TREATMENT OF DAIRY WASTE WATER USING NATURAL LOW COST ADSORBENTS

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Article Info
Article history:
Received 25 January 2019
Received in revised form
20 February 2019
Accepted 28 February 2019
Available online 15 March 2019

Keywords
Ricehusk, Redmud, Fly ash,Chemicals
Sugarcane baggaseash .

ABSTRACT
The aim of the project is to investigate the technicial feasibility of treating dairy waste waterWith natural low cost adsorbents available. .It responds to the need of controlling industrialPollution resulting from diary waste water, which is currently discharged into sewer systemsAnd open areas without treatment, causing high organic loads and septic degradation. Effulentfrom milk processing unit contains soluble organic, suspended solids, and trace organicsrealising gases, causing taste and ordour,and imparting colour and turbidity producing as aresult of high consumption of water from the manufacturing process, utilities and servicesection, chemicals, and residues of technological activites used in the individual operationswhich make it crucial matter to be treated for preserving the aesthetics of the environment. In this experimental study after determination of the initial parameters of the raw wastewateIt was subjected to batch adsorbtion study using natural low cost adsorbents. Comparative study of different low cost adsorbent in treatment of wastewater from dairyIndustry is carried out, the goal being to remove organic pollutants and procuderswaterThat can be reused in the production process this study focus on removal of BOD, COD, Turbidity,TOC, Conducivity, and pH in the wastewater of diary industry by using ricehusk,Flyash, redmud ,sugarcane baggase ash .

INTRODUCTION

Industrialization is the backbone for development of country.The caused by the industrial sector is a serious concern in through the world .All industrial activities the food sector have one of the consumption of water and are one of the biggest effluents.

The diary industry is example of this sector diary industry is one of the major food industry in India, and India ranks first among the maximum milk producing nation. The diary industry is one the major source of waste water. The liquid waste from diary industry originates from various section namely from the receiving station ,bottling station ,cheese plant ,butter plant, casein plant, condensed milk plant , dried milk plant and ice creamed plant. Waste also comes from washing silos and milk processing plants.

Effluents from milk processing units discharged into water bodies or simply to the land disturbs the ecological balance deteriorates the water quality and also promotes eutrophication. Diary water consume large amount of water from the manufacturing process. Large amount of water also used to clean the processing equipment which further add to the quantity of waste water generated. Diary waste which is generated is organic in nature and also rapid oxygen depletion if the waste is directly released into the river stream without being treated by the process or self-purification. Different types of biological process are adopted for the treatment of diary waste such truckling filter, activated sludge process, oxidation ponds etc.

Worldwide water demand is increasing day by day due to rapid population and industrial growth, and on the other hand there is continuous decline in ground and surface water due to over exploitation. Efforts or being made to find the alternatives for water supply and one prominent solution is treatment and re- use of industrial wastewater. The diary industry involve processing or raw milk into products such as milk, yogurt, cheese, etc. And generate lot of wastewater which contains very high concentration of organic substance such as proteins, carbohydrates, and lipids. Many technologies are in practice to treat the diary wastewater and in the present study. An attempt was made investigate the application of low cost adsorbent.

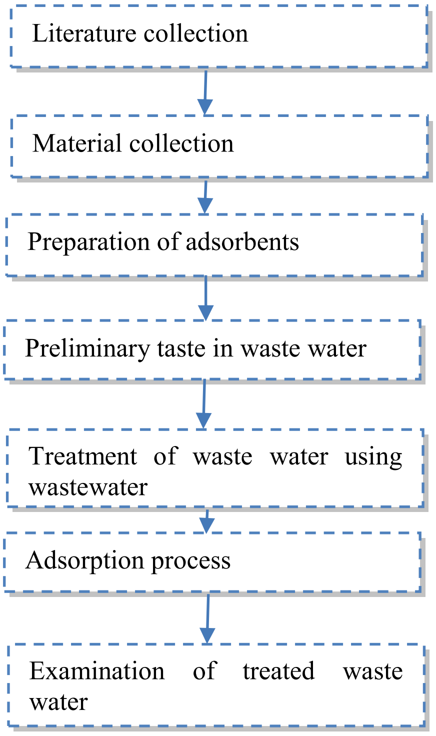
1.2 OBJECTIVE

1) To study the characteristics of collected diary effluent.
2) To investigate the feasibility of natural low cost adsorbents.
3) To compare the low cost adsorbents with commercially available adsorbents.
4) To study the various parameter such as pH effect, initial concentration, adsorbent dose, contact time, temperature effect of treated water.

SCOPE

1) Environmental pollution control of dairy waste water.
2) Procedure adopted should be simple & industries (diary) are affected to use this techniques for waste water treatment.
3) Removing of organic matter by adsorption techniques & reduction of B.O.D., C.O.D., increase of pH of natural water.
4) Space requirement for the process should be as less as possible & without much infrastructures requirement.

2. METHODOLOGY



3. MATERIALS AND METHODS

3.1 Preparation of Rice Husk Adsorbent

The rice husk used was obtained from a nearby rice mill in Salem,India.It was washed repeatedly with doubledistilleg water to remove dust and soluble impurities, and this was followed by drying in the sunlight for 24h.It was sieved sing meshes to get the desired adsorbent size of 30 micrometers and stored in an air tight container.

3.2 Preparation Of Red Mud Preparation

Samples of red clay are collected and washed several times with distilled water and then dried for 48 hours in an oven 100^{o}c to remove the moisture content.The collected samples are sieved through 600 m and then directly used as bio sorbent in the experimental investigations.

3.3 Preparation Of SugercaneBaggase Ash (SBA) Adsorbent

The sugarcane baggese as (SBA) was collected from a sugar industry in Erode. It was washed with distilled water to remove dirt and suspended impurities and then dried for 48 hours in a oven at 100 ^{o}c to remove the moisture content.After the drying process, it was removed from the oven and kept in sunlight for one day and sieved to 600 m.Sieved material is collected for future use.

3.4 Preparation of Fly Ash Adsorbent

Samples of fly ash clay are collected and washed several times th distilled water and then dried for 48 hours in an oven at 100 ^{o}c to remove the moisture content.The collected samples are sieved through 600 m and then directly used as bio sorbent in the experimental investigations.

Avoid writing long formulas with subscripts in the title; short formulas that identify the elements are fine (e.g., “Nd–Fe–B”).

4. EXPERIMENTAL METHODS

4.1 Determination of pH

pH determination is the measurement of acidity or basicity of the aqueous solution.

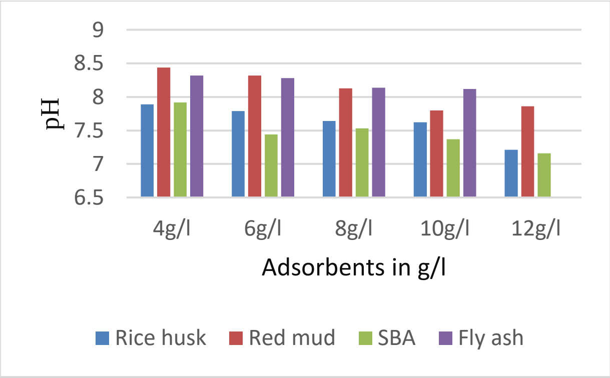


Fig 4.1 Graphical representation of variation in pH value

sss

4.2 Determination of Turbidity

When light is passed to a sample having suspended particles. The scattering of the light or absorption of lightis generally proportional to the turbidity. The turbidity of the sample is thus measured from the amount of light is scattered by the scattered by the sample taking a reference with standard turbidity suspension.

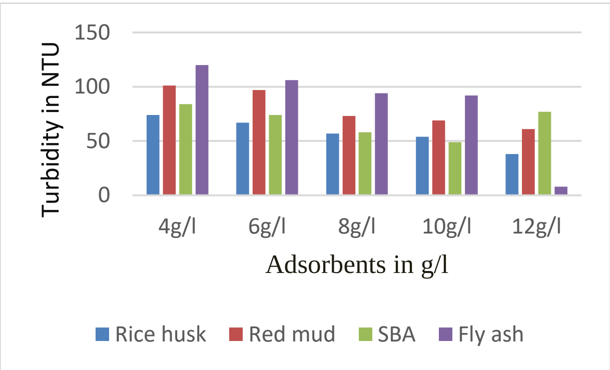


Fig 4.2 Graphical representation of variation in turbidity

4.3 Determination of Solids

Total solids are determined as the residue left after evaporation and drying the unfiltered sample.

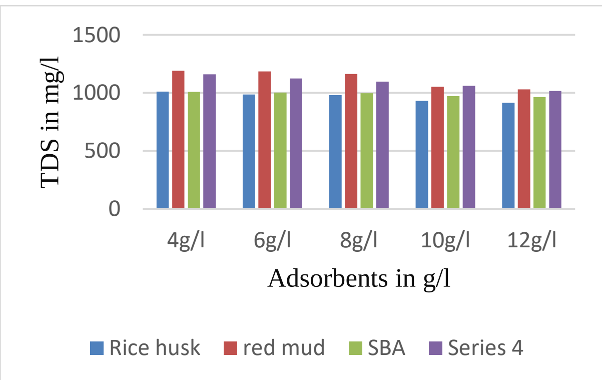


Fig 4.3(a) Graphical representation of variation in TDS

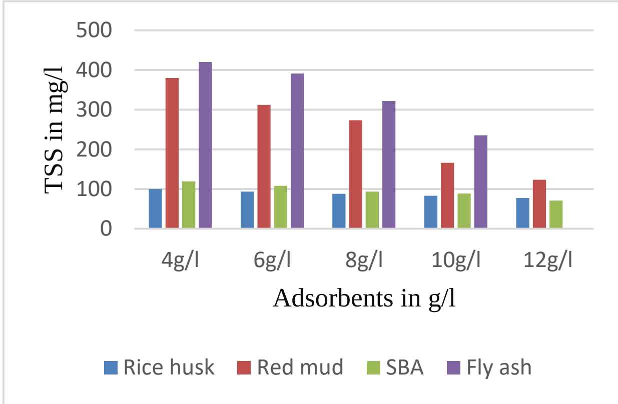


Fig 4.3(b) Graphical representation of variation in TSS

4.3 Determination of Hardness

Take the sample of 20ml in a conical flask and add 2ml of ammonia buffer solution. Adding erichrome black T indicator followed by buffer solution and the solution becomes wine red in colour. Titrate the above solution against EDTA solution taken in a burette. The end point is the appearance of blue colour.

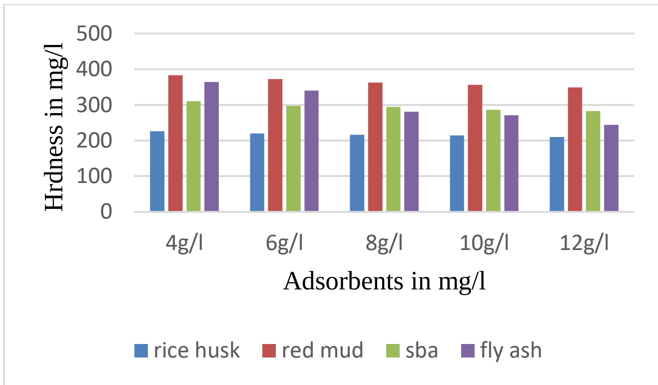


Fig 4.3 Graphical representation of variation in hardness

4.4 Determination of BOD

The dissolved oxygen content of the sample is determined before and after 5 days incubation. The amount of oxygen depleted is calculated as BOD. Sample devoid of or containing less amount of oxygen is diluted several times with a special type of oxygen dilution water saturated with oxygen , in order to provide sufficient amount of oxidation.

Take the sample, dilute it with dilution water. Take the diluted sample in 2 BOD bottles. Immediately find DO of the diluted wastewater sample and dilution water. Incubate the other 2 BOD bottles for 5 days. They are to be tightly stopper to prevent any air entry in to the bottles. Determine the dissolved oxygen content in the bottles at the end of 5 days.

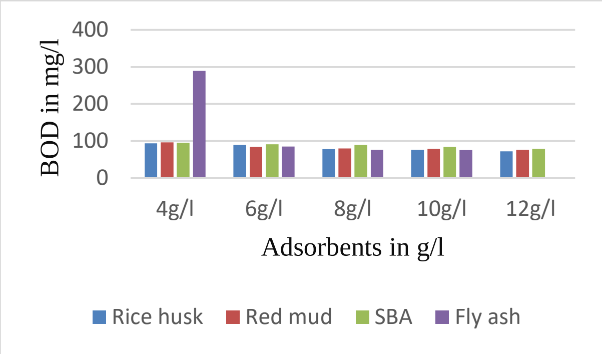


Fig 4.10 Graphical representation of variation in BOD

4.5 Determination of COD

After dilution of 10ml of sample in a COD bottle and add 1 pinch of mercury sulphate and 1 pinch of silver nitrate in to it. Add 5ml of potassium dichromate solution in to the above solution. Add 5ml of potassium dichromate solution in to the above solution. Add 5ml of concentrated sulphuric acid in to it. Allow the solution in the room temperature for some time. Heat the solution for 2 hours in the COD apparatus. After cooling add 40ml of distilled water into it. Titrate the solution against ferrous ammonium sulphate use fermion as indicator. The end point is the appearance of wine red colour.repeat the same procedure for blank solution.

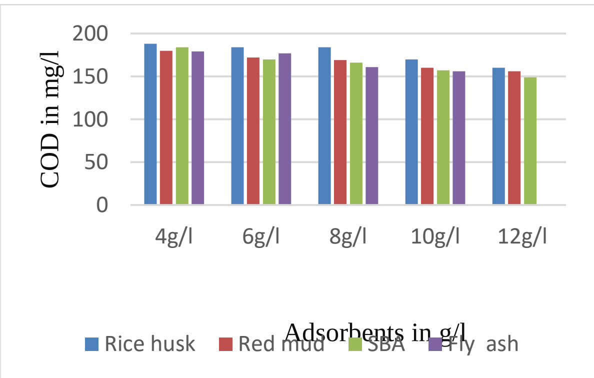


Fig 4.11 Graphical representation of variation in COD

4.6 Dissolved Oxygen

Take the BOD bottle and collect 300ml of water sample in to it. Add 2 ml of manganese sulphate and 2ml of alkali iodide-azide solution to the BOD bottle. The tip of the pipette should be below the liquid level while adding these reagents. Restopper with care to exclude air bubbles and mix by repeatedly inverting the bottle 2 to 3 times. If no oxygen is present, the manganese ion reacts with hydrogen ions from white precipitate of $Mn(OH)_2$.

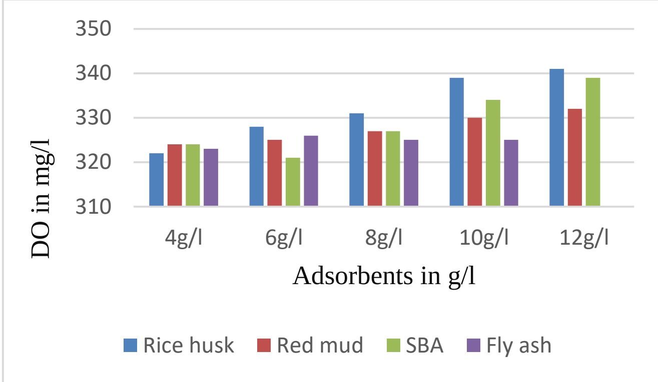


Fig 4.12 Graphical representation of variation in DO

4.6 Determination of Chlorides

Chloride is determined in a natural or slightly alkaline solution by titration with standard silver nitrate, using potassium chromates an indicator. Silver chromate is quantitatively precipitated before red silver chromate is formed.

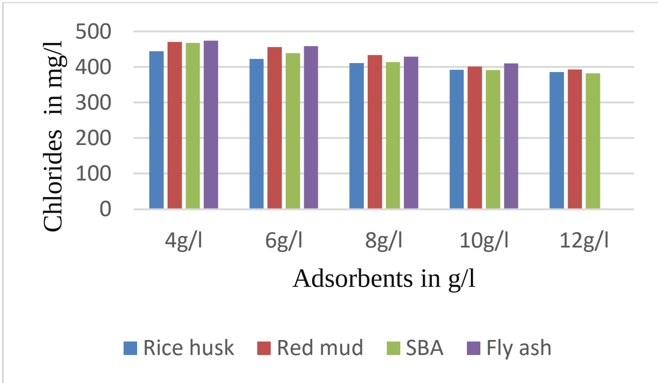


Fig 4.13 Graphical representation of variation in chlorides .ss

4.7 Determination of Sulphate

Sulphate ions are precipitated as $BaSO_4$ in acidic media (HCl) with Barium Chloride. The absorption of light by this precipitated suspension is measured by spectrophotometer at 420 nm or scattering of light by Nephelometer.

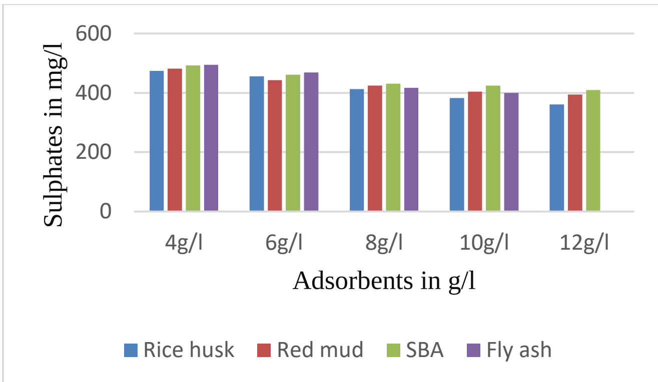


Fig 4.14 Graphical representation of variation in sulphates

5. CHARACHTERISTICS OF EFFLUENT

6. Table 5.1 Characteristics Of Diary Effluent

PARAMETERS	VALUE	NORMAL WATER STANDERDS AS PER IS10500:2012
Appearance	White	Colourless
Odour	Strong butyric acid	None
pH	9	6.5-8.5
Turbidity(NTU)	610	5.0
Total dissolved solids(mg/L)	320	500
Total suspended solids(mg/L)	760	100
Total hardness as $CaCo_3$(Mg/L)	860	200
Dissolved oxygen (mg/L)	354	75
BOD(mg/L)	440	50
COD(mg/L)	950	100
Chlorides(mg/L)	756	250
Sulphates(mg/L)	820	200

Table 5.2 Characteristics Of Treated Effluent Using RiceHusk

Parameters	4g/l	6g/l	8g/l	10g/l	12g/l
Appearance	colourless				
Odor	Slightly bad odor	accept able			
pH	7.89	7.79	7.64	7.62	7.21
Turbidity(NTU)	74	67	57	54	38
Total dissolved solids(mg/L)	1010	987	981	930	915
Total suspended solids(mg/L)	100	94	88	83	78
Total Hardness as $CaCo_3$(mg/L)	226	220	216	214	210
BOD(mg/L)	94	89	78	76	72
COD(mg/L)	188	184	184	170	160
DO(mg/L)	322	328	331	339	341
Chloride(mg/L)	444	423	411	392	386
Sulphates(mg/L)	474	456	412	382	361

Table 5.3 Characteristics Of Treated Effluent Using Red Mud

Parameters	4g/l	6g/l	8g/l	10g/l	12g/l
Appearance	colourless				
Odor	Slightly bad odor	acceptabl e	-	-	-
pH	8.44	8.32	8.13	7.8	7.86
Turbidity	101	97	73	69	61
Total dissolved solids(mg/L)	1190	1184	1163	1054	1030
Total suspended solids(mg/L)	380	312	274	166	124
Total Hardness as $CaCo_3$(mg/L)	383	372	363	356	349
BOD(mg/L)	96	84	80	79	76
COD(mg/L)	180	172	167	160	156
DO(mg/L)	324	325	327	330	332
Chloride(mg/L)	471	456	434	401	393
Sulphates(mg/L)	481	443	424	404	394

Table 5.4 Characteristics Of Treated Effluent Using SBA

Parameters	4g/l	6g/l	8g/l	10g/l	12g/l
Appearance	colourless				
Odour	Slightlybad odour	accept able			
pH	7.92	7.74	7.5 3	7.3 7	7.1 6
Turbidity(NTU)	84	74	58	49	77
Total dissolved solids(mg/L)	1008	1003	998	972	963
Total suspended solids(mg/L)	120	108	94	89	71
Total Hardness as $CaCo_3$(mg/L)	310	297	294	286	283
BOD(mg/L)	95	91	89	84	79
COD(mg/L)	184	170	166	157	149
DO(mg/L)	324	3216	327	334	339
Chloride(mg/L)	468	439	414	391	382
Sulphates(mg/L)	492	461	431	424	409

5.5 Characteristics Of Treated Effluent Using Fly Ash

Parameters	4g/l	6g/l	8g/l	10g/l	12g/l
Appearance	colourless				
Odour	Slightly bad odour	acceptable			
pH	8.32	8.28	8.14	8.12	7.92
Turbidity(NTU)	120	106	94	92	89
Total dissolved solids(mg/L)	1160	1125	1098	1060	1018
Total suspended solids(mg/L)	420	391	322	236	198
Total Hardness as $CaCo_3$(mg/L)	364	340	281	271	244
BOD(mg/L)	289	85	76	75	71
COD(mg/L)	179	177	161	156	153
DO(mg/L)	323	326	325	325	327
Chloride(mg/L)	474	459	429	410	398
Sulphate(mg/L)	494	468	417	399	391

6. CONCLUSION

Colour and odour removal is highly efficient by using all the adsorbents by increasing the dosage.pH of the collected diary effluent is 9 and is reduced 7.21 for rice husk 7.86 for red mud 7.16 for sugarcane baggase ash and 7.92 for fly ash at the adsorbent dosage of 12g/l.Removal of efficiency of the turbidity and total suspended solids are 71% and 85% using rice husk and sugarcane baggase ash adsorbents.

Removal efficiencies of parameters like BOD,COD is more than 70% from waste water in all adsorbents.DO of the collected diary effluent is 320mg/l and is increased to 341mg/l for rice husk ,332mg/l for red mud ,339mg/l for sugarcane baggase ash for 339 and 327 for fly ash at the adsorbent dosage of 12mg/l.Hardness of the collected effluent is 860mg/l and is reduced to 210 mg/l for rice hisk,349 mg/l for red mud,283mg/l for sugarcane baggase ash and 244mg/l for fly ash at the adsorbent dosage of 12g/l.Chlorides and sulphates are removed to a maximum limit of 55% and 60% using rice husk and sugarcane baggase ash adsorbent.

Odour removal of the waste water is best in all adsorbents.Moreover it is a cost effective process since it is a cheaply availablerawmaterial.Hence the present study shows that rice huskandsugarcanebaggase ash adsorbent can effectively used when compared to the red mud and fly ash adsorbent.Treated water can be used as recyclable water.

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