THE EFFECT OF WASTEWATER TREATMENT OF THE LEATHER INDUSTRY ON THE ENVIRONMENT. TECHNIQUES FOR TREATMENT OF INDUSTRIAL EFFLUENTS

CHROMIUM ADSORPTION ON FAT EXTRACTED FLESHING CHARCOAL FROM TANNERY WASTEWATER

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In leather processing, chrome tanning is the most popular tanning due to its high thermal stability. In chrome tanning, basic chromium sulphate (chromium salt) is used as tanning agent which makes the collagen imputrescible. Worldwide, every year 1.5×10^4 ton chromium salt is used in the chrome tanning (Bhuiya et al. 2011) where pickle pelt up takes only 60% chromium and the remaining 40% chromium remains in the wastewater (Fabiani et al. 1997). Hashem et al. (2015) reported that chromium content in the waste chrome liquor ranges from 2656-5420 mg/L. Discharging this chromium containing wastewater is a major concern for the environment.

Trivalent chromium, Cr (III) is an essential trace element for human body (Kalidhasan et al. 2009) nonetheless long-term exposure to Cr (III) is recognized to cause allergic skin reactions and cancer (Matos et al. 2009). Yalçin et al. (2004) reported that Cr(VI) could be toxic and carcinogenic.

Generally, chromium cannot be either degraded or destroyed in waste effluent but could be removed or reduced from water bodies through various methods (Onyeji and Aboje, 2011). However, those methods are either costly or difficult to perform (Bhatti et al. 2007). Also, diverse methods have been enacted to recover/remove chromium from the tannery wastewater (Attia et al. 2010; Onenc et al. 2011) but these processes need extra activation to create more pores on surface activated carbon.

In this study, the fat extracted fleshing was used to produce charcoal without any chemical impregnation for chromium adsorption from tannery wastewater.

The dried fat extracted fleshing was burnt in a furnace at 575-600°C for 2 and half hours, crushed and sieved on 80-mesh. The charcoal was directly mixed with chrome tanning wastewater. Before treatment and after treatment, chromium content was measured following the official methods of analysis of Society of Leather Technologist and Chemists (SLTC 1996).

Fig. 1 depicts the batch-wise effect of charcoal dose on chromium adsorption. It seems that the chromium content was decreased in treated wastewater with increasing charcoal dose. Fig.1 (b) explicitly indicates that with increasing charcoal dose chromium content in the treated liquor was significantly decreased. Chromium content of the treated liquor for the charcoal doses 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 g were 408.28, 339.08, 103.80, 76.12, 69.20 and 38.75 mg/L, respectively. Chromium content was in raw waste chrome liquor was 3650.3 mg/L therefore chromium adsorption efficiencies for charcoal dose 0.5, 1.0, 1.5, 2.0, 2.5, and 3.0 g were 88.8%, 90.7%, 97.2%, 97.9%, 98.1 and 98.9%, respectively.

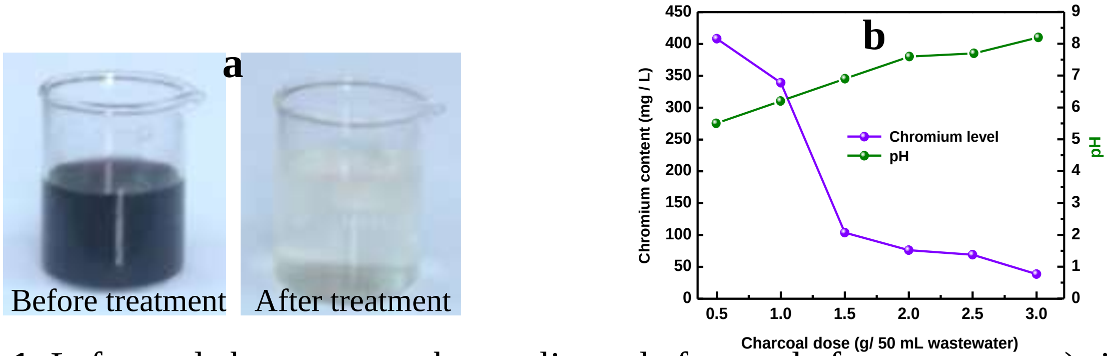

Fig 1. Left panel shows waste chrome liquor before and after treatment **a**) right panel shows effect of charcoal dose on chromium adsorption **b**)

Fig. 1(b) also implies that with increasing the charcoal dose pH was also gradually increased. It is clear that during chromium adsorption on charcoal dose pH plays a vital role. pH is responsible for the promotion of metal binding site during chromium adsorption. Chonjacka (2005) stated that at the elevated pH adsorption of hydrolysis yields and chromium is precipitated as colloidal insoluble chromium hydroxide. Therefore, at the higher pH, chromium removal was obtained more than the lower pH.

Table. **Data comparison before and after treatment**

Parameters	Raw sample	This study	(MoEF, 1997)
pH	3.7	8.2	6–9
TDS (g/L)	21.96	19.98	2.1
EC (mS)	48.3	40.98	1.20
Salinity (ppt)	31.6	21.6	–
Cr (mg/L)	3650.3	69.2	2.0

The investigated results at optimized conditions are shown in Table . After all stages of treatments, the obtained result for physicochemical parameters pH, TDS, EC, salinity, and chromium was 8.2, 19.89 g/L, 40.98 mS, 21.6 ppt, and 69.2 mg/L, respectively. The maximum chrome removal efficiency was 98.1%. The study indicates that the present approach was an effective adsorption technique of chromium on charcoal to minimize pollution load from the spent chrome liquor especially tannery wastewater.