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Removal of Vanadium from Polluted Waters Using Bio-Adsorbents

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Abstract

Ashes of leaves of Asclepias gigantean plant, Black-palm tree and Eucalyptus tree, the barks of Tamarind tree, Dried and crushed Neem tree leaves has been used as bio-adsorbents for the removal of Vanadium from aqueous solutions. Batch system of extraction procedure was adopted. Vanadium was determined by using xylenol orange method spectrophotometrically.

Introduction

Vanadium is more abundantly distributed in earth's crust as its compounds than other heavy metals such as Copper, Zinc and lead. The Vanadium minerals include sulphide ores viz., $V_2S_2.3Cu_2S$, oxidized ores such as alaite, $V_2O_5.H_2O$, Vanadium Mica, Vanadinite, $Pb_4\ (VO_4)_{3PbCl}$ Mottramite, $(Cu,Pb)_5V_2O_{10}.2H_2O$, Carnotite $(KO)_2U_2O_3V_2O_5.3H_2O$ and Eosite[1]. Vanadium has been reported in many Iron ores and the magnetite type. It occurs in ash of flue dust of the numerous lignites of coal. It also occurs in the other fossil fuels to an extent of 50 ppm. In fact like Phosphorous cycle, Vanadium too, has **cycle in nature**[2]. Further Vanadium finds many industrial applications such as dyeing, ceramics, ink and catalyst manufacturing. The improper discharges of effluents from these industries contribute to the presence of Vanadium in natural waters.

Laboratory and epidemiological evidence suggests that Vanadium may play a beneficial role in prevention of heart disease. However, it causes Gastro Intestinal and respiratory problems. It also reported recently that it causes some deterioration in bone marrow, which may lead to bone cancer.

The thorough review of the literature shows that there is hardly any attempt in controlling the pollution of Vanadium. The biological approaches for the removal and accumulation of minerals from aqueous solutions during the last decade have shown interesting results. They have stimulated continuous and expanding research in this field.

The present work aims to explore the possibilities of using some of the waste materials of flora and fauna origin as potential adsorbents in removing Vanadium from polluted waters.

Material and Methods

A) **Chemical :** All chemicals used were of analytical grade. Stock solution Vanadium was prepared by dissolving 1.146 gm of Ammonium Vanadate in 1000ml distilled water. Its concentration is 500 ppm. It is suitably diluted as per the need.

B) **Adsorbents :** Diverse adsorbents of flora and fauna origin are used. The promising adsorbents are:

1. **Ashes :** Leaves of Asclepiads gigantean plant, Eucalyptus tree and black-palm tree and also the Barks of Tamarind tree were collected, washed, dried and burnt.
2. **Leaves:** The neem tree leaves were collected, washed and air-dried. The driedleaves were crushed to powder.

C) **Adsorption Experiment :** Batch system of extraction procedure was adopted. Carefully weighed quantities of adsorbent were taken into pre-washed I lit/500ml stopper bottles containing 500ml/250ml of Vanadium (V) solution of predetermined concentrations. The various pH values of the suspensions were adjusted with dilute HCl or dilute NaOH solutions using pH meter. The samples were shaken in a mechanical shaker. After the said equilibration period, an aliquot of the sample was taken for Vanadium determination. Vanadium (V) was determined by using xylenol orange method, spectrophotometrically. [3-4]