Comparative Study Using Rice Husk and Its Ash as Natural Coagulants in Waste Water Treatment

Anjitha.A , Duithy Goerge

Abstract
This study presents the usage of waste materials (ashes and non ashes) to treat the turbid water for safe drinking for reuse. The effect of rice husk ash and its dust on turbid water are evaluated. The properties of the water sample is tested for both physical and chemical properties like pH, turbidity, TDS,TSS,Elecrical Conductivity, and total solids are estimated by suitable laboratory procedures. Suitable quantities rice husk is collected and are converted to ash using Muffle Furnace at 500°C. This ash and dust added to the water sample in varying proportions (0.2 gm 0.4 gm 0.6gm 0.8 gm and 1 gm) and the changes in the sample properties are recorded. Also, the properties of the samples are evaluated allowing different settling times (15min and 30min). Later the filtered water is tested for the physical and chemical properties and the variations in the properties are noted. Comparative analysis is done by studying the variation in the properties by the addition of ash and non ash with different coagulation period.

Index Terms: rice husk, rice husk ash, settling time, dosage, turbid water

1.0 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 only about 3 percent of the world's water is fresh (unsalted). Eco-toxicity specifically from water sources on living organism has become a prime concern for the last few decades. Rapid industrialization and substantial urbanization has led the waste effluents to discharge directly in river water causing pollution to environment[1].The problem of water contamination is neither new nor limited to a particular geographical area. Variation of water quality in an area is a function of physical and chemical parameters that are greatly influenced by geological formations and anthropogenic activities. It is the world's burning issue, which needs to be given highest priority in order to save the future

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generations from serious water borne diseases. Water purification is one of the best ways to Problem. This paper presents the usage of waste materials (ashes and non ash) to treat the turbid water for safe drinking for reuse. 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[4].Also the paper assesses the effect of normal rice husk on the property of turbid water.

2. MATERIALS AND METHODOLOGY

2.1 Rice Husk

Rice husk from nearby rice mill was collected and washed using demonized water.The washed rice husks were sun dried for several hour till it completely loses the moisture content present in it. And this rice husk is placed in a muffle furnace at 500°c for 1 hour for converting it into ash. Both rice husk and rice husk are added to turbid water for testing.

Fig 1: Rice husk

Fig 2: Rice husk ash

2.2 Coagulation

Coagulation is an essential process in the treatment of both surface water and industrial wastewater. Its application includes removal of dissolved chemical species and turbidity from water via addition of conventional chemical-based coagulants, namely, alum ($AlCl_3$), ferric chloride ($FeCl_3$) and polyaluminium chloride (PAC).While the effectiveness of these chemicals as coagulants is well-recognized, there are, nonetheless, disadvantages associated with usage of these coagulants such as ineffectiveness in low-temperature water, relatively high procurement costs, detrimental effects on human health, production of large sludge volumes and the fact that they significantly affect pH of treated water. There is also strong evidence linking aluminium-based coagulants to the development of Alzheimer's disease in human beings. It is therefore desirable to replace these chemical coagulants with naturally obtained materials as coagulants to counteract the drawbacks[2].

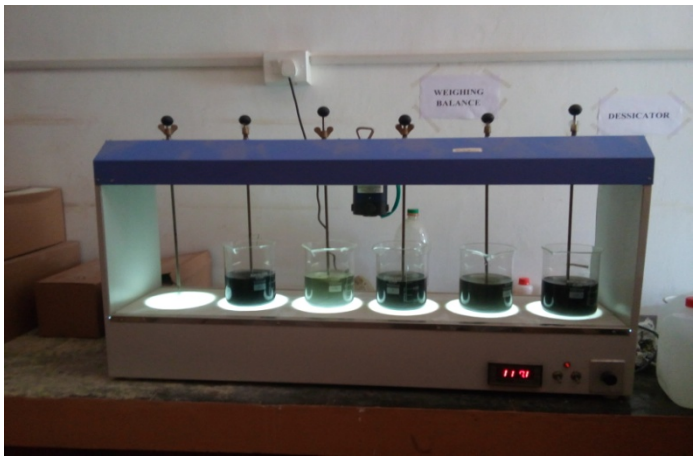

Fig 3: coagulation using jar test apparatus

Figure 3 shows the coagulation process using jar test apparatus. The rice husk and rice husk ash are added to the waste water for different dosage such as 0.2 gm, 0.4 gm, 0.6 gm, 0.8 gm and 1 gm and for the coagulation period of 15 min and 30 min.

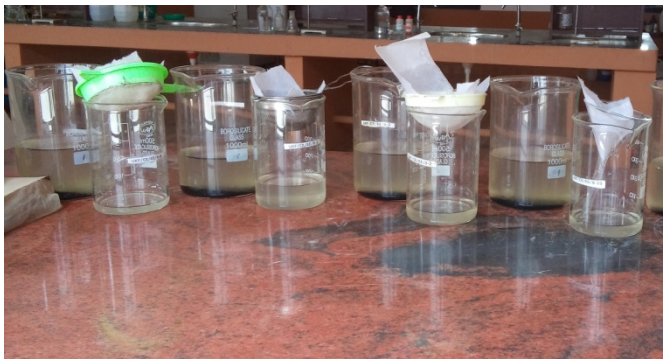

Fig 4: Filtarion process

After coagulation the samples are allow to settle for 15 min. Then the samples are taken for filtration. The filtration is done using normal grade filter paper. That filtered water only taken into further testing.

3. RESULTS AND DISCUSSION

The water samples are collected from nearby dairy industry. Four parameters have been used for assessment of water quality before and after the addition of rice husk and rice husk ash. They are pH, Turbidity, Electrical Conductivity and Total Solids. These parameters are initially determined for the raw water samples without any treatment. Later, the required dosage of rice husk and rice husk ash (0.2 gm, 0.4 gm, 0.6 gm, 0.8 gm and 1 gm) is added to the sample of 500ml of water and the samples are taken into for coagulation. After coagulation the samples are allowed to settle for 15 min and are filtered using normal filter paper. Table 1 gives the preliminary results obtained for raw water sample. From the table we can observe that the raw sample has high amount of turbidity and also other parameters are also high. Our main aim is removal of turbidity. As mentioned earlier the rice husk and rice husk ash is added in turbid water (500 ml) in different quantities. The result obtained is shown in the table 2 and 3.

Parameters	Domestic raw water standards	Raw water sample values
Turbidity(NTU)	5-10	105
pH	6.5-8	8.78
EC(μs/cm)	1500	5100
TS(mg/l)	500	3000

Table 1: parameters of raw water and standard drinking water samples

3.1. Effect of Rice husk

Table 2 and 3 given the variation of properties of turbid water due to addition of rice husk and rice husk ash. It is found that due to the addition of rice husk turbidity drastically reduced for varying dosage. The variation in the turbidity due to the addition of rice husk is shown in figure 5 and 6 for different settling time. Not much variation is obtained in pH values. The electrical conductivity and total solids are also reduced as compared to the raw water sample.

3.2. Effect of Rice husk ash

The addition of rice husk ash showed significant improvement compared to rice husk. Turbidity and pH of the water greatly reduced on the addition of ash. The variation in the turbidity by the addition of dosage is given in the figure 7 and 8. However, total solids and electrical conductivity remained unchanged by the rice husk and rice husk ash.

3.3. Effect of coagulation period

While increasing the coagulation period the percentage of turbidity removal also increasing. Here two coagulation periods are provided, 15 min and 30 min. From this it shows that at 30 min coagulation period more removal of turbidity is obtained. By adding the rice husk we obtained 84 % of turbidity removal. Whereas while adding the rice husk ash 95% of turbidity removal is obtained.

Parameters	15 min					30 min				
	0.2	0.4	0.6	0.8	1 gm	0.2	0.4	0.6	0.8	1 gm
Turbidity	92	90	82	81	81	56	56	49	38	35
pH	8.78	8.69	8.12	8.15	8.17	8.16	8.13	8.36	8.42	8.27
EC	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800
TS	2000	1000	1000	2000	2000	1000	2000	2000	1000	1000

Table 2: variation of parameters for different dosage of rice husk

Parameters	15 min					30 min				
	0.2	0.4	0.6	0.8	1 gm	0.2	0.4	0.6	0.8	1 gm
Turbidity	41	37	33	29	27	32	32	29	26	22
pH	7.31	7.42	7.51	7.96	7.41	7.89	7.91	7.41	7.32	7.91
EC	4700	4700	4700	4700	4700	4700	4700	4700	4700	4700
TS	1000	2000	2000	2000	1000	1000	2000	2000	2000	1000

Table 3: Variation of parameters for different dosage of rice husk ash

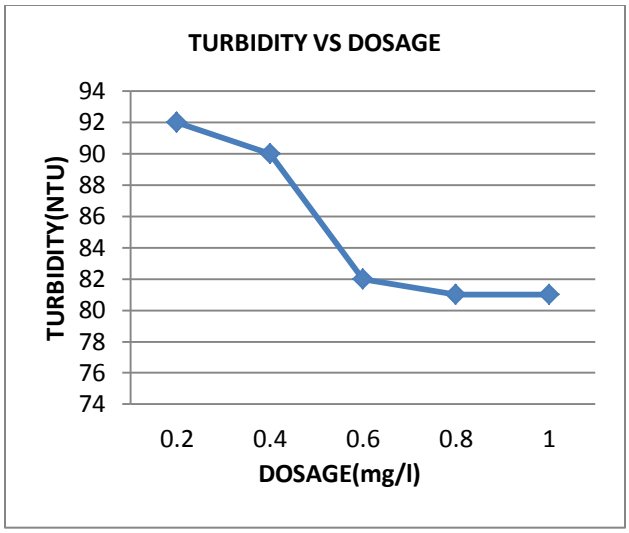

Fig 5: Graph shown the variation of turbidity for different dosage of rice husk for a coagulation period of 15 min

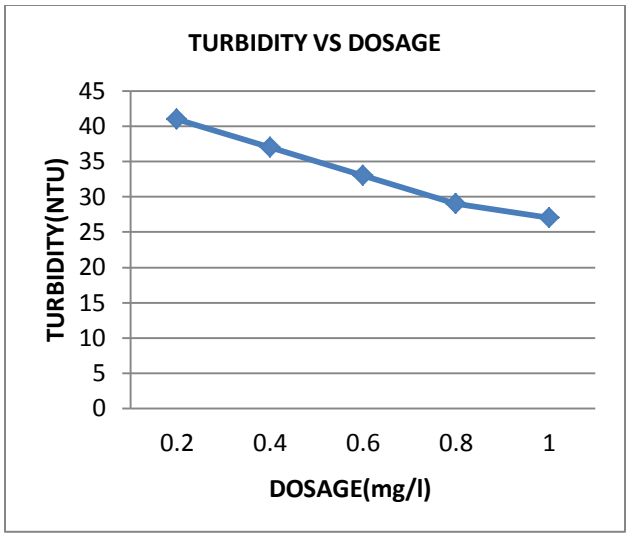

Fig 7: Graph shown the variation of turbidity for different dosage of rice husk ash for a coagulation period of 15 min

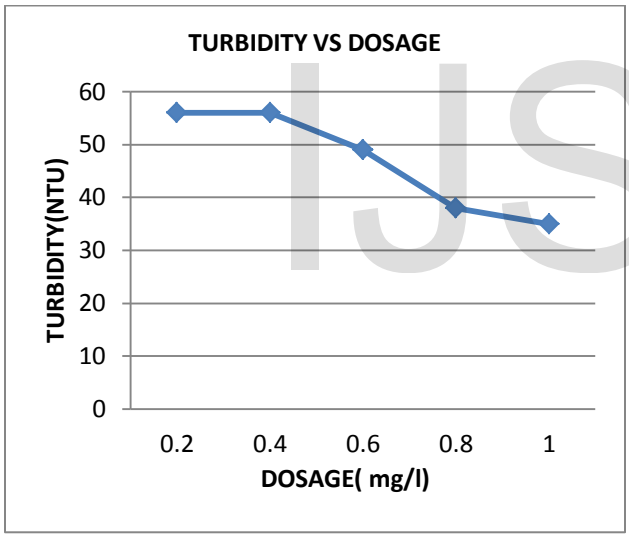

Fig 6: Graph shown the variation of turbidity for different dosage of rice husk for a coagulation period of 30 min

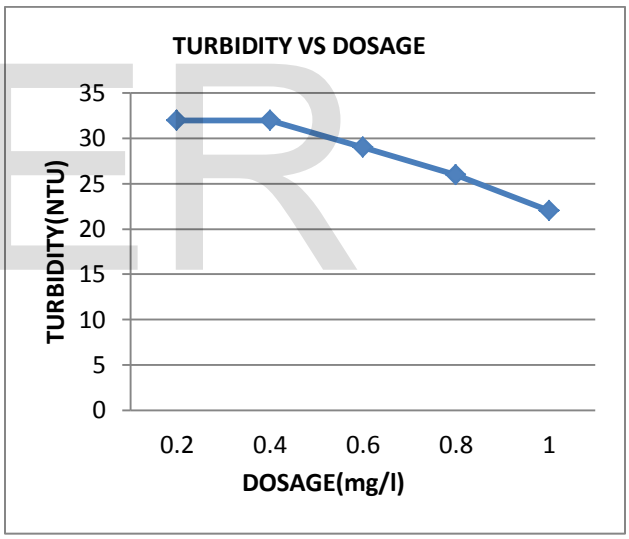

Fig 8: Graph shown the variation of turbidity for different dosage of rice husk ash for a coagulation period of 30 min

4. CONCLUSION

Four number of jar tests were conducted with ash and non ash of rice husk to analyze four parameters pH, turbidity, electrical conductivity and total solids. Results showed that there was a significant reduction in turbidity and pH when rice husk ash was used. The turbidity removal improved further with increased coagulation time. The results of the study indicate that naturally obtained substances can be used as effective coagulants instead of chemicals

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