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Tannery Effluent Treatment by Using Natural Adsorbent

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ABSTRACT

The concept of effluent treatment, by means, of a collective effort, has assumed reasonable gravity by being especially purposeful for cluster of small scale industrial unit. Common effluent treatment plant (CETP) not only helps the industries in easier control of pollution, but also act as a step towards cleaner environment and service to society at large. A number of technologies have been developed over the years to remove organic matter (expressed as chemical oxygen, COD) from industrial wastewater. The most important technologies include coagulation/ flocculation process [1], membrane filtration [2], oxidation process [3,4]. These methods are generally expensive, complicated, time consuming and requires skilled personal. The high cost of coal- based activated carbons has stimulated the search for cheaper alternatives. Low cost and non-conventional adsorbent include agricultural sector. This study assesses pollutant removal efficiency from distillery- spent wash by three adsorbents (activated charcoal, fly ash and wood ash). Pots were kept in polyhouse at 30^{o} C (humidity 75^{o} C) with 35% reduction in natural sunlight. After 10 days of growth, adsorbent (15g each) were added separately to the pots soil and irrigated with two different concentrations (50% and 100%) of the effluent. One set of the pots was maintained as control. On each irrigation date, effluent was poured in a pot. Subsequent irrigation, with respective concentration of effluent was done at 12 days' interval. After 6 hr. of irrigation, treatment – wise leachate was collected, brought to the laboratory and all the selected parameters pH, color, COD, Total solids (TS), Total dissolved solids (TDS), total soluble solids (TSS), Ca, Mg, Na, K and heavy metals (Cu, Zn, Fe) were analyzed.

Introduction

The adsorption process with activated carbon is attracted by many scientists because of the effectiveness for the removal of heavy metal ion even at trace quantities. But process has not been used extensively for its high cost. For that reason, the use of low cost materials as sorbent for metal removal from wastewater has been highlighted. More recently, great effort has been contributed to develop new absorbents and improve existing adsorbents like granular activated carbon, other adsorbent and improve existing adsorbents like granular activated carbon, other adsorbent such as iron oxide coated sand [5-10] porous cellulose carrier modified with polyethylene amine, iron cost granular activated carbon , modified chitosan etc. One of the exploitation is use of natural wastes. Materials investigated are cotton, walnut waste, peanut skins sugar cane waste and onion skin, woolfiber, green algae and rice hull; bark and other cellulosic material, Cottonseed hulls, Rice straw, soybean hulls, linseed flax straw [11-22]. Because of the low cost, high availability of these materials, and no need for complicated regeneration process. This method is attracting more and more Scientists and Engineers.

Experimental Methods

1. Take three 100-ml conical flasks and pour 50 ml of water sample in each.
2. Simultaneously run distilled water blanks standards.
3. Add 5ml of K_2 Cr_2 O_7 solution in each of the six flasks.
4. Keep the flasks in water bath at 100^{o}C for one hour.
5. Allow the samples to cool for 10 minutes.
6. Add 5 ml of potassium iodide in each flask.
7. Titrate the contents of each flask with 0.1M sodium thiosulfate until the appearance of pale yellow color.
8. Add 1 ml of starch solution to each flask.
9. Titrate it again with 0.1 M sodium thiosulfate until the blue color disappears completely.

Materials and Methods

Conditioning of the adsorbent

Commercial peat has humidity levels between 60 and 80%, so it was dried through a natural process on a 1 cm – thick bed exposed to the air during a two- days period, and turning it every 5hrs.

Characterization of the peat

Particle size: The distribution of sizes of the commercial peat used in this process was determined through screening. Assuming a particle- size distribution in accordance with a distribution log- normal, Bennett's form of the Rosin-Rammler model (RRB) was used (Bennett, 1936). For later studies, the cut was selected between [-18 +60] meshes.

Density: Solid density was measured by liquid picnometery with hexane and gas picnometry with helium.

Specific surface: The specific surface was quantified with the Langmuir isotherm, using Methylene Blue (BB9). For this purpose, 12 samples were prepared with initial concentrations of 50 and 600 mg L^{-1} of dye and a dose of 2g of peat per solution liter, plus a blank consisting of distilled water and an equal dose of peat. These samples were continuously agitated in a thermostatized shaker at 30^{o}C during a contact time of

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24hrs. Finally, all samples were filtered determining the residual concentration, the specific surface was determined through the BET isotherm with nitrogen. The distribution of pore sizes was evaluated through mercury porosimetry.

Jar test

The most common way to determine dose adjustments of flocculants is with a jar test. The jar test is an experiment to determine the best flocculants dose to optimize the flocculation reaction.The first step to setting up a jar test is to ensure that the test has been set up to mimic the conditions of the plant. This will include the speed and duration of flash mixing the speed and duration of the flocculation mixing the length of time for settling. Set up the jar by collecting two, eight liter samples of raw water for testing. Measure six one liter quantities and pour into each of the six jars. Place all six jars into the stirring apparatus.

Results and Discussion

Before treating effluent testing range

Sl.no	Parameter	Range
1	pH	3.7 – 4.8
2	COD	7370- 28500 mg/L
3	Conductivity	140 – 400 mS/m
4	Total Dissolved Solids	1000 – 2800 mg/L
5	NO_3	35 – 132 mg/L
6	CL-	20-425 mg/L
7	PO_4^3	98-251 mg/L
8	NH^{4+}	68 – 378 mg/L
9	K^+	330-1490 mg/L
10	Na^+	18- 170 mg/L
11	Mg2+	14 – 86mg/L
12	Ca^{2-}	21 – 90 mg/L

The best used presented humidity between 70-75 %, which decreased up to 6.06+ 0.13% after finishing the drying process. The density of the selected cut was 1125 Kg m-3; it was determined by liquid picnometry and corresponded to the range of particle sizes between 1 and 0.25.Analysis of distillery spent wash (pH 4.8, color 1543.33 CU) gave following parameters: COD,7566.6; TS, 40116.6; TDS, 26146.6; TSS, 13970.0; Ca, 110.3; Mg, 21.33; Na, 98.66; K, 78.3; Cu, 1.78; Zn, 1.42; and Fe, 6.03 ppm. COD concentration is higher than the permissible limit. Considerably higher education in all physicochemical parameters was observed when the effluent was treated with activated charcoal followed by fly ash and wood ash at 50%.From these studies, coconut shell- based activated carbon was found to effectively adsorb organic matter. Chemical activation was found to affect adsorptive capacity of the carbon based upon variations in the characteristics of the carbons such as surface area, density, pH and conductivity. Coconut shell- based acid activated carbon (CSA) had higher adsorption capacities than coconut shell- based barium chloride activated carbon (CSB) and commercial carbon (F-300) at all the extraordinary adsorptive capacity of corn cob granulate with respect to oil adsorption could be confirmed by the results of this project.

After Treating Common Effluent Range

S.no	Natural Adsorbend	Range	COD (Chemical Oxygen Demand)	pH
1.	Drum stick	25	1930	5.9
		50	1890	3.8
		75	1600	3.7
2.	Corn	25	1120	4.8
		50	640	3.9
		75	480	3.8
3.	Phyllanthus Emblica	25	2440	4.7
		50	2080	3.6
		75	1890	3.3

Tannery effluent which was above the permissible limits caused hazard to the potable water, soil and the workers associated with the tannery industry. The effluent could be best managed by diluting it to 25% and used for the growth of the edible plants since the edible portion is not affected by the pollutants in the effluent.

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