Development of a Sustainable Water Filtration System Using Plant-Based Silver Nanoparticles Synthesized From Olive Leaves for Enhanced Removal of Bacterial Contamination in Drinking Water, Targeting Emergency Situations and Water-Scarce Regions

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An estimated 2.1 billion people were not able to access safely managed drinking water services in 2024. This water treatment project aims at exploring the use of a portable water filtration system that uses green silver nanoparticles. synthesized silver nanoparticles (AgNPs). The research process had two main stages in terms of experimental work: the green synthesis of (AgNPs) using olive leaves as an eco-friendly and sustainable option, followed by the design and experimental testing of the multilayer filtration system with (AgNPs). E. coli was used as an indicator organism in the experiment, an eco-friendly and sustainable option, followed by the design and experimental testing of the multilayer filtration system with (AgNPs). E. coli was used as an indicator organism in the experimental testing of the antimicrobial properties of the system. Throughout all experimental tests conducted using olive leaf-synthesized (AgNPs), it was found that the concentration of E. coli was reduced. It was also found that the concentration of E. coli affected the overall disinfection efficiency. This was achieved by controlling the contact time between the (AgNPs) and the bacteria in the filtration system. Moreover, the results showed that the reduction of bacteria was not only the result of mechanical filtration but was also linked to the antimicrobial properties of AgNPs, showing that the disinfection was chemically dependent as well. Another important aspect of the filter design was the consideration of safety issues, such as pH stability and the possibility of Ag leaching .The results show the possibility of using sustainable nanotechnology for the design of water treatment filters at the point of use.

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