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Synthesis of silver nanoparticles in porous activated charcoal for water purification applications

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Activated charcoal is wildly used in many communities for purification of water as an important step in the production of portable water. The success of activated charcoal in retaining contaminants in water filtration unit lies in part to the large surface area and the presence of numerous inherent micron or nano-pores that are associated with the body of the engineered material. However activated charcoal have shown to act as a substrate for the growth of many bacterial species, this is particularly important in rural households in developing economies where activated charcoal made small-size filtration units are used. The growth of bacterial and production of chemical by-products can be both toxic and in consequence reduces the filtration efficiency of the charcoal filters. Currently the practice is to kill these bacterial colonies by passing UV radiation through the filtered water, but the initial cost of a UV generating chamber to a filtration unit can be costly to a lot of homes in developing economies. The filtering efficiency of the adsorbent activated charcoal is routinely restored by heating at a high temperature followed by a series of washing, this leads to loss of adsorption capacity of the material. Silver nano particles have a wide range of antimicrobial activity as a result there are studies where silver has been doped with other materials for the filtration of water. In this study we have synthesized silver nanoparticles in activated charcoal and tested for its antimicrobial activity as well as test for the filtering efficiency of material after recharging. The silver nanoparticles of 50-100 nm were synthesized using sonochemical method in the presence of ballmilled activated charcoal. The sample was then characterized using scanning electron microscopy (SEM) transmission electron microscopy (TEM) and X-ray diffraction (XRD) techniques. The antimicrobial activity before and after recharging (by heating at low temperature) of the nano scale silver and activated charcoal material was studied using ATCC 11775 E. Coli, a common water borne contaminant which is an inhabitant of the gastro-intestinal tract. Preliminary results show that the Ag/charcoal hybrid material kills all the bacterial at a combination of 2.5 mg of silver and 100 mg of activated charcoal. No traces of bacterial was detected when water containing 40 x 10^5 CFU bacterial colonies was passed down a silver/charcoal column and the filtrate incubated overnight at room temperature in McConkey agar plates compared with a control containing only charcoal without silver.

Biography

Apalangya Vitus is a ph.D student in material science and engineering in Tuskegee University. He had completed a master degree in chemistry in Tuskegee University in May 2010. He is currently working on the synthesis of calcium related nanomaterials from natural sources for various biomedical applications. Apalangya also holds bachelor's of science degree in chemistry from the University of Ghana.