Testing the Waters: Development of A Novel Chitosan-Based Water Filter for Industrial and Third World Applications

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In developing countries, nearly 80% of all illnesses are attributed to drinking water polluted with heavy metals and industrial runoff. Current water filtration systems are expensive and inaccessible to many third world countries. To solve this problem, two economical water filters were designed to purify Lead, Copper, Fluoride, and Nitrate- Contaminated Water using accessible materials. It was hypothesized that a chitosan-nanoparticle composite with Zinc Oxide and Silver nanoparticles would remove heavy-metals from water. To test this, Zinc Oxide Nanoparticle-Chitosan Composite, Silver Nanoparticle-Chitosan Composite, along with Sapwood and Banana Peel-Derived Activated Carbon were tested against each concentration of contaminated water. A total of 1200 trials concluded that the Silver Nanoparticle-Composite, Banana Peel Derived Activated Carbon, and Sapwood combined removed 99.39% of all contaminants. The filtration system reduced contamination levels deemed safe to drink by EPA standards. To determine if the filtered water was ecologically safe, the heartbeat rates of a model organism, Daphnia magna, in tap, filtered, and contaminated water were recorded. Results concluded that the Daphnia heartbeat rates were extremely safe and stable in filtered water. A cost analysis of the large-scale and portable water filter determined the total prices of each filter $12.22 and $5.41 respectively. This experiment opens a pathway for the use of novel chitosan-nanoparticle composites with antibacterial and antiviral properties for water filtration. The two filtration systems created show promise as novel, affordable, and safe methods of providing more than 700 million people in the world with access to clean drinking water.

Awards Won:

King Abdulaziz &amp

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

Samvid Education Foundation: Agni Third Award