



**Development of a water filtering material to remove heavy metal ions in water, by incorporating zinc oxide nanoparticles to a kaolin matrix prepared using rice husk as pore forming agent**

By

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## ABSTRACT

Water pollution by heavy metal ions is a serious environmental issue in modern times. Industrialization and urbanization have increased the quantity of release of toxic heavy metal ions in to aquatic systems. Few of these toxic heavy metal ions include lead, cadmium, mercury, nickel, cobalt, arsenic and antimony. These are released by various industries and through residential setting. Once these metal ions are released in to environment, they are in turn can enter in to humans and other living organisms via water and other consumables. Most of these heavy metal ions do not have a known biological function in human body and are non biodegradable. They can cause serious health problems in humans and other living organisms. Health problems which can be caused by heavy metal ions in humans include effects to central nerve system, anaemia, encephalopathy, renal disturbances, bone lesion, kidney damage hypertension, problems in cardiovascular system and hepatic damage. Some heavy metals such as nickel and arsenic are considered to be human carcinogens. Therefore removal of these toxic heavy metal ions from water is of utmost importance.

Among various methods available to remove heavy metals from water, adsorption is one of the most widely used techniques since it is both efficient and cost effective. The goal of this project was to develop an effective, efficient and a low cost filtering matrix to remove heavy metal ions in water.

In this research kaolin based adsorption material was tested for its ability to adsorb and remove heavy metal ions in water. A porous kaolin matrix was prepared using kaolin : rice husk at 15 : 2 ratio and this matrix was burnt at 650 °C. The ability of this matrix to adsorb and remove lead and cadmium ions in water was tested. Another important aspect of this research is to study the ability of zinc oxide nanoparticles to adsorb and removing heavy metal ions in water. Zinc oxide nanoparticles were prepared and they were characterized using FTIR spectroscopy and scanning electron microscopy imaging. Zinc oxide nanoparticles were incorporated in to the porous kaolin matrix. The resulting matrix was then tested for adsorption of lead and cadmium ions. Results revealed that both kaolin matrix and zinc oxide nanoparticle embedded matrix are efficient adsorbents for lead and cadmium ions. However zinc oxide incorporated kaolin matrix proved to be a better adsorbent with enhanced ability to remove lead and cadmium ions. The additions of zinc oxide nanoparticles in to the kaolin matrix have enhanced the adsorption of heavy metal ions significantly. It confirms that zinc oxide nanoparticles have a high affinity towards lead and cadmium ions and it can be used as an effective and efficient substance to absorb heavy metal ions in water.