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A review: Removal of lead (II) from aqueous solution using various activated carbons

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ABSTRACT
Lead as a toxicologically relevant element has been brought into the environment by man in extreme amounts, despite its low geochemical mobility and has been distributed worldwide. Lead amounts in Deep Ocean waters are about 0.01-0.02 μg/L, but in surface ocean waters is about 0.3 μg/L. Lead has been recognized of centuries as cumulative poison. High-dose of Lead may induce severe complications such as abdominal colic pain, bloody diarrhea, and kidney failure. These limits suggest more stringent requirement for the removal of lead from aqueous environment, which necessitated the development of innovative, sludge reduce and cost-effective technique. This review article is aimed at providing information and summarized in review paper.
Keywords: *Heavy metal; Mercury; Adsorption; Isotherm*

I. INTRODUCTION

Water contains impurities of various kinds which are dissolved as well as suspended. Heavy metals are major toxic pollutants with serious health effects on humans (Inglezakis et al., 2003; Demirbas, 2008). The toxicity of heavy metals depends on the concentration of metal ions, nature of the organism with which it interact. The heavy metals are the most toxic metals of wide spread use in industries such as tanning, electroplating, electronic equipment, manufacturing and chemical processing plants. Lead has been recognized of centuries as cumulative poison (Hua et al., 2012; Kadirvelu et al., 2001; WHO 1977).

Health studies done in Poland have linked elevated levels of lead in the environment with retardation and learning disabilities of children (Groffman et al., 1992). Acute lead poison in human causes severe damages to the kidney, the reproductive system, the liver, the brain and central nervous system. The neuro toxicity of lead is well known but the exact mechanisms of its toxicity are not yet solved. Distribution in glutamate homeostasis of neural tissue on interactions with calcium metabolism has been considered as potential mechanism (Raunio et al., 2001).

Results show a declined trend of BLLs (Blood lead level) in children when compared with those reported from metropolitan cities of India where leaded gasoline was in use. BLLS were significantly associated with biochemical indices in the blood, which have the potential to be used as biomarkers of lead intoxication (Ahamed et al., 2005).

Removal of Pb (II) by adsorption using treated granular activated carbon in both batch and column studies were carried out (Goel et al., 2005). Activated carbon developed from tamarind wood by zinc chloride activation was examined for the removal of Pb (II) from wastewater (Jyotikusum et al., 2009). Activated carbon prepared from marine green algae was used for removal of adsorption of Pb (II) ions (Suresh Jeyakumar et al., 2014). Treatment of lead contaminated water using activated carbon adsorbent from locally available papaya peel bio-waste is used for the removal of Pb (II) ions (Sahar Abbaszadeh et al., 2016).

Edidiong Asuquo et al., (2017) were reported, Cd (II) and Pb (II) ions removal from aqueous solutions using a commercial activated carbon adsorbent (CGAC) under batch conditions. The adsorbent was observed to have a coarse surface with crevices, high resistance to attrition, high surface area and pore volume with bimodal pore size distribution which indicates that the material was mesoporous. Sorption kinetics for Cd (II) and Pb (II) ions proceeded through a two-stage kinetic profile- initial quick uptake occurring within 30 minutes followed by a gradual removal of the two metal ions until 180 minutes with optimum uptake (q_e,exp) of 17.23 mgg^{-1} and 16.84 mgg^{-1} for Cd (II) and Pb (II) ions respectively.

Adewumi O. Dada et al., (2017) was studied; the adsorption of Pb^{2+} onto wood-activated carbon-supported zerovalent iron (WAC-nZVI) nanocomposite. WAC-nZVI was characterized by a combination of spectroscopic and analytical techniques (BET, PZC, FTIR, SEM, and EDX). BET surface area was 101.50 m^2/g and BJH Adsorption average pore diameter 116.73 A. The adsorption of Pb^{2+} studied in batch process depends on various operational parameters ranging from effect of pH to ionic strength. Kinetics data were best described by pseudo-second-order model based on high initial adsorption rate, h2 (166.67 mgg^{-1} min^{-1}) and correlation coefficient ($R2$ > 0.99). The mechanism was controlled by both external and intraparticle diffusion models confirmed by Bangham and Boyd models. Equilibrium data were fitted to seven isotherm models. The Langmuir monolayer adsorption capacity (77.52 m^2/g) surpassed those previously investigated for adsorption of Pb^{2+} onto nanoadsorbents.

Zahoor Ahmad et al., (2018), the novel application of biochars derived from potassium (K)-rich feedstock (banana peels (BB) and cauliflower leaves (CB)). The sorptive property of the produced biochars was evaluated with multi-element Cu (II), Cd (II) and Pb (II) sorption experiments. Morphologies of the pre- and post-sorption samples were characterized using SEM/EDS and XRD spectra analyses. The produced biochar was further subjected to mono-element sorption studies to explore the effect of the pH value of the sorbate solution on the removal efficiency of Cu (II), Cd (II) and Pb (II) ions. Biochar productivity was noticeably high (61.44 and 64.66% for BB and CB, respectively) due to the catalytic action of K during the pyrolytic conversion of the feedstock. K-minerals were the predominant on the XRD patterns of both biochars.

Junaid et al., (2019) were reported, olive stones have been widely used as a renewable energy bio-waste source. As they are rich in elemental carbon (40–45 wt %), much research focused on effectively converting olive stones, as precursors, into activated carbon adsorbents. However, only a few studies have concentrated on summarizing the various techniques used to produce activated carbon from olive stone. Various physical, chemical and physico-chemical treatments to remove heavy metals, organics and dyes are discussed, and the resultant adsorption capacities are reported.

Alkherraz et al., (2020) was reported The equilibrium and thermodynamics of the biosorption of Pb (II), Zn (II), Cu (II), and Cd (II) onto activated carbon prepared from olive branches under different parameters of pH, initial concentration, and temperature. The batch biosorption procedure was used to find the optimum conditions. The biosorption of each metal ion was found to be pH-dependent. The maximum metal ion biosorption was achieved at pH value 5 for Pb, Cu, and Cd ions and at pH 3 for Zn ions. The extent of the metal ion biosorption increased with temperature (indicating the endothermic character) and initial metal ion concentration. The experimental data of metal ion biosorption were analyzed by Freundlich and Langmuir isotherm models. For all metal ions, the Freundlich isotherm model gave a better fit with higher correlation (R2) to equilibrium data than Langmuir model. The adsorption capacity values were 41.32, 34.97, 43.10, and 38.17 (mg/g) for Pb (II), Zn (II), Cu (II) and Cd (II), respectively.

II. Conclusion

From the above literature survey that the adsorption using activated carbons is a valuable tool for analyzing aqueous mercury (II) solution. It is simple, effective and economical methods of water treatment.

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