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PURIFICATION OF DISTILLERY SPENT WASH BY USING ACTIVATED CHARCOAL

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Abstract:-

Purification of distillery spent wash using activated charcoal has great potential as a sustainable method as it is cost effective method. The purpose of this investigation is to study the activated charcoal purification method for purification of distillery spent wash. For this, the study encompassing evaluation of reduction of various physical chemical parameters (pH, COD, TS, TDS, Ca, Mg, Na and K) of distillery spent wash was done by passing it through the activated charcoal column. The distillery spent wash was acidic (pH 4.7) and dark brown in color which often cause psychological fear in farmers for its utilization. Activated charcoal purification of distillery spent wash exhibited maximum reduction in COD (48.98%), TS (64%), TDS (55.26%), Mg (78.03%), Na (60%), Ca (80.91%), K (75.30%) and increase in pH toward pH 7. Purified distillery spent wash showed a good growth of wheat seeds.

Keywords:-*"Distillery spent wash", "Activated Charcoal", "Irrigation", "Adsorbent", "and Chemical Parameters".*

1. INTRODUCTION

Rapid industrialization for sustaining economic growth and ever increasing population is leading to the pollution of the environment due to the disposal of unpurified effluents. Various pollutants produced in industries directly or indirectly and result in cumulative pollution of our environment. These pollutants cause severe degradation in pedosphere, hydrosphere, atmosphere and thus causing a potential menace to the health and welfare of mankind.

Wastes generated from various industries include the effluent from textile, chemical fertilizers, pulp and paper, petro chemical and breweries, metal processing, automobile manufacturing, leather and tannery industries and power plants including nuclear, thermal, etc.

Improper disposal methods and inadequate treatment of toxic constituents from different industries have led to the widespread contamination of surface and ground waters and have made the water resources unfit for usage. Hence there is an urgent need for waste water treatment.

Environmental pollution by distillery industry has recently been the subject of much research. Distillery waste is one of the major wastes of ecological concern. It is a complex, caramelized and recalcitrant waste containing high percentage of organic matter and heavy metal ions (Nemade and Shrivastava, 2000). This causes pollution in receiving waters as well as in land.

To safeguard humanity, we require conductive and congenial environment for which the industrial pollution need to be minimized substantially. To achieve this, several physical, chemical and biological methods/techniques have been developed and being practiced in very few industries along with distilleries (Lin et al 2003). The reason of limited scope of these techniques lies with their adhered economical solution of the pollution abatement problems, adsorption treatment has been one of the cost effective method and practical unintentionally during crop irrigation. Once the industrial effluent is suitably purified, it could be applicable for crop irrigation. The application of effluent to short rotation forestry crop is a treatment system which if properly designed and maintained could both increase the productivity of the crops and reduce the waste disposal problem (Sims and Riddell 2001). Keeping this in view, the present study is planned to investigate the land treatment of distillery spent wash with the following objectives

1. To characterize physico-chemical characteristics of distillery spent wash.
2. To study the impact of Activated Charcoal as adsorbent on distillery spent wash quality.

2. MATERIAL AND METHODS

2.1 Sample collection

Effluents waste water (distillery spent wash) was taken from a distillery, located in Dehradun. The factory uses molasses as the raw material. The effluent flows out into "River Song" that passes through nearby villages. Samples were collected at main outlet of distillery on date 02.11.2016. Samples were collected five times at weekly from November to December 2016 in clean sterile plastic container and stored at 4^{o}C in a refrigerator.

2.2 Effect of soil as adsorbent on various physiochemical Characteristics of distillery spent wash

Five plastic pots were filled with 2 kg activated charcoal each and wheat was grown (Triticum aestivum) Variety UP2329, after 20 days of growth, pots were irrigated with purified distillery spent wash and the 5th pot was used as control. On each irrigation date one liter of purified effluent was poured in each pot. 24 hour purified, 48 hour purified and 72 hour purified distillery spent wash was used in pot 1, pot 2, pot 3 and pot 4 for irrigation. Same time purified samples were collected in sterile reagent bottles for physical and chemical tests.

2.3 Physico Chemical Parameters Selected for analysis

2.3.1 Physical Parameters pH, TS, TDS.
2.3.2 Chemical parameters COD, Ca, Mg, Na & K.

2.4 Measurement of Total Solids (TS)

Total solids were determined by measuring the residue left after evaporation of unfiltered samples (APHA 1995).

2.4.1 Calculations Total Solids (mg/l) = (A-B) X 1000 / Vol. of sample (ml).
Where A= Dry weight of residue + dish (mg) B=Weight of dish (mg).

2.5 Total Dissolved Solids (TDS)

Total dissolved solids are determined by measuring the residue left after evaporation of filtered sample (ALPHA 1995).

2.6 Measurement of pH

The pH of effluent was measured by pH meter using a glass electrode and universal pH indicator solution.

2.7 Measurement of COD

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

In this ferrous ammonium sulphate (0.25M) and potassium dichromate ($K_2Cr_2O_7$) of 0.04167 M are used for titration.

2.7.1 Calculations

COD (mg/l) = (A-B) X M x1000/ volume of Sample in ml.

Where

A = Volume of FAS used for blank in ml.

B = Volume of FAS used for sample in ml.

M = Molarity of FAS.

FAS = Ferrous ammonium sulphate.

2.8 Determination of Ca and Mg

It was measured by complexo metric titration using ethylene di amine tetra acetic acid (EDTA). (Schwazenbach) .

2.9 Determination of Na and K

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

3. RESULT

Tab 1.1 shows that visible color of distillery spent wash is dark brown having foul smell, with acidic nature (4.7) and contain TS-10000mg/l, TDS-7600mg/l, COD-8200mg/l, Ca2200mg/l, Na-800mg/l, Mg-1730mg/l and K-1700mg/l Tab 1.2 and 1.3 reveals the removal of pollutants from distillery spent wash, which is seen maximum with activated charcoal after 72 hour purification. After purification with activated charcoal, pH of distillery spent wash was increased significantly from 4.7 to 6.2 after 72 hours (Table1.2 and 1.3). COD (4184mg/l), TS (3600mg/l), TDS (3400mg/l) were found minimum after 72hours of irrigation with activated charcoal (Table1.2 and 1.3), maximum reduction in Ca, Mg, Na, and K is seen after 72 hours with activated charcoal (Table1.2 and 1.3) followed by 48 hour purification and minimum reduction is observed after 24 hour purification.

4. DISCUSSION

Activated charcoal is an ideal adsorbent for color removal from waste water and referred discoloration up to 99% while discoloration decreased with increasing concentration. Removal of COD from distillery spent wash was found maximum 48.98 % by using activated charcoal. Changed activated charcoal characteristics resulted in an altered growth of wheat plant was increased by irrigation with effluent (24, 48 and 72 hour purification) irrigation caused low reduction. Effluent was purified more with activated charcoal after 72hour purification.

5. CONCLUSION

On the basis of experimental result it could be conclude that adsorbent purification 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 purified effluent could be beneficial for better growth of wheat plant which also enhances wheat seed germination. The adsorbent purification method of effluent could be profitably practiced for removing the pollutants and thus avoiding the ground water contamination and its environmental impacts.

Activated charcoal can be used for this purpose successfully.

6. REFERENCES

[1].Abumaizar,R. and Khan, L.I, "Laboratory investigation heavy metal removal by soil washing" in Journal of the Air and Waste Management Association. 1996, 46:765-768.

[2].APHA , AWWA , WPCA ,Starndard Methods for the examination of water and waste water, A.M. Publ. Health Assoc, New York,19th (ed.),1995.

[3].Baruah A.K. ,Sharma R.N, Borah G.C., "Impact of sugar mill and distillery effluents on water quality of river Crelabil Assam" in Indian J. of Environ.Health,1998,3 (94):288293.

[4].Binklay,W.A and Wolform M.L. , "Composition of Cane juice and Cane final molasses" in Advances in carbohydrate chemistry. Ed C.S.Hundsor and M.L. Wolform Academic Press.Inc. Pub, New York, 1997, U.S.A. 8-29.

[5].Bharat Kumar, "Treatment of Distillery Effluent Using Activated Charcoal, Fly Ash, Wood Ash for Irrigation Purpose", in International Journal of Novel Research in Life Sciences,2015, Vol. 2, Issue 2, pp: (27-30).

[6].Chandra, R., "Biodegradation of distillery effluent isolation and characterization of microbial consortium", in Indian J. Env. Prom.1996, 16(5):352-355.

[7].Chandra,R. and Panday, P.K., " Decolourisation of anaerobically treated distillery effluent by activated charcoal adsorption method", in Indian J. Env. Prot, 2000, 21(2):134-137.

[8].Cheriminisinoff P.N., Hand book of water and waste water treatment technology, Marcel Dekker Inc. New York 1995.

[9].Chhonkar, P.K.Datta, S.P.Joshi, H.C. and Pathak H., "Impact of industrial effluents on soil health and agriculture. Indian experience: Part I- distillery and paper mill effluent", Journal and Scientific and Industrial Research, 2000, 59(5):350-361.

[10]. Jain S. and Singh, M.K. Water pollution control equipments and instruments. In Industrial safety and pollution control hand book. Ed. J.Nagarey, A joint publication of National Safety Council Associates (Data) Publishers Pvt.Ltd. Secundarabad, India, 1998, 291-306.
[11]. Kadirvelu, K.Palanivel, M.Kaltana, and Rajes wari, "Activated carbon prepared from agricultural bi product for the treatment of dyeing waste water", Bioresource Technol. 2000, 75:25-27.
[12]. Khoshoo T.N., Environmental priorities in India and sustainable development, Presidential address, 73rd session, 1999. Indian Science Congress Association, New Delhi. 224.
[13]. Lee C.K, Low K.S. And Gan P.Y., "Removal of some organic dyes by acid spent bleaching earth", Environ.Technol, 1999, 20:99-104.
[14]. Lin, S.H. and Kiang, C.D., "Combined physical chemical biological treatment of waste water containing organics from a semi-conductor plant", Journal of Hazardous material, 2003, 97(1-3): 159-171.
[15]. Menambal, T., "Experimental coagulants responses in dicolourization of treated distillery effluent", in Advances in waste water treatment ed. T.K. Goel, Techno science Publication Jaipur, India, 1999,240-249.
[16]. Nemade, P.N and Shrivastava, V.S., "Metals in different effluents and their impacts on ground water and plant tissues", Indian J.Env.Prot, 1997, 17(2):133-136.
[17]. Nriagu, J.O.and Pacyna. J.M., "Quantitative assessment of worldwide contamination of air water and soil by trace metals", Nature, 1998, 333:134-139.
[18]. Pathade, G.R., "A review of current technologies distillery waste water treatment", in Advances in industrial waste water treatment ed.P.K. Goel, Techno science Publication, 2001.
[19]. Royguard, J.K.F. Green, S.R.Clophier,V.E.Sims, R.E.H. and Bolan,N.S., " Short rotation and forestry for land treatment", in Australian Journal of soil Research,1999,37(5):983991.
[20]. Sahu, A.K. and Patel, M., "Effluent treatment technologies based on adsorption and coagulation for environment in pulp and paper industry", IPPTA,1997,7(1):18-28
[21]. Sharma O.P., Bangar K.S., Jain R. and Sharma P.K, "Heavy metal accumulation in soil irrigated by municipal and industrial effluent", J.Environ.Science and Engg. 2004, 46(1):65-73.
[22]. Srivastava A. and Pathak A.N, "Modern technologies for distillery effluent treatment", J. of Scientific and Industrial Research, 1998, 57:388-392.

TABLE: 1.1 Effect of Activated Charcoal on Color and Odor of Distillery Spent Wash.

Parameters	Original Sample	Activated Charcoal		
		24hr	48hr	72hr
Color	Dark Brown	Colorless	Colorless	Colorless
Odor	Offensive molasses odor	Odorless	Odorless	Odorless

TABLE: 1.2 Physico Chemical Characteristics of Distillery Spent Wash Purified with Activated Charcoal at Various Irrigation Periods.

Para-meters	**Original - sample**	**Activated charcoal**		
		24hr	**48rh**	**72hr**
TS	10000	4800	4200	3600
TDS	7600	4400	3800	3400
pH	4.7	5.6	5.8	6.2
COD	8200	5012	4552	4184
Ca	2200	540	500	420
Mg	1730	480	420	380
Na	800	420	360	320
K	1700	560	500	420

All values are in mg/lit except pH

TABLE: 1.3 Percent Change in Physic Chemical Characteristics of Distillery Spent Wash Purified with Activated Charcoal at Various Irrigation Periods.

Para-meters	Original - sample	Activated charcoal		
		24hr	48rh	72hr
TS	10000	-52	-58	-64
TDS	7600	-42.11	-50	-55.26
pH	4.7	+19.15	+23.40	+31.91
COD	8200	-38.88	-44.49	-48.98
Ca	2200	-75.45	-77.27	-80.91
Mg	1730	-72.25	-75.72	-78.03
Na	800	-47.5	-55	-60
K	1700	-67.06	-78.59	-75.30

+ Increase
- Decrease