Industritrial Effluents Managed by Treating it using Indegeiously Preapred Cation-Excahnger from Agricultural Waste

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Abstract

Industrial waste means the waste produced by industries during their manufacturing processes and mining operations. .Some examples of industrial wastes are chemical solvents, pigments, sludge, metals, ash, paints, sandpaper, paper products, industrial by-products, metals, and radioactive wastes. The managing of industrial waste has become a serious problem. Most industries produce waste water and its control has become a serious environmental threat. Its removal had become a challenging task for the environmentalist and engineers. Several methods have been developed for the removal of various contaminants from surface and waste water from various industries. The cation exchanger from wheat straw were used for the treatment of effluents of various industries like paper mill, distillery and steel industry. The cation exchanger made from wheat straw were subjected to various studies like exchange capacity, exchange equillibria, exchange kinetics, effect of concentration of electrolyte effect of flow and particle size on exchange. This newly formed Cation Exchanger has been used for treatment of various effluents from industries. The average exchange capacity is 0.9meq/gm as compared to synthetic cation exchanger i.e 1.4 to 2.9 meq/gm. But these are economically more viable as compared to synthetic exchangers. The commercially available product is R250/500gm and ours is Rs 40/500gm apprx. After tertiary treatment of effluent of paper, steel and distillery plant has been successfully used for irrigation purposes.

Keywords - *Cation exchanger, Effluent, Sulphonated Wheat Straw, contaminants, industrial .*

I. INTRODUCTION

The treatment of industrial effluents is a challenging topic in environmental science, as control of water pollution has become of increasing importance in recent years .Agricultural waste like wheat straw is abundantly available in developing countries like India. Wheat straw can be used for the manufacturing of ion-exchanger and the same can be used for the treatment of various industrial effluents .The effluent of various industries should be tertiary treated so that it can be used for various useful purposes. The traditional tertiary treatment is being done by reverse osmosis, adsorption, ion-exchange techniques etc. This manuscript deals with treatment of paper mill effluent, distillery effluent and steel mill effluent by indigenously prepared cation exchangers from agricultural wastes.i.e wheat straw. Today there is a big need for exploring the possibilities to convert wheat straw into cation exchangers and ever growing realization among environmentalist and chemist to prepare new cation exchangers from industrial and agricultural wastes.

II. EXPERIMENTAL

A. STEP-1 Conversion of wheat straw into Cation Exchanger

Conversion of wheat straw into cation exchanger is an indigenous approach for making use of agricultural waste for the production of cation exchanger. The cation exchangers from wheat straw can reduced the pollution load of distillery spent wash to such an extent that it can be successfully used for irrigation purpose or may be drained into various water bodies. The cation exchanger has been prepared after reacting the wheat straw with ethyl alcohol to remove soluble gradients. The exchangers can also be prepared by oxidative treatment and sulphonation .We have synthesized cation exchanger by sulphonation of wheat straw .It was tried with chlorosulphonic acid and sulphuric acid under various conditions, then washing was given with distilled water, till the filtrate was free from sulphate ion. The washed product was dried and analyzed. The dried product was screened and graded with mesh sieves of different porosity.

B. STEP-2 Fundamental applications of cation Exchanger

After the cation exchanger was formed ,it was subjected to various studies viz. ash content, moisture content, sulphur, carbon exchange capacity, exchange equillibria, exchange kinetics, effect of concentrtaton of electrolyte on exchange, effect of flow and effect of particle size etc.The cation exchangers were converted into various forms viz hydrogen form, sodium form, potassium form magnesium an barium form.The result obtained were then compared with synthetic cation-exchangers as shown in table(1-5)

TABLE-1 -Proximate analysis of S.W.S

1.***Proximate Analysis*** ***% by Mass***

(as received basis)

Ash Content	3.82
Moisture content	10.01
Volatile Matter	68.56
Fixed Carbon(by diff.)	19.23

2. ***Ultimate analysis***

Carbon	43.64
Nitrogen	0.54
Sulphur	less than 0.02
Hydrogen	16.09
Ash	4.24
Oxygen	remainder

Table 2- Moisture Content and Ash Content For Different Forms of Cation Exchanger from SWS

S.No	Forms of SWS	% Ash Content	% Moisture Content
1	Ba^+	16.02	17.35
2	Na^+	13.89	12.90
3	K^+	12.98	13.82
4	Mg^+	13.01	13.20
5	H^+	14.04	13.97

Table-3 Density of Swollen Form of SWS

Solvent	Amount of SWS	Time of Contact	Density
Water	1 gm	10 min	0.8989
Water	1 gm	24 hour	0.9243
Water	1 gm	48 hour	0.9622
Water	1 gm	72 hour	0.9954
Benzene	1 gm	10 min	1.2111
Benzene	1 gm	24 hour	1.2521
Benzene	1 gm	48 hour	1.3011
Benzene	1 gm	72 hour	1.3782
Acetone	1 gm	10 min	1.0705
Acetone	1 gm	24 hour	1.1143
Acetone	1 gm	48 hour	1.1279
Acetone	1 gm	72 hour	1.1627

Table-4 Exchange Capacities of Various Cation-Exchangers.

Trade Name	Porosity/Type	Exchange Capacity(Meq/gm)
Duolite C-3	10 W	3.0
Duolite A-2	High	8.4
Duolite C-10	High	2.9
Zea -Karb	High	1.6
Wafatit	Low	2.5
Zeolit 215	Low	2.6
SWS	Low	0.9

Table-5 Exchange Capacities of Various Forms of SWS

S.No	Form of SWS	Exchange Capacity in Meq/gm
1	Ba^+	1.1009
2	Mg^+	1.482
3	K^+	1.0392
4	NH^+	1.1140
5	Ca^+	1.402
6	H^+	0.921
7	Na^+	1.2217

Table 6- Treatment of Distillery Effluent with SWS

S.No	Parameters	Untreated Effluent	Treated Effluent with SWS	% age with SWS
1	D.O	0.4	4.8	------------------
2	Acidity	480 ppm	80 ppm	72
3	Chloride Content	185.8 ppm	97.8 ppm	88.02
4	BOD	445	243	49.20
5	COD	9760	2429	75.91
6	Alkalinity	270 ppm	170 ppm	43.60 ppm
7	Free CO_2	300 ppm	117 ppm	63.70 ppm
8	Total	4900	1525	75.89 ppm

	Hardness	ppm	ppm	
9	Permanent Hardness	2767 ppm	573 ppm	74.80 ppm
10	Temporary Hardness	2133 ppm	952 ppm	1.09 ppm
11	Total Solids	99,314 ppm	68763 ppm	32.15
12	Dissolved Solids	85,432 ppm	54675 ppm	34.15
13	Suspended Solid	13,882 ppm	14,088 ppm	20.11

Table 7 Treatment of Steel Mill Effluent with SWS

S.No	Parameters	Untreated Paper Mill Effluent	Treated Paper Mill Effluent with SWS	% age with SWS
1.	pH	7.9	6.4	-----------------
2.	D.O	2.9	6.9	------------------
3.	Acidity	64 ppm	45 ppm	33.10
4.	Chloride Content	182.5 ppm	96.6 ppm	47.20
5.	BOD	185	57	69.20
6.	COD	370	209	45.81
7.	Alkalinity	220 ppm	150 ppm	31.60 ppm
8.	Free CO_2	28 ppm	19 ppm	33 ppm
9.	Total Hardness	3860 ppm	2000 ppm	49.12 ppm
10	Permanent Hardness	3360 ppm	1810 ppm	50.80 ppm
11	Temporary Hardness	500 ppm	190 ppm	51.09 ppm
12	Total Solids	1854 ppm	1400 ppm	32.15
13	Dissolved Solids	1150 ppm	730 ppm	31.15
14	Suspended Solid	704 ppm	670 ppm	30.11

Table 8 Treatment of Steel Mill Effluent with SWS

S.No	Parameters	Untreated Paper Mill Effluent	Treated Paper Mill Effluent with SWS	% age with SWS
1.	pH	2.6	4.6	-----------------
2.	D.O	0.5	2.8	------------------
3.	Acidity	47000 ppm	1810 ppm	62.10
4.	BOD	5220 ppm	1930 ppm	65.20
5.	COD	370ppm	209ppm	45.81
6.	Alkalinity	10600 ppm	4050 ppm	98.60 ppm
7.	Free CO_2	84 ppm	23 ppm	74 ppm
8.	Total Hardness	19000 ppm	7400 ppm	66.12 ppm
9.	Permanent Hardness	15000 ppm	4900 ppm	50.80 ppm
10	Temporary Hardness	4000 ppm	190 ppm	51.09 ppm
11	Total Solids	81000 ppm	59000 ppm	28.15
12	Dissolved Solids	12000 ppm	39000 ppm	28.12
13	Suspended Solid	69000 ppm	20000 ppm	71.11

III. RESULT AND DISCUSSION

The conversion of wheat straw into cation exchanger is an indigenous approach for using agricultural waste for the production of cation-exchangers .The average value of exchange capacities of various forms of cation -exchanger from wheat straw was found to be 0.9meq/gm only while the exchange capacity of synthetic cation exchangers is app (1.9 to 2.9 meq/gm).But the cost of formation of cation-exchanger from wheat straw in finished form is approximately (Rs40/500 gm) as compared to commercially available cation exchangers appx(Rs 300/500gm) .Thus the price of cation-exchanger from wheat straw is quite less and economically more viable as compared to synthetic cation exchangers and can be generated easily by dipping them in decinormal hydrochloric acid for 24 hrs. There is no storage problem for them.It has been observed that effluents of various industries when treated with S.W.S showed considerable reduction in various physico-chemical parameters such as D.O, Acidity, Alkalinity, B.O.D, C.O.D, Free CO_2 and Total suspended solids as shown in table (6 to 8) .The cation excahnger from wheat straw can reduce the pollution load of industrial effluents to such an extent that it can successfully used for irrigation purposes or after treatment may be drained into water bodies.

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