International Journal of Applied and Advanced Scientific Research (IJAASR)
Impact Factor: 5.255, ISSN (Online): 2456 - 3080
(www.dvpublication.com) Volume 1, Issue 2, 2016

ADSORPTION AND DISCOLORATIONON TANNERY EFFLUENTS USING VARIOUS METAL CHLORIDE SAMPLES COLLECTED NEAR TANNERY INDUSTRY

E. Revathi*, A. Thaminum Ansari*, S. Ulaganathan & CT. Ravichandran****

* Department of Chemistry, Muthurangam Government Arts College (Autonomous), Vellore, Tamilnadu

** Department of Chemistry, Arignar Anna Government Arts College Cheyyar, Tamilnadu

Cite This Article: E. Revathi, A. Thaminum Ansari, S. Ulaganathan & CT. Ravichandran, "Adsorption and Discolorationon Tannery Effluents Using Various Metal Chloride Samples Collected Near Tannery Industry", International Journal of Applied and Advanced Scientific Research, Volume 1, Issue 2, Page Number 114-120, 2016

Abstract:

In tannery wastewater treatment adsorption is one of the most gifted discoloration techniques. Adsorption techniques for wastewater treatment have become trendier owing to their efficiency in the removal of pollutants too stable for fixed bed column experiments were applied with actual textile wastewater various Metal chloride methods. Tannery adsorption is a result of two mechanisms adsorption and ion exchange and is influenced by many factors such as dye -adsorbent interaction, adsorbent's surface area, particle size, temperature pH, COD, BOD, Alkalinity, TDS, Chloride, Sulphate, toxic metals and also color removal efficiencies. Adsorption reduces the procedure cost which helps to manufacture low-cost materials. The present review initially introduced the technology process, research history and research hotspot of adsorption. Then, the application of adsorption in treatment of tannery wastewaters in the past decades was summarized, enlightening the inspiring changes in modes, trends, and conditions. From this review article, the different philosophy of synthesis of adsorbent materials becomes apparent.

Key Words: Adsorption, Tannery Wastewater, Metal Chloride, Sustainability, Past & Future

Introduction:

Heavy metal contamination of industrial effluents is one of the significant environmental problems due to their toxic nature and accumulation throughout the food chain as non -biodegradable pollutants[1-5]. Tannery is the one of the oldest and fastest growing industry in India. However sustenance of tanneries is becoming increasingly difficult because of alarming level of environmental pollution caused by various tannery operations and practices. The main pollutants of concern in tanneries are BOD/COD, suspended solids and heavy metals. Various metal like Cr, Mg, Mn, Ca are toxic even at minute quantities. Removal of metals from wastewater is achieved principally by the application of several processes such as adsorption, sedimentation, electrochemical processes , ion exchange , biological operations, cementation , coagulation/flocculation, filtration and membrane processes, chemical precipitation and solvent extraction [6-11]. However, all of the methods suffered from one or another limitation and none of the processes described above were successful in removing of heavy metal from wastewater completely. Adsorption is probably the simplest process for removal of heavy metal. At present, there is a growing interest in using inexpensive and potential materials for the adsorption of reactive dyes. Saw dust and coconut shell has been reported the potential media to remove pollutants from wastewater because of their chemical characteristics and inexpensive material. This had led to a search for low-cost materials, which could be considered as adsorbents alternative to low cost adsorbent and utilization with biological treatment system. This study is aimed at investigating the adsorption of reactive tannery effluents onto saw dust, coconut shell along with metal chloride nano particles. Some metal chlorides were also used as adsorbents. The experiments were performed for different parameters, such as contact time, pH, initial concentration and temperature on adsorption rate of tannery effluents on Nano adsorbents were investigated. Langmuir and Freundlich models were used to describe adsorption isotherm. The fixed bed column experiments were applied with actual tannery wastewater for estimation of life span and COD, BOD, Alkalinity, TDS, Chloride, Sulphate, toxic metals and also color removal efficiencies.

Material and Methods:

Water sample collected near tannery industryreservoir at a depth of one feet using polyethylene bottles of two liter capacity. The collected water samples were immediately bought to the laboratory and analysed. All the physico-chemical parameters like air temperature, water temperature, turbidity, dissolved solids, conductivity, pH, carbonate alkalinity, bicarbonate alkalinity, alkalinity, hardness, calcium, magnesium, ammonia, nitrite, chloride, sulphate and phosphate were carried out as per the standard methods [12-13]. The conditions of the experiment are shown in Table 2. Adsorption studies were carried out at two different metal chlorides of mass (1, 2, 3,4 and 5 g). A series of 250 ml Erlenmeyer flask containing 200 ml of tannery solution and required amount of shale were mixed using the shaker at constant agitation speed of 150 rpm. The sorbent was then separated by filtration. The filtrated tannery effluents concentrations were physico-chemical parameters are tested. As shown in table 1and 2, the tannery adsorption capacities of metal chlorides were

increased with an increasing of the concentration of metal chloride in grams. The adsorption capacity of metal chloride was quite rapid in the first 48 hrs

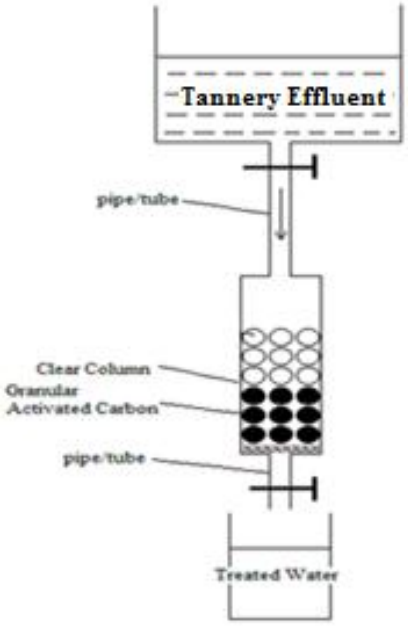


Fig : 1

Results and Discussion:

The results of variations in physico-chemical parameters of tannery effluents were grouped in to presented in thetables 1and 2.

pH: The pH value recorded ranges between 10.72 to 6.54in$CaCl_2$. The pH value recorded ranges between 9.82to 7.98in$FeCl_3$.The maximum pH was recorded during increasing of the concentration of metal chloride in grams.

Turbidity: In the present study the minimum value of 18.82 to 10.71NTU in $CaCl_2$.The minimum value of 17.62 to 10.32NTU in $FeCl_3$ was recorded during as turbidity was decreased towards increasing of the concentration of metal chloride in grams.

TDS: level of TDS ranges between 4862 to 2631 mg/lin $CaCl_2$. The minimum amount of TDS was recorded in 5652 to 2868 mg/l$FeCl_3$. The variability of TDS value may be due to dissolved soil minerals, surface run off etc.

Total Alkalinity: In the present investigation, the total alkalinity ranges from 1736to 836 mg/lin$CaCl_2$. Total alkalinity ranges from 1852to 960 mg/lin$FeCl_3$.It was observed that the sampling station is highly productive from the view point of alkalinity. The maximum alkalinity was observed due to increase and carbonates and bicarbonates in the Vat dye effluents.

Calcium: Calcium hardness values ranged between 1892to 1236 mg/l in $CaCl_2$.Calcium values ranged between 1738to 1236 mg/l in $FeCl_3$.Decrease of calcium hardness may be due to calcium being absorbed by living water organisms. The maximum Calcium hardness was recorded during increasing of the concentration of metal chloride in grams.

Magnesim: The amount of magnesium recorded in ranged between 432 to 178mg/l in $CaCl_2$. values ranged between 396 to 168 mg/l in $FeCl_3$. Decrease ofmagnesium hardness may be due to calcium being absorbed by living water organisms. The maximum of magnesium hardness was recorded during increasing of the concentration of metal chloride in grams.

Nitrite: The values of nitrite content varied between 178 to 78 mg/l in $CaCl_2$.The values of nitrite content varied between 143 to 96 mg/l in $FeCl_3$. In the present study, the content of nitrite value was high in due to human activities. The nitrite was recorded during increasing of the concentration of metal chloride in grams.

Chloride: The values of chloride content varied between 1362 to 732 mg/l in $CaCl_2$.The values of chloride content varied between 2362 to 1236 mg/l in $FeCl_3$. Relatively higher concentration of calcium in surrounding rocks and soils of sampling station might have also contributed to the rich calcium level.Thechloride was recorded during increasing of the concentration of metal chloride in grams.

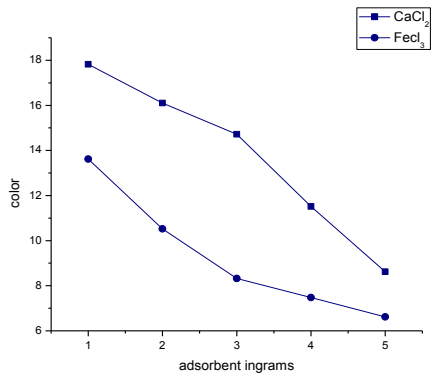
Phosphate: In the present study, amount of phosphate ranges between 187 to 81mg/lin$CaCl_2$. The amount of phosphate ranges between 163 to 75 mg/lin$FeCl_3$. The high phosphate concentration of the water body (0.59 mg/l) may be due high rate of water evaporation and washing activities.

Tables 1: Variation of physiochemical properties of Tannery effluent on adding $CaCl_2$

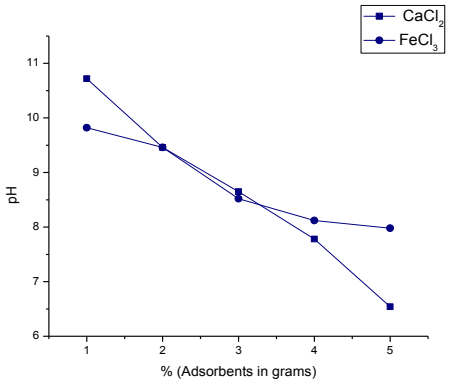
S.No	Test Name	Unit	Adsorbant Dosage				
			1g	2g	3g	4g	5g
1	COLOUR	TCU	17.82	16.10	14.72	11.52	8.62
2	COD	Mg/Lit	396	354	266	221	178
3	BOD	Mg/Lit	186	163	144	112	96
4	TDS	Mg/Lit	4,862	4310	3,732	3148	2,631
5	PH		10.72	9.46	8.65	7.78	6.54
6	ALKALINITY	Mg/Lit	1736	1548	1,362	1120	836
7	Chloride	Mg/Lit	1362	1152	922	840	732
8	Residual Free Chlorine	Mg/Lit	560	463	362	297	226
9	Sulphate	Mg/Lit	742	590	436	361	266
10	Barium	Mg/Lit	136	109	86	67	58
11	Copper	Mg/Lit	88	72	53	41	32
12	Iron	Mg/Lit	152	126	88	65	46
13	Manganese	Mg/Lit	53	48	43	35	26
14	Nitrate	Mg/Lit	548	492	436	313	188
15	Nitrite	Mg/Lit	178	146	124	96	78
16	Zinc	Mg/Lit	86	68	46	31	18
17	Al	Mg/Lit	232	202	173	136	129
18	Ca	Mg/Lit	1892	1734	1562	1420	1236
19	Mg	Mg/Lit	432	410	262	216	178
20	sulphide	Mg/Lit	72	54	46	36	26
21	Sodium	Mg/Lit	752	590	436	417	398
22	Potassium	Mg/Lit	963	818	668	560	436
23	Phosphate	Mg/Lit	187	154	126	104	81
24	Turbidity	NTU	18.82	17.42	16.61	13.54	10.71

Variation of physiochemical properties of Tannery effluent on adding $FeCl_3$

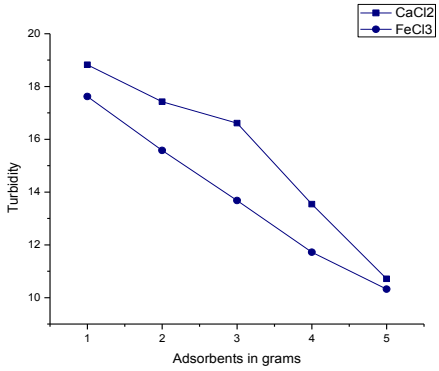
S.No	Test Name	Unit	Adsorbant Dosage				
			1g	2g	3g	4g	5g
1	COLOUR	TCU	13.62	10.52	8.32	7.48	6.62
2	COD	Mg/Lit	446	414	386	355	322
3	BOD	Mg/Lit	238	217	198	178	156
4	TDS	Mg/Lit	5,652	4568	3,436	3152	2,868
5	PH		9.82	9.46	8.52	8.12	7.98
6	ALKALINITY	Mg/Lit	1852	1612	1,342	1124	960
7	Chloride	Mg/Lit	2362	2142	1,870	1630	1236
8	Residual Free Chlorine	Mg/Lit	742	632	560	468	346
9	Sulphate	Mg/Lit	862	732	592	480	366
10	Barium	Mg/Lit	188	161	136	128	108
11	Copper	Mg/Lit	84	73	62	52	43
12	Iron	Mg/Lit	92	86	77	64	53
13	Manganese	Mg/Lit	77	63	43	37	28
14	Nitrate	Mg/Lit	626	530	432	395	363
15	Nitrite	Mg/Lit	143	131	118	107	96
16	Zinc	Mg/Lit	128	110	93	79	66
17	Al	Mg/Lit	398	321	243	221	197
18	Ca	Mg/Lit	1738	1634	1542	1386	1236
19	Mg	Mg/Lit	396	319	242	206	168
20	sulphide	Mg/Lit	86	74	62	51	43
21	Sodium	Mg/Lit	790	682	563	469	377
22	Potassium	Mg/Lit	836	638	432	348	268
23	Phosphate	Mg/Lit	163	147	128	102	75
24	Turbidity	NTU	17.62	15.58	13.68	11.72	10.32



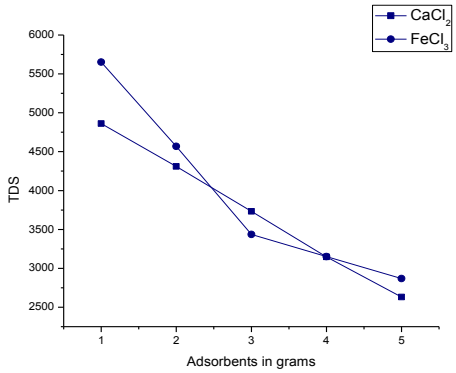
Effect of colour on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



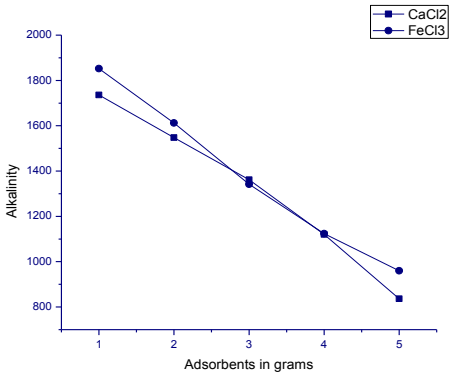
Effect of pH on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



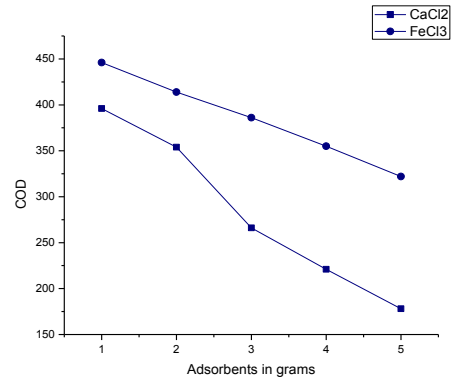
Effect of Turbidity on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



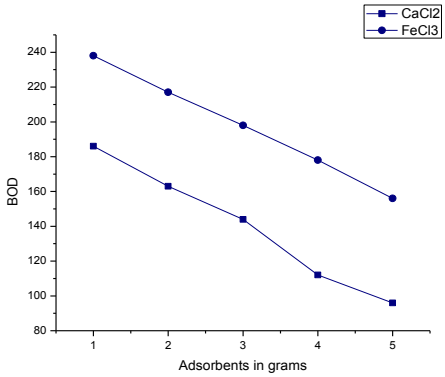
Effect of TDS on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



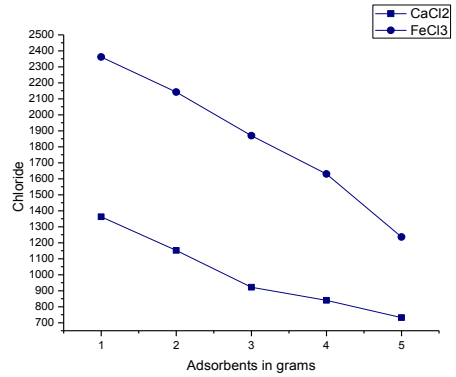
Effect of Alkalinity on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



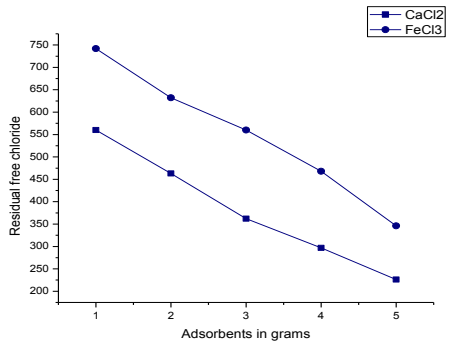
Effect of COD on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



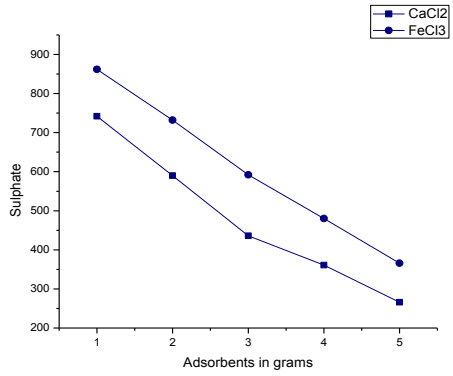
Effect of BOD on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



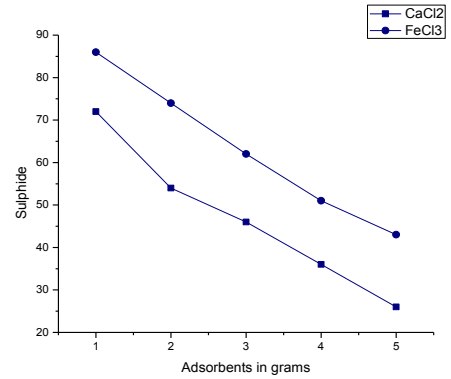
Effect of Chloride on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



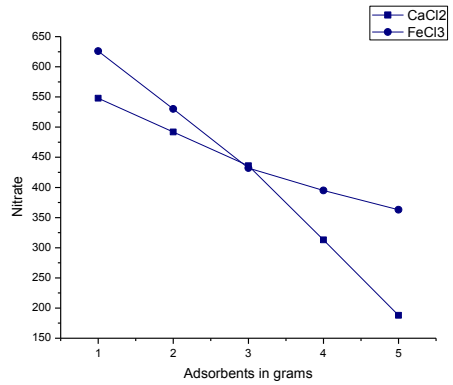
Effect of residual free chloride on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



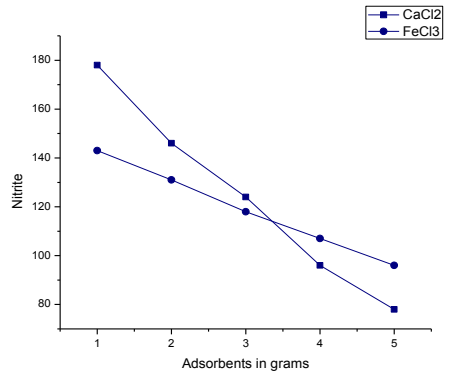
Effect of sulphateon adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



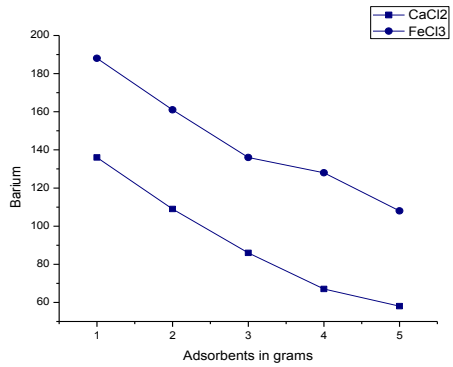
Effect of sulphide on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



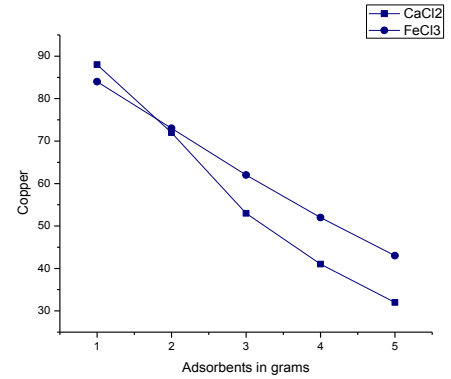
Effect of Nitrate on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



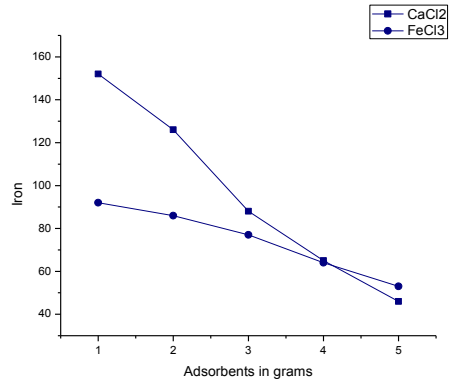
Effect of Nitrite on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



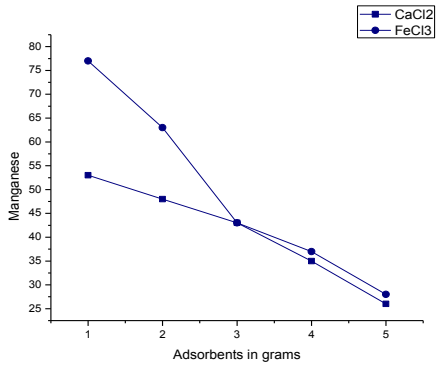
Effect of Barium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



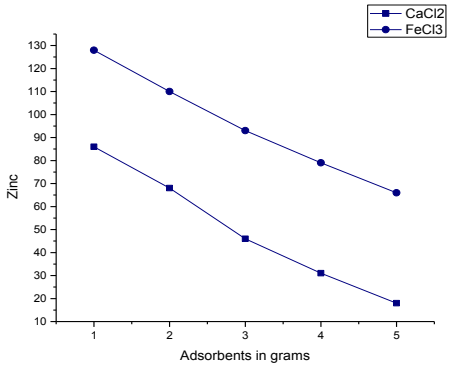
Effect of Copper on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



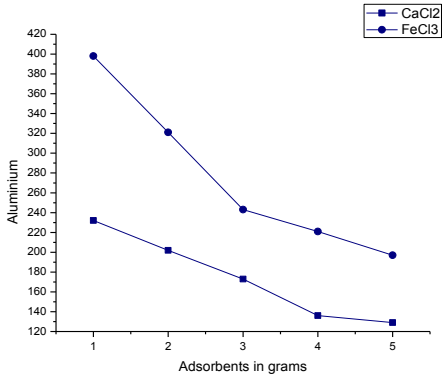
Effect of Iron on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



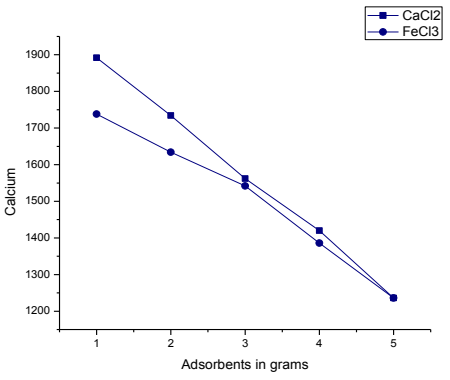
Effect of Manganese on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



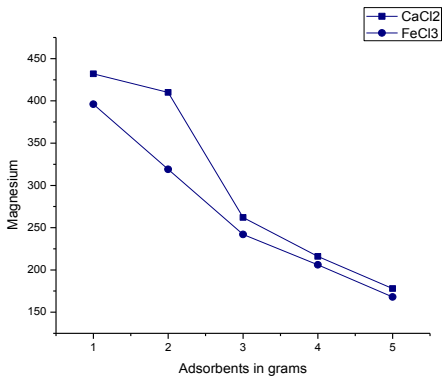
Effect of Zinc on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



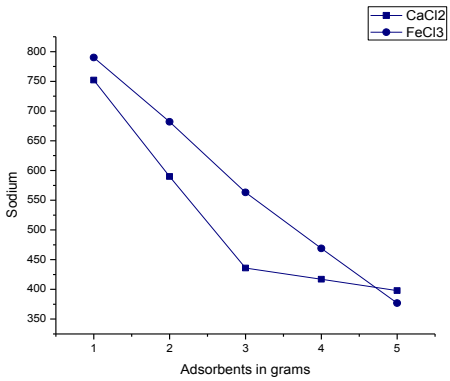
Effect of Aluminium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



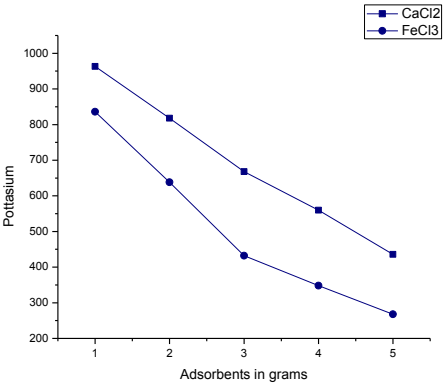
Effect of Calcium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



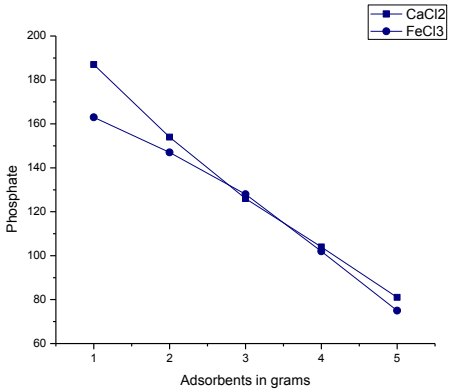
Effect of Magnesium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



Effect of Sodium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



Effect of Potassium on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K



Effect of Phosphate on adsorption of Tannery effluent Various metal chlorides (Adsorbents) dosages at room Temperature 273K

The graphical representation is shown below in Figure 2 and 23. It was found that adsorption was found decreasing further with increase in dosage in both the case of adsorbents.

Conclusion:

The present study suggested that most of the all the physico-chemical parameters Addition of equimolar concentrations of two different metal chloride reduced the removal of temperature, water temperature, turbidity, dissolved solids, conductivity, pH, carbonate alkalinity, bicarbonate alkalinity, alkalinity, hardness, calcium, magnesium, ammonia, nitrite, chloride, sulphate and phosphate hardly influenced the removal.

References:

1. Akar T, Tunali S; Biosorption performance of Botrytis cinerea fungal by -products for removal of Cd (II) and Cu (II) ions from aqueous solutions, Mienral Engineering, 2005; 18:1099–1109.
2. Kumar U; Agricultural products and byproducts as a low cost adsorbent for heavy metal removal from water and wastewater, A review Science Resource Essays, 2006; 1:33–37.
3. Mata YN, Blazquez M, Ballester A, Gonzelez F, Munoz JA; Biosorption of lead, cadmium and copper with calcium alaginatexerogels and immobilized Fucusvesiculosus, Journal of Hazardouus Material, 2009; 163: 555–562.
4. Macchi G, Pagano M, Pettine M, Santrori M, Tiravanti G; A bench study on chromium recovery from tannery sludge, Water Resource, 1991; 25:1010-1020.
5. Wang LK, Dahm DB, Baier RE; Treatment of tannery effluents by surface adsorption, Journal of Applied Chemistry and Biotechnolology,1975; 25:475-481.
6. Song Z, Williamsm C, Edyvean RGJ; Sedimentation of tannery wastewater, Water Resources, 2000; 34: 2171-2179.
7. Oda H, Nakagawa Y;Removal of ionic substances from dilute solution using activated carbon electrodes, Carbon, 2003; 41:1037-1045.
8. Vlyssides GA, Israelites CJ; Detoxification of tannery waste liquors with an electrolysis system, Environmental Pollution, 1997; 97:147-156.
9. Tiravanti G, Petruzzelli D, Passino R; Pretreatment of tannery wastewaters by an ion exchange process for Cr(III) removal and recovery, Water Science and Technology, 1997; 36:197-206.
10. Kapoora A, Viraraghavana T, Cullimoreb DR; Removal of heavy metals using the fungus Aspergillusniger, Bioresource Technology, 1999;70:95-103.
11. FilibeliA, Buyukkamaci N, Senol H; Solidification of tannery wastes, Resource Conservation Recycle, 2000; 29: 251-230.
12. BIS 10500: Bureau of Indian Standard, Drinking water specification second revision, Drinking water sectional committee, New Delhi (2012)
13. APHA: Standard Methods for the estimation of water and waste water, American public health association, American waste water Association and water pollution control federation, Washington (1995)