Adsorption of heavy metal in contaminated surface water onto Limestone and Coconut Coir pith

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Geo-environmental studies were conducted in Katedan Industrial Development Area, Hyderabad, India, where the industrial effluents has contaminated the fresh water lakes.

To treat the effluent through a Permeable Reactive Barrier (PRB), the contaminated lake samples were collected to carry out the column tests in the laboratory to identify the appropriate reactive material to reduce the concentration of toxic/heavy metals like Lead, Zinc, Chromium, Arsenic, Copper etc. to an environmentally acceptable limit by their adsorption on to the reactive material.

The column experiment was conducted for one week to treat the contaminants in the surface water from Katedan Industrial Area using various reactive materials such as Zero Valent Iron, Coal, Limestone and other organic materials like Coconut coir pith, Hey, Cow dung cakes and plant materials like leaves, barks and stems etc.

The contaminated water was passed through the column made of Polyvinyl Chloride (PVC). The column is 50 cm long with diameter of 10cm. It was filled with 70% (14cm) height of 2-4 grain sized limestone and 30% (6 cm) of fibrous coconut coir pith.

The flow rate of 55 rpm was kept constant through out the column experiment. The effluents from the column were quantitatively analysed using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES).

The concentration of certain heavy metals at the effluent was reduced to the environmentally acceptable limits eg. (Cr 43.52 µg/kg to 21.49 µg/kg), (Cu 30.4 µg/kg to 4.62 µg/kg), (Ni 27.44 µg/kg to 12.54 µg/kg), (Pb15.62 µg/kg to 9.92 µg/kg), (Zn 98.25 µg/kg to 0.80 µg/kg) by limestone and coconut coir pith. The limestone has helped in increasing the alkalinity of contaminated water passing through it up to $_{P}$H – 9, the rise in alkalinity allowed the heavy metals to precipitate that in turn was adsorbed by the coir pith. The fibres containing lignin did remove the heavy metal ions showing that lignin does play a major role in metal ion sorption.

References

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Electrical properties of geikielite at high pressures and temperatures

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Fe-Mg- titanates minerals (ilmenite, pseudobrookites, ulvospinel, geikielite, etc.,) are common accessory minerals in terrestrial metamorphic and igneous rocks, and are especially abundant in the high-Ti environment of the lunar crust [1]. Study of high-pressure phase stability of Ti based minerals are considered to be most important in estimating, and extracting helium-3 from the moon's regolith, because helium-3 gets trapped on the moon within Ti-rich glass particles, along with –geikielite-ilmenite crystal boundaries, and within moon dust [1]. Minerals with intermediate compositions of ilmenite-geikielite solid solution also known to occur as accessory mineral in kimberlites, with geikielite content ranging from 30 to 70 mol % [1,2]. Information on high-pressure phase stability of Ti –based oxides would provide a useful geobarometer for ilmenite-bearing rocks either shocked by a meteorite or exhumated from the Earth's deep mantle. The electrical resistivity of nano-crystalline geikielite decreases from 2.246 X 10^{8} Ω m at room pressure to 2.0 X10^{6} Ω m at 7.8 G Pa, whereas the electrical resistivity of natural geikielite decreases from1.098 X10^{8} Ω m at room pressure to 1.74 X 10^{5} Ω m 7.8 G Pa, indicating more compressibility of natural geikielite in the pressure range of investigations. The present shows that the geikielite does not undergo any pressure induced phase transition up to 7.8 G Pa, indicating its stability in the earth's mantle pressure conditions [3,4].

References

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