Around 50% reduction is observed in the case of TDS on addition of rice husk ash. It is observed that among all ashes rice husk ash reduced the pH and turbidity effectively and the cow dung ash reduced BOD drastically. Hence, the combination of cow dung ash and rice husk ash will give a better result for the purification of raw water.

4. CONCLUDING REMARKS

The rice husk is more effective in reducing the turbidity compared to other ashes. Also, it maintained the pH value of the water. Additions of more ash (dosage), the TDS values are increased. Cow dung ash is found to be more effective in reducing the chlorides and BOD when compared to other ashes. Rice husk is effective in reducing pH also. Not much variation is observed in the values of DO on addition of ashes.

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