

Treatment of Distillery Effluent Using Activated Charcoal, Fly Ash, Wood Ash for Irrigation Purpose

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Abstract: Adsorbent treatment of distillery effluent has great potential as a sustainable method as it is a low cost method. The aim of this investigation is to study the adsorbent treatment method for purification of distillery spent wash. For this, the study encompassing evaluation of reduction of various physico chemical parameters (pH, COD, TS, TDS, Ca, Mg, Na and K) of distillery spent wash in response to treatment by using activated charcoal, fly ash and wood ash was performed. Treatment efficiency of used adsorbents against distillery spent wash was checked by passing through the adsorbent column. The distillery effluent was acidic (pH 4.7) and brownish yellow in color which often cause psychological fear in farmers for utilization as irrigation water. It has a high value of COD (3989 mg/ml), TS (4800 mg/ml) which is greater than its value. Activated charcoal treatment of 50% spent wash exhibited maximum reduction in COD, TS, TDS, Mg, Na, Ca and increase in pH toward pH 7. Treated spent wash showed a good growth of wheat seeds.

Keywords: Absorbent, Spent wash, Activated charcoal, Fly ash, Wood ash.

I. INTRODUCTION

Rapid industrialization and ever increasing population has resulted in the deterioration of air, land, and water quality, various pollutants produced by the human reach. The aquatic system directly or indirectly result in cumulative pollution of our environment, thereby deteriorating the water quality and possessing potential menace to the health of mankind. Today India is counted amongst the first ten industrialized countries of the world. Presently the country has developed a sound base in several core industries like petroleum, pulp and paper, metal, chemical, textiles fertilizers and beverages industries etc. The fermentation industry including distilleries, breweries and malteries are possessing serious environmental threat throughout the world. Molasses based industries generate an average of fifteen liters of water called spent wash\ liter alcohol produced. This waste water is characterized by high organic matter and dissolve solids, BOD, COD, pH and dark brown color with a foul smell. Because of higher COD and BOD values distillery effluent create toxic condition in the receiving stream by immediate depletion of oxygen which cause massive destruction of aquatic flora and fauna. The offensive odor spreads over few kilometers and results in serious public health hazards. So there is a greater need to treat industry effluents. Among physico- chemical treatment method absorption appears to be promising for the removal of heavy metals and other toxicant from waste effluents. The removal of organic material onto low cost absorbent, has recently become the subject of considerable interest. A number of low cost adsorbents are suitable ranging from agro based adsorbent to non agro based like fly ash, coal, activated charcoal, wood ash, saw dust.

II. MATERIAL AND METHODS

Effluents waste water (spent wash) was taken from Mansoorpur Distillery, Muzaffarnagar on date 26.12.2004. The factory uses molasses as the raw material. The effluent flows out into river Kali Nadi that passes through nearby villages.

Sampling:

Samples were collected at main out let point of distillery, collected in clean sterile plastic container, five times at monthly basis from November to march and stored at 4 °C in a refrigerator.

Effect of various adsorbent on physiochemical Characteristics of distillery effluent

Eight plastic pots were filled with 2 kg soil in each and wheat was grown (*Triticum aestivum*). Variety UP2329, after 20 days of growth 5 gm of AC, FA, WA were added separately to 6 pots and irrigated with two different effluent concentrations i.e. 50% and 100%, seventh pot was used as control. On each irrigation date one liter of effluent was poured in a pot. Then again after 20 days. After 72 hours of irrigation leachate was collected and tested.

Physicochemical parameters tested

Physical parameters : pH, TS, TDS

Chemical parameters : COD, Ca, Mg, Na, K, BOD,

Measurement of total solid (TS) : TS determines the residue left after evaporation of unfiltered samples (APHA 1995), and calculated as

$$T S \text{ (mg/lit)} = \frac{(x - y) \times 1000}{\text{Volume of sample in ml}}$$

Where X = (weight of residue + dish) in mg

Y = weight of empty dish (mg)

Total dissolved solid (TDS) : Determined as the residue left after evaporation of the filtered sample and calculated as above equation.

pH measurement: Measured by using a glass electrode

Chemical Parameters:
Chemical oxygen demand (COD):

It is the maximum amount of oxygen that can be consumed by the organic matter in the sample for their complete degradation. It is measured by method described in APHA (1995).

Determination of Ca and Mg : it was done by complex metric titration using ethylene di amine tetra acetic acid (EDTA).

Determination of Na and K : A characteristics light is produced due to excitation of electrons when the samples with Na/K sprayed into a flame. The intensity of this characteristic radiation is proportional to the concentration of Na/K and can be read at 529/768 nm by using suitable filter device (Tondon, 1998).

III. RESULT

Tab 1.0 shows that visible color of distillery effluent was brownish black, having foul smell, with acidic nature and contain TS-4800mg/l, TDS-3880mg/l, COD-3989.5mg/l, Ca-1380mg/, Na-530mg/, and K-950mg/l Tab 2.0 and 3.0 reveals the removal of pollutants from distillery spent wash, which is seen maximum in activated charcoal followed by fly ash and minimum in wood ash. After treatment with various adsorbents, pH of spent was increased significantly from 4.7 to 6.3 at 60th day irrigation (table 3.0). COD, TS, TDS were found minimum at 60th of irrigation with activated charcoal (table 3.0), maximum reduction in Ca, Mg, Na, and K is seen at 60th day with activated charcoal (tab 2.0 and 3.0). While table 4.0 and 5.0, showed that maximum reduction in TS, TDS, CDO, Ca, Mg, and K and is shown by activated charcoal at 20days, 40days, and 60days interval using 100% spent wash and 50% spent wash.

IV. DISCUSSION

Activated charcoal is an ideal adsorbent for color removal from waste water and referred discoloration up to 99.7% while discoloration decreased with increasing concentration, removal of COD from distillery effluent was found maximum 58.15% by using activated charcoal. Changed soil characteristic result in a altered growth of wheat plant was increased by irrigation with 50% effluent, where as 100% effluent irrigation caused low reduction. Effluent was purified more with activated charcoal at 50% effluent concentration.

V. CONCLUSION

On the basis of experimental result it could be concluded that adsorbent treatment is one of the best method for removal of pollutants from distillery spent wash and we can reshape the effluent characteristics so it could be used as irrigation water to reduce the pressure of application of fertilizers and normal water irrigation. The study also revealed that the diluted effluent could be beneficial for better growth of wheat plant which also enhances wheat seed germination. The adsorbent treatment method of effluent could be profitably practiced for removing the pollutants and thus avoiding the ground water contamination and its environmental impacts and activated charcoal can be used for this purpose successfully.

Table.1 Initial Physico chemical characteristics of distillery spent wash before treatment:

S.N.	Parameters	Value
01	pH	4.7
02	TS	4800
03	TDS	3880
04	COD	3989.5
05	Ca	1380
06	Mg	830
07	Na	530
08	K	950
09	Color	Brownish Black
10	Smell	Fouling

Note: All parameters are in mg/ml excluding pH value.

Table.2 physico chemical characteristics of 100% spent wash treated with different adsorbents at various irrigation periods.

Parameter s	Sample UT	Activated Charcoal			Fly Ash			Wood Ash		
		DAYS			DAYS			DAYS		
		20	40	60	20	40	60	20	40	60
pH	4.7	5.6	5.8	6.2	5.2	5.5	6.0	5.0	5.3	5.8
TS	4800	2400	2100	1800	2700	2300	2000	3000	2700	2400
TDS	3880	2200	1900	1700	2400	2200	2000	2500	2400	2300
COD	3989.5	2506	2276	2092	2660	2464	2300	2732	2582	2479
Ca	1380	270	250	210	280	260	220	360	350	320
Mg	830	240	210	190	270	250	240	340	330	330
Na	530	210	180	160	230	200	180	250	230	210
K	950	280	250	210	310	290	270	420	410	390
Color	BB	LB	LB	TP	LB	LB	VLB	LB	LB	VLB
Smell	Fouling	F	C	C	F	F	C	F	F	LF

LB: Light brown, BB: Brown black, TP: Transparent, F: Foul, C: Clear, LF: Light foul, VLB: Very light brown

Table.3 physico chemical characteristics of 50% spent wash treated with different adsorbents at various irrigation periods.

Parameters	Sample UT	Activated Charcoal			Fly Ash			Wood Ash		
		DAYS			DAYS			DAYS		
		20	40	60	20	40	60	20	40	60
pH	4.7	5.8	5.2	6.3	5.7	5.9	6.1	5.5	5.8	6.0
TS	4800	2350	2000	1900	2450	2400	2200	2650	2550	2500
TDS	3880	1800	1600	1300	1900	1800	1600	2200	2000	1900
COD	3989.5	2160	1927	1669	2604	2476	2330	2700	2609	2471
Ca	1380	240	220	200	260	250	240	240	280	280
Mg	830	140	120	100	180	160	130	140	180	160
Na	530	170	150	130	200	170	150	210	190	180
K	950	280	240	230	310	280	270	340	300	280
Color	BB	LB	LB	TP	LB	LB	VLB	LB	LB	VLB
Smell	Fouling	F	C	C	F	F	C	F	F	LF

LB: Light brown, BB: Brown black, TP: Transparent, F: Foul, C: Clear, LF: Light foul

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