DETERMINATION OF HEAVY METALS IN TANNERY EFFLUENT

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Abstract:

The present research work determined some heavy metals (Zn, Cr, and Fe) in tannery effluents. Tannery effluents were collected from three industries in Challawa industrial sites, Kano. The samples were digested using mineral acid (H_2SO_4), and distilled water by heating. The concentrations were determined by plotting a graph of absorbance against concentration of standard solution. The analysis is performed using atomic absorption spectrometer, AAS (Perkin-Elmer, 2380). Results indicated that Cr ranged between 4.00 to 7.00 mg/LFe ranged between 6.5 to 11.5 and Zn ranged between 6.00 to 7.00, in all the samples which are above the permissible limits.

INTRODUCTION

Tannery waste is generated in huge amounts during the process of tanning by leather industries throughout the world. It has been considered one of the most polluted industrial wastes and contains high amounts of metals which are very toxic to plants, animals and soil. Tannery wastes are of serious consequence since it has a role in pollution of fresh water bodies, streams and land.

Tanneries, oil refineries and metal industries are causing depletion of surface and ground water quality [E.M.Raj et al, 1996]. The discharge of various sub processes of tanneries like bathing, pickling, tanning, dyeing and fat liquoring may cause water pollution severely. The pollution of a particular water body can always be link to an industry or sewage or agricultural run-off [N.S.Subramanyam, 2006].

The current pattern of industrial activity alters the natural flow of materials and introduces novel chemicals into the environment. The released organic compounds and heavy metals are one of the key factors that exert negative influences on man and environment causing toxicity to plants and other forms of biotics and abiotics that are continually ex-posed to potentially toxic heavy metals [Saritha Banuraman, 2013]. The pollution of heavy metal ions in the environment is a critical problem be-cause of their toxicity and other adverse effects on the receiving waters and /or soils [Salah Abdelwanees, 2012]. Unlike organic pollutants which may degrade to less harmful components as a result of biological or chemical processes, metals are not degradable by natural pro-cesses especially when elemental metallic content is considered. The effects of metal pollution on local environments and organ-isms may therefore be substantial and long lasting in spite of extensive remediation efforts.

In the environment, Heavy metals are toxic and resist to bio-degradation which are discharging pollutants from industrial wastewater. Disposal of effluents from the industries has resulted in serious contamination of numerous sites. Numerous metals such as Cr, Fe, Zn, etc. have toxic effects on human's health and also non-renewable resources. Contamination of lakes and streams by the presence of heavy metals from the natural ecosystem, as pollutants adsorption onto the soil and then to lakes etc. has cause the serious problem to human health [YadlaSatyaVani, 2012].

Heavy metal content of soil is of major significance in relation to their fertility and nutrient status. Many metals such as Zn, Cu and Se are essential elements for normal growth of plants and living organisms. However, deficiency or excess of these metals could lead to a number of disorders. Metals other than essential elements such as Pb or Cr, may be tolerated by the environment in low concentrations, become toxic in higher concentrations. [Yargholi B, 2008].

Studies have documented that direct disposal of effluents to land and water bodies has potential to contaminate air, surface, ground water as well as soils and crops grown on these soils which will have bearing on human health [Khurana M. P. 2012].

Long-term disposal of tannery wastes has resulted in extensive contamination of agricultural land and water sources in many parts of the world.

Such treatments are essential to prevent the contamination of drinking water and the reach of contaminants into food chain (Pang et al., 2010).

MATERIALS AND METHODS

Tannery effluent sample

Tannery effluent samples were collected from two industrial sites in Challawa, these are; Kano Fata and Mahaza, Kano State Nigeria.

Preparation of wastewater sample for heavy metals detection

A volume of 100 ml of the effluent was digested with 2 ml concentrated H_2SO_4(for metal digestion) and 2 ml H_2O_2 (for digestion of any residual organic matter) at 80°C and left until the volume reached 15 to 20 ml, then cooled, filtered and completed up to a volume of 100 ml with distilled water (EPA 2007,1987).

Measurement of heavy metals

The previously prepared sample was used for heavy metals determination.A cathodes lamp of each metals to determine was placed in the machine and all parameters were set. Individual solutions form the blank, standard and sample were aspirated and their absorbance readings recorded respectively. The procedure was repeated using different lamps and samples. Average reading of both standards and samples were corrected from the blank readings. A calibration curve was plotted for the standards. The concentrations of each element under investigation in mg/dm3 and were determined from the calibration curve of its standard.

RESULTS AND DISCUSSION:

The physico-chemical characteristics of the treated tannery effluent from Mahaza and Kano Fata industrial sites are shown in Table 1 and 2. The results of this study show that the effluent of tannery process is one of the most important sources of environmental pollutants. The concentration of Heavy and transition metals in the effluent is extremely high. The pH of effluent was 8.1 having conductivity of 15860 and 14780 moles/cm. The Heavy metal such as Cr, Fe, and Zn were present in significant quantities. Total Cr concentrations in the tannery effluent is 5.50 and 11.0 mg/l, Fe concentration is 6.50 and 11.0 mg/L and Zn concentration is 6.00 and 7.00 mg/L respectively, which were above the permissible limits, given by W.H.O.

Table 1: Characterization and heavy metals content of the treated effluent from Mahaza site

PH of untreated sample is 8.10

Parameter	Result
Ph	1.33
Conductivity (moles/cm)	15850
Turbidity (NTU)	117
Chromium (mg/L)	5.50
Iron (mg/L)	11.5
Zinc (mg/L)	7.00

Table 2: Characterization and heavy metals content of the treated effluent from Kano Fata site

PH of untreated sample is 8.40

Parameter	Result
Ph	1.53
Conductivity (moles/cm)	14780
Turbidity (NTU)	115
Chromium (mg/L)	11.0
Iron (mg/L)	6.50
Zinc (mg/L)	6.00

CONCLUSION

The analysis of effluent water for heavy metal contamination is an important step in ensuring human and environmental health. Excess levels of heavy metals might cause several short term and long term health effects to human beings. The present study is focused on determination of three heavy metals like, Zinc (Zn) Chromium (Cr) and Iron (Fe) in Challawa Industrial Region, Kano state. In two study areas during the study period above, all the heavy metals are above the permissible limit set by the World Health Organization. This study reveals that effluent water from industrial sites were highly polluted.

RECOMMENDATION

There is urgent need to follow adequate effluent treatment methods before their discharge to surface water for reducing their potential environmental hazards. Strict environmental laws become imperative so as to control this stress.

Government should take a possible action to ensure that industries treat and if possible recycle their effluent back to the factories for their activities.

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