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Antimicrobial properties of plasmonic metal decorated/doped titanium dioxide photocatalytic films

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The presence of pathogens drinking and wastewater raises concerns about water-borne diseases; hence the killing or removal of pathogenic organisms in water is important. The current disinfection techniques include the use of chemicals, filtration and photochemical damage. Chlorination, which is the most widely used technique prevents infectious diseases but it is not effective for the removal of spores, cysts and some viruses (Zszewsyk *et al.*, 2000). The use of chemicals also leaves undesirable chemical residues and generates toxic by-products that may pose a health risk to humans hence the use of TiO_2 for disinfection is desirable. The photocatalysts produce hydroxyl radicals and other highly reactive oxygen species that are capable of destroying microbial pathogens. Plasmon decorated TiO_2 and carbon/plasmonic metal co-doped TiO_2 photocatalytic films immobilized on fused silica were prepared and tested for their antimicrobial properties in water using *Escherichia coli* ATCC 3695. The study showed that the doping of TiO_2 making it visible light responsive improves its antibacterial action against *E. coli* ATCC 3695. The highest antibacterial action was observed from Ag/C co-doped TiO_2 (0.5 % Ag) photocatalyst under sunlight. All the plasmonic metals (Au, Ag & Cu) were found to enhance the antibacterial action of TiO_2. There was an increase in the antibacterial action of TiO_2 when the plasmonic metal film thickness was increased from 5 nm to 10 nm for Au and Cu but a decrease in the case of Ag. The highest enhancement of TiO_2 antibacterial action was achieved by Au for the same metal content and the best antibacterial inactivation under weak UV light was achieved by TiO_2 photocatalyst deposited on 10nm of gold film.

Biography

Pardon Nyamukamba completed his PhD in 2015 from the Universityof Fort Hare and he is currently doing postdoctoral studies at the same institution. He has published more than 7 papers in reputed journals.

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