Versatile Usage of Spent Coffee as an Eco-friendly Water Purifier

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Modern mankind is at odds with two issues: waste management and access to potable water in developing nations. Current water treatment methods such as reverse-osmosis have proved to be energy intensive and costly. Coffee, one of the world's most consumed beverages, is also one of the largest contributors of organic waste. Hence this study was aimed at exploiting the potential of spent coffee to be effectively and conveniently purify water at low cost. Activated carbon (AC) was derived from spent coffee through base treatment and carbonization. Spent coffee extracts were then used to synthesise silver nanoparticles (AgNPs). These AgNPs were coated onto spent coffee and its derived AC to increase antibacterial efficacy. Adsorption studies on lead(II) and copper(II) ions were carried out on all the adsorbents. Results showed that both spent coffee and its derived AC were comparable in adsorbing copper(II) ions but AC was more effective in adsorbing lead(II) ions than spent coffee. Silver coating enhanced the antibacterial efficacy of both adsorbents while preserving adsorption capacity. To increase the practicability and impact of our project, a novel teabag-sized adsorption bag was developed. The outer cotton bag was coated with AgNPs using microwave irradiation and was filled with AC and silver coated spent coffee. This manufacturing process was refined for reliability and cost-efficiency. The adsorption bag exhibited promising results, removing 78% of copper(II) ions, 97% lead(II) ions and 99.99% of E.coli. This study shows great potential to be commercialised through partnerships with international coffee chains to obtain spent coffee grounds, and could be deployed in developing nations to improve access to clean water and reduce waste at a communal level.

Awards Won:

King Abdulaziz &amp

his Companions Foundation for Giftedness and Creativity: Award of $1,000 for Water Technology