Ayurvedic Pharmaceutical Waste Water Treatment Using Rice Husk Ash

Aleena K Jose, Anjitha K S, Akhil A R, Arjun Krishna K A

Abstract— Ayurvedic medicines are growing in popularity worldwide. A huge amount of water is used in pharmaceutical production and it becomes toxic after use. Ayurvedic pharmaceutical industries have become the major contributors of water pollution nowadays. The main reason is the usage of herbs, synthetic chemical in the manufacturing process. Chemical used include alcohol, sugar gelatin, lactose, mineral salts, clay, different organic solvents and also include different alkaloids. Characterization of this wastewater revealed Chemical oxygen demand 1000 mg/L, Biochemical oxygen demand 392 mg/L, Total dissolved solids 1360 mg/L etc. Pharmaceutical waste water can be treated easily by using adsorption methods. Rice husk is an attractive bio-based adsorbent material for pollutant removal since it is one of the low-cost and renewable resources. In this study, rice husk ash (RHA) was used as adsorbent in batch study to remove contaminants and we analysed the removal efficiency of BOD and COD hence we determined the removal efficiency of RHA as an good and inexpensive adsorbent.

Keywords —Adsorbents**,** Adsorption, Ayurvedic pharmaceutical waste water, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Rice husk, Rice husk Ash (RHA).

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1 INTRODUCTION

This paper shows Ayurvedic pharmaceutical waste water treatment by using Rice Husk Ash. Nowadays water pollution from organic wastewater has become a serious issue. It is important to prevent this water contamination. Waste management is the activities and actions required to manage waste from its inception to its disposal. Ayurvedic pharmaceutical industries are among the leading pharmaceutical industries worldwide. The presence of these organic compounds in water posess serious threat to public health since most of them are toxic, potentially carcinogenic to humans, animals and aquatic life in general. Though the Product of these industries is based on herbs, synthetic chemicals are also used in the manufacturing process. Ayurvedic pharmaceutical industries produce a huge amount of high strength wastewater, and it cannot be discharged directly into the surface water, as it decomposes very fast.Adsorption is an effective method for removal of organics and colour from waste effluent.According to abundant literature data, adorption is one of the physicochemical treatment processes that has become well-established and is a powerful technique for the removal of aromatic compounds from aqueous solutions since proper design of the adsorption process will produce a high quality treated effluent [4]. Recent researches and studies have shown that treatment of pharmaceutical waste water by rice husk ash techniques can offer a good opportunity to prevent and remedy pollution problems due to strict environmental regulations.

2 MATERIALS AND METHODS

2.1 Material

Materials used for the treatment of ayurvedic pharmaceuticals are; ayurvedic medicines, water, Rice Husk Ash (RHA).

2.1.1 Rice Husk Ash

Rice Husk, which is a relatively abundant and inexpensive material. It is formed from hard materials, including silica and lignin, to protect the seed during the growing season.Good adsorbent for the removal of various pollutants from water.RHA that contains a high amount of carbon after the burning process.various pollutants, inorganic anions and heavy metals can be removed very effectively with RHA as an adsorbent.

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2.1.2 Ayurvedic medicines

In this experiment we use four samples of different concentrations.The concentrations are;

Ayurvedic medicines	Sample 1	Sample 2	Sample 3	Sample 4
Rasnadichoornam	0.025g	0.05g	0.075g	0.1g
Asokarishtam	2ml	4ml	6ml	8ml
Dhwanatharam gulika	0.1g	0.2g	0.3g	0.4g
Pathyakshadthradi kashayam	0.1g	0.2g	0.3g	0.4g
Yogaraja guggulu vatika	0.1g	0.2g	0.3g	0.4g

2.2 Methods

2.2.1 Jar test

A laboratory procedure that stimulates coagulation with differing chemical dosage.The purpose of the procedure is to estimate the minimum coagulant dose required to achieve certain water quality goals. Jar tests are conducted on a four- or six-place gang stirrer, which can be utilized to simulate mixing and settling conditions in a clarifier.

Samples of synthetic waste water to be treated are placed in four jars. Various amounts of RHA are added to each jar, stirred, and the settling of solids is observed.

2.2.2 Experimental set up

Samples of synthetic waste water to be treated are placed in four jars. Various amounts of Rice husk ash are added to each jar, stirred, and the settling of solids is observed.And the adsorbent dosage are 0.4g,0.6g,0.8g,1g for sample 1,sample 2,sample 3,sample 4 respectively as shown fig. 1.

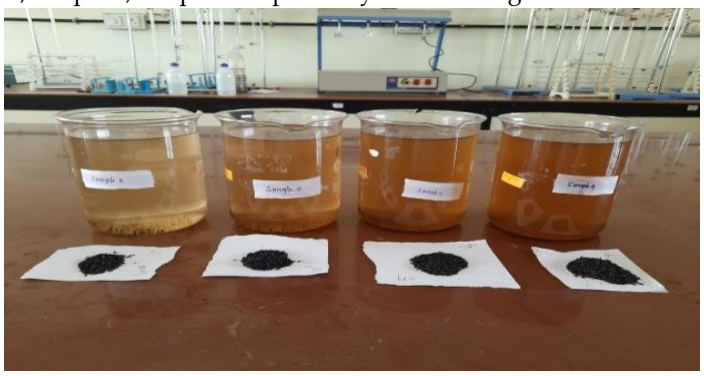


Fig. 1 Synthetic waste water with respective adsorbent.

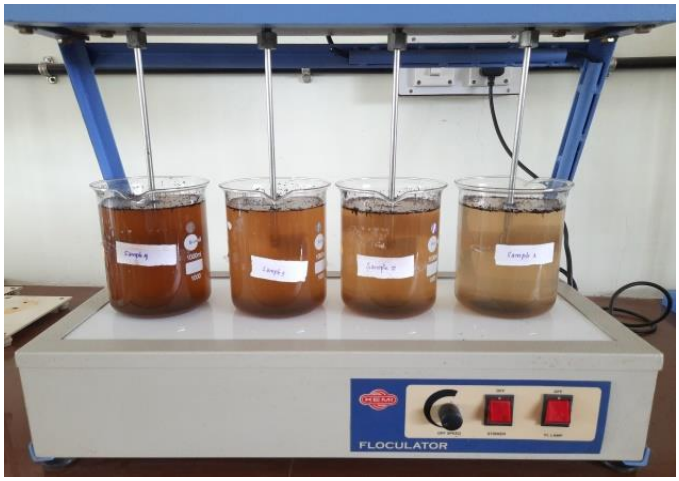


Fig. 2 Working of flocculator Jar test conducted at 30rpm speed for 60 minutes and the adsorbent dosage are 0.4g, 0.6g, 0.8g, 1g for each sample respectively.

Stirred at 30rpm speed for 60 minutes as shown in fig 2, and settling of solids is observed at 60 minutes.After 60 minutes, filter the samples are shown in fig 3 and test the characteristics of treated synthetic waste water solution.Find the removal efficiency of characteristics.The waste water treatment happened when the characteristics value become less than initial characteristics value.

Fig. 3 Filtration of treated synthetic waste water

After the jar test the samples are observe for the settling of solids for 60 minutes and after 60 minutes filter each of samples for checking removal efficiency of parameters.

3 RESULTS AND DISCUSSIONS

3.1 Results

3.1.1 Test results before treatment

Prepare synthetic waste water with rasnadi choornam, asokarishtam, yogaraja guggulu vatika, etc.then check the

characteristics of synthetic waste water.The characteristics of synthetic waste water are shown in table 1.

TABLE. 1 Test results before treatment

Parameters	units	Test results of samples			
		1	2	3	4
pH		4	3.8	3.3	3.1
Turbidity	NTU	9	11.97	13.40	26.37
Conductivity	µs	160.2	225.7	279.2	356.3
COD	Mg/L	8372	15652	21476	44772
BOD	Mg/L	7500	6500	7980	8500

In this test results sample 1 has higher pH value and lowest pH is for sample 4.Turbidity is higher for sample 4 and lowest value for sample 1. For conductivity is higher for sample 4 and least for sample 1. In COD & BOD values are higher for sample 4 and least value for sample 1.

3.1.2 Test results after treatment

TABLE. 2 Test results after treatment

The synthetic waste water mixed with Rice Husk Ash and do the jar test at 30rpm speed for 60 minutes and the adsorbent dosage are 0.4g, 0.6g, 0.8g, 1g for each sample respectively and after the jar test take 60 minutes for settling of solids then we filter the treated synthetic waste water and the test results are shown in table 2.

Parameters	units	Test results of samples			
		1	2	3	4
pH		6	5.02	4.66	4.58
Turbidity	NTU	4.7	11.21	10.76	24.32
Conductivity	µs	315.7	500	671.3	774.9
COD	Mg/L	7452.8	1192.5	6463.1	20600
BOD	Mg/L	2400	5100	3210.6	8500

After the jar test and filtration test result are shown in table 2 from this the pH value is higher for sample 1 and lowesrt for sample 4 .Turbidity value is lowest for sample 1 and higher for sample 4, Conductivity values is higher for sample 4 and lowest value for sample 1, COD & BOD values are higher for sample 4 and lowest for sample 1.

3.1.3 Removal efficiency of BOD and COD

Biological Oxygen Demand and Chemical Oxygen Demand are two of the important parameters use to find the characteristics of wastewater. The COD measures all type of organic matters and BOD only measures organic matter which is biologically degraded. The amount of waste removed in percentage format is given.

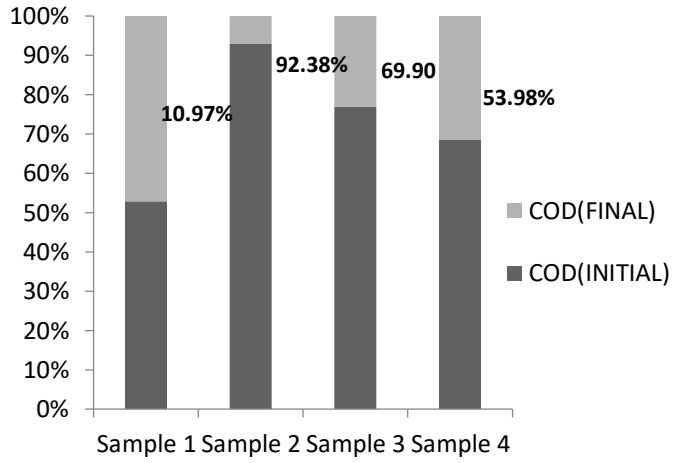
TABLE. 3 Removal efficiency of BOD & COD

The higher COD efficiency for sample 2 the value of efficiency is 92.38% and for BOD higher efficiency for sample 2 value of removal efficiency is 68%.

Removal efficiency	Sample 1	Sample 2	Sample 3	Sample 4
COD	10.97%	92.38%	69.90%	53.98%
BOD	68%	21.53%	59.76%	39.57%

3.1.4 Graphical representation of removal efficiency of COD

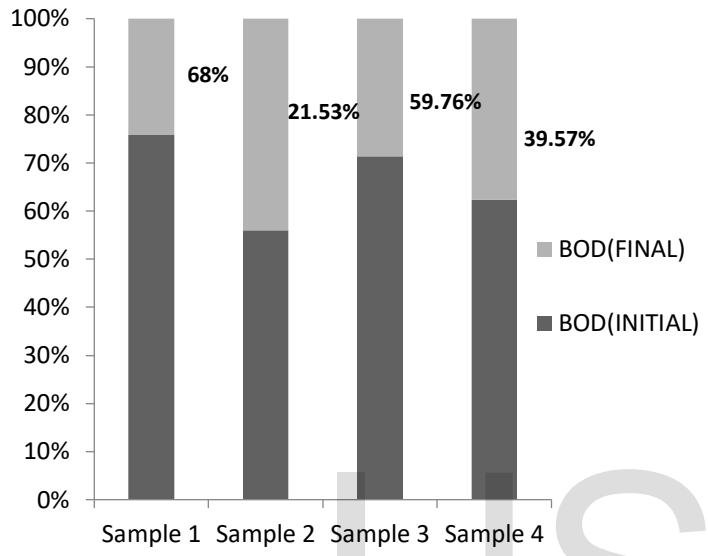
Graphical representation of removal efficiency of COD is given,



This graph shows the removal efficiency of COD, in which the x axis shows the samples 1, 2, 3 and 4 and y axis shows the COD value.Highest removal efficiency is in the sample 2, the value is 92.38%. The amount of waste removed in percentage format.

3.1.5 Graphical representation of removal efficiency of BOD

Graphical representation of removal efficiency of BOD is given,



This graph shows the removal efficiency of BOD,the highest removal efficiency is in the sample 1,value is 68%. The amount of waste removed in percent format.

3.2 Discussion

From this analysis the obtained results such as the effect of pH is greater for sample 1 with adsorbent dosage 0.4g, effect of conductivity is greater in sample 4 with adsorbent dosage 1g, highest removal efficiency of BOD in sample 2 with adsorbent dosage 0.6g,highest removal efficiency of COD in sample 1 with adsorbent dosage 0.4g.

4 CONCLUSION

Thus the present study, reviewed the various pollutants present in pharmaceutical wastewater and its harmful effects on the environment. Adsorption was proved to be efficient and inexpensive method for treating these pollutants. By using RHA as an adsorbent it was found that the material is effective in removing the impurities to a considerable amount. It was demonstrated from the literature that RHA has been used as a potential low-cost adsorbent material for the removal of various pollutants from wastewater. From the test results before and after the treatment the removal efficiency of COD and BOD are calculated. And the graphical representation of removal efficiency of COD and BOD are also plotted.The highest removal efficiency of COD is in the sample 2,the value is 92.38%.And highest removal efficiency of BOD is in the sample 1, the value is 68%. From which concluded that RHA is used as an inexpensive adsorbent for the treatment of ayurvedic pharmaceutical waste water to a considerable amount.

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