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Effect of pH on the Recovery of Chromium with Removal of COD and Colour from Wastewater of Leather Industry

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ABSTRACT: It is based on the experiments conducted for study of chromium removal and recovery from chrome tanning waste water of leather industry for chromium removal about 98.5% was achieved at pH 8.0 and at this pH reduction of COD is 61.5 % and percentage for removal of color from the wastewater of leather industry is 99.5% under applying the batch experimental condition.
For this purpose, it is carried out by using the most economical process as precipitation process. To use precipitating agent as calcium hydroxide for effective recovery of chromium is 98.5% at pH 8 for batch experiments. Results also show that the effective pH value is 8 for 61.5 % removal of COD and pH 8 is very optimize for 99 % removal of colour and gives with high settling rate for wastewater treatment from leather industry.

Key words: Tanning Waste water, Chromium, Recovery, Precipitation Agent, Optimum

INTRODUCTION

Environmental pollution through different sources is one of the serious problems in the world. The average concentration of different pollution parameters in wastewater of leather industry and their load which shows high percentage of TDS, sulfate and chromium in chrome tanning spent liquor. $Cr_2(SO_4)_3$ and sulfuric acid are the main source of these pollutants. The concentration of chloride ions is due to sodium chloride used in the pickle bath. Thus recycling of this float has significant effect on the final effluent from the tanning industry (Fatima *et al*., 2016).

Lime recycling is very important as saves 28% Calcium Hydroxide and 39% Sodium Sulfide. Lime recycling spent liquor contains very high BOD, COD and TSS. Its recycling imparts significant impact on the effluent pollution load. Overall reduction of BOD, COD and TSS by recycling of all above discussed options is 407 kg/d, 1,450 kg/d and 807 kg/d respectively, but major impact is due to liming process. Concentration of sulfide ions reduced form 174 mg/1 to 18mg /1 in recycled effluent (Badar *et al.*, 2016).

The discharge of liming process is the most polluted stream in the tanning industry. It contributes almost 30 to 40 of the total pollution caused by tanning processes. Liming effluent contains very high values of BOD, COD, TSS, TDS, alkalinity and sulfide. The recycling of this float would reduce the pollution load substantially and lot of chemical cost saving is possible (Daniel RC *et al.*, 2011) (Badar *et al.*, 2016).

In pickle recycling system the unexhausted chemicals are sodium chloride 41%, sulfuric acid 28% and sodium formate 43%. Chloride ions reduction is about 1,521 kg/d. The remaining chloride ion concentration in the final effluent with pickle recycling is 1,336 mg/1, which is mainly due to discharge of soaking float. The NEQS level of 1,000 mg/1 can be achieved by additional salt dedusting of hid, before the soaking. Overall financial anises show that all these recycling options need Rs. 1.85 million investment and cost saving is about Rs. 0.90 million, the payback period is only 2 months, at production capacity of 30,000kg/d as shown by previous research reports. Saving in pollution charge is about Rs. 5 million per year (Moghira *et al.*, 2016).

In the present study, to investigate the chromium recovery with effect of the removing the COD value of wastewater from leather industry.

MATERIALS AND METHODS

All the samples of waste water were taken during the leather manufacturing operations from an industrial unit of leather tanning under stick condition of quality control parameters like temperature, pressure and humidity (ASTM, 2005a).

Seven different vessels of different colors used were which mentioned the sampling name, each samples vessels have one liters capacity and vessels were sterilized and uncontaminated with excellent polymers materials based manufactured (Reed S, 2010).

The both qualitative and quantitative chemical analysis was performed for parameters as Chromium, BOD, COD, TSS, TDS, Sulphate and Chloride under standard analytical titration methods (ASTM, 2005b).

All waste water samples were tested and analyzed three times and one value result indicate the mean value of that (Russell RL *et al.,* 2009).

RESULTS AND DISCUSSIONS

Experimental results of different experiments conducted to determine different experimental conditions of pH for recovery of chromium are discussed below:

In Table 1, it shows high concentration of TDS, chloride and sulfate in the pickle-spent liquor. High TDS and chloride ions concentration is due to addition of sodium chloride and sulfates are due to sulfuric acid in the pickle bath. The recycling of this present liquor would ultimately reduce the concentration of these pollutants in the final effluent.

Results show that high level of toxicity due to high value of different water pollution parameters like, BOD, COD, Chromium, Chloride, Sulphate, etc.

Table 1: Average concentration of different pollution parameters in pickle spent liquor.

Sr. No.	Parameter	Concentration (mg/l)	Pollution load(Kg/d)	% of total pollution load
1	BOD	1611	38.66	1.50
2	COD	5269	126.30	4.80
3	TSS	2744	65.80	2.50
4	TDS	54055	1297	50.00
5	Sulphate	21489	515.6	20.00
6	Chloride	23381	561	21.50
7	Chromium	93	316	30.4

A. Effect of pH on recovery of Chromium

It is shown from Fig. 1, when pH is increased from acid medium to basic medium the recovery of chromium is reached towards maximum .increasing the pH from 4 to 7, there is about gradual change for chromium removal but at pH 6 to 8 have slight change for recovery of chromium from wastewater. From result in Fig. 1, it can be said that chromium recovery is very sensitive with regarding the pH values and recovery efficiency is totally depend on pH values.

B. Effect of pH on COD Removal

It shows towards the characteristics changes of COD value for treated chrome wastewater at different pH that decrease in value of COD and colour with increase for value of pH for chromium recovery. Thus optimum reaction pH was observed is 8.0.

In addition, value of pH is increased of wastewater containing chromium as major pollutant, there is many changes as precipitation is take place, then chromium metal was a cause of COD value which is separated through precipitation .Filtrate wastewater is free from chromium metal and this is a automatically step for reduction in COD after chromium recovery from wastewater of leather industry. It is already studied in literature about nature of COD of wastewater and its value is increased with high value of organic and inorganic chemicals dissolved in wastewater (Dunn K., 2010).

Results from Fig. 2 may also explain as reduction and removal of COD is 70 % at pH 8 because maximum precipitation is possible at this pH and given COD value after wastewater treatment is acceptable for natural environment and according to ecological rules (Kim DS *et al.,* 1995).

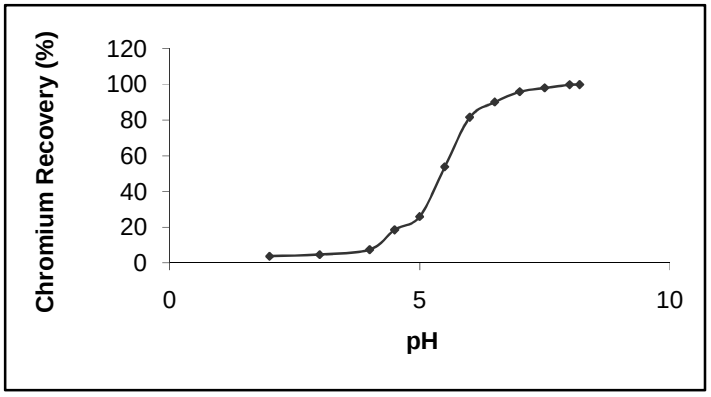

Fig. 1. Effect of pH on Chromium recovery from waste water.

C. Effect of pH on Colour Removal

It is reported in literature for effects of pH on colour remove from the wastewater of paper and pulp industry but do not show as significant change in colour after treatment [8]. From Fig. 2, it is shown at pH 4.5 for colour remove is about 25% in waste water due to filter out precipitate of chromium hydroxides of green colour and as pH increased colour removing is starting from pH 4.5 to 8 with range of colour removing.

It is experimental studies about the optimum pH is 8 for about 99 % removing of colour from waste water. It is because green colour salt of chromium sulphate in wastewater and precipitation is a process for removing these particle from wastewater. One reason is for maximum colour removing at pH 8 because chromium recovery at 8 pH is 98.5% for chromium metal and colour of filtrate is like as water colour (Peters TB *et al.*, 2010).

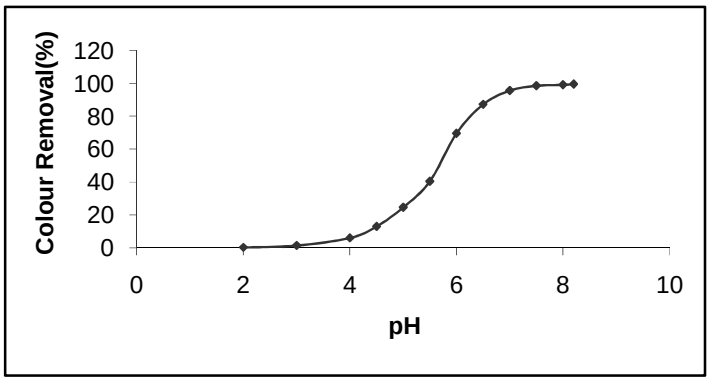

Fig. 2. Effect of pH on colour removal from waste water.

From Fig. 2, it is showed that increasing the pH values may help to reduce the colour intensity of wastewater because it approach towards maximum recovery of chromium from wastewater of leather industry.

CONCLUSIONS

Precipitating agent as calcium hydroxide was used. The effects of pH on recovery and removal of Chromium were studied in batch experiments. Results show that the optimum pH is 8 for recovering the chromium from tanning wastewater by using the Ca $(OH)_2$ with effective concentration as 3500 mg/l and also effect of optimum pH value is 8 upon removal of COD, colour and gives with high settling rate from tanning wastewater.

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