International Journal of
Alternative Fuels and Energy
ISSN: 2523-9171 (Online) – A Peer-reviewed Journal

Editorial 2018 | Volume 2 | Issue 1 | 14-15

Article Info

Open Access
Citation: Iqbal, M.N, Ashraf, A., 2018. Environmental Pollution: Heavy Metals Removal from Water Sources. Int. J. Altern. Fuels. Energy., 2(1): 14-15.

Received: January 6, 2018

Accepted: March 29, 2018

Online first: April 4, 2018

Published: April 4, 2018

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Environmental Pollution: Heavy Metals Removal from Water Sources

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EDITORIAL

Environmental pollution arising from heavy metals and minerals in the wastewater is the most serious problem. Due to extensive anthropogenic activities such as industrial operations particularly mining, agricultural processes and disposal of industrial waste materials; their concentration has increased to dangerous levels. Heavy metals in industrial effluent include nickel, chromium, lead, zinc, arsenic, cadmium, selenium and uranium. A wide variety of toxic inorganic and organic chemicals are discharged into the environment as industrial wastes, causing serious water, air, and soil pollution. Water pollution caused by toxic heavy metal ions has become a serious environmental problem. Heavy metals are natural constituents of the earth crust and present in the environment as a result of weathering and erosion of parent rocks. In addition to natural sources, they are introduced in the ecosystems through wastewaters originating from anthropogenic sources such as chemical manufacturing, metal finishing, welding, alloys manufacturing, painting, mining, extractive metallurgy, plating, tannery battery industry and from agriculture using fertilizers and pesticides (Bradl, 2005). These toxic metal ions, even at low concentrations, have deteriorated water resources and drinking water and easily accumulated in the human body through the food chain, causing a variety of diseases and disorders. So, it is necessary to remove these metal ions from industrial effluents for their subsequent safe disposal. The removal of heavy metal ions from wastewaters has been a subject of extensive industrial research. Different methods, such as precipitation, solvent extraction, chemical and electrochemical techniques, ion-exchange methods ultra filtration and reverse osmosis, flotation and coagulation have been established for the removal of toxic metal ions from industrial effluents and wastewaters. However, most of these processes are unacceptable, owing to the disposal of sludge, their high cost, low efficiency and inapplicability to a wide range of pollutants (Emamjomeh and Sivakumar, 2009). So, various readily available natural materials were reviewed as adsorbents of heavy metals from industrial wastewater.

Adsorption is one of the alternatives for such cases and is an effective purification and separation technique used in industry especially in water and wastewater treatments. Cost is an important parameter for comparing the adsorbent materials. Therefore, there is increasing research interest in using alternative low-cost adsorbents. Ion exchange is probably one of the major adsorption mechanisms for binding divalent metal ions to the walnut sawdust. Novel adsorbents and membrane filtration are the most frequently studied and widely applied for the treatment of metal-contaminated wastewater. However, in the near future, the most promising methods to treat such complex systems will be the photo catalytic ones which consume cheap photons from the UV-near visible region. They induce both degradation of organic pollutants and recovery of metals in one-pot systems. Adsorption on solid-solution interface is an important means for controlling the extent of pollution due to heavy metal ions. The use of activated carbon and ion exchange resins is not suitable for developing countries due to their high capital and operational costs. This has encouraged research into discovery of materials that are both efficient and cheap. Interest has recently arisen in the investigation of some unconventional methods and low cost materials for scavenging heavy metal ions from industrial waste waters from industry.

Materials such as silica gel and bentonite are of great interest as their cost is less and are also available abundantly (Rengaraj and Moon, 2002). However, there are many cases in which these do not adsorb metals efficiently; therefore it becomes necessary to modify these materials by using suitable method. Silica gel cross linked with bentonite composite may effectively remove trace elements such as Cu, Zn, Fe, Cd, Pb, and Mn from contaminated water (Jal *et al.,* 2004).

Composites can be defined as natural or synthesized materials which are made from two or more materials having significantly different physical and chemical properties. Such materials remain well defined, separate and distinct at the microscopic or macroscopic scale within the material and can also be regenerated after their use through the process of desorption. Moreover, very high reactivity of composite materials and their excellent selectivity towards specific pollutant makes them a promising and attractive adsorbent for the removal of various kinds of pollutants(Jiuhui, 2008).

In recent years, polymer nanocomposites have attracted the attention of scientists and technologists in water purification due to improved processability, surface area, stability, tunable properties, and cost effectiveness (Pandey *et al.,* 2017). The purpose to synthesize composites is to combine the desired properties of the materials. In nano composite, the nano particles (such as clay, metal, carbon nano tubes, etc.) play the role of filler in the matrix. Combined properties are shown by Polymer–clay composites; which represent an improvement in thermal, mechanical and porosity properties compared with the homogenous characteristics of the bare individual clay and polymer components (Bulut and Tez, 2007).

In Pakistan, the provision of safe water is lacking in most areas of the country. Water pollution is damaging the ecosystems and the aquatic life. The need of the hour is to deploy effective water treatment strategies for the removal of heavy metals from water sources.

CONFLICT OF INTEREST

The authors declare that no competing interests exist.

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