Modified nanocomposite materials for removal of water pollutants

Polymeric membranes, electrospun fibers, biosorbents and ceramic materials can be modified through various avenues. Zeolitic and catalytic nanoparticle coated ceramic membranes; hybrid inorganic-organic nanocomposite membranes and bio-inspired membranes (e.g. hybrid protein-polymer biomimetic membranes); aligned nanotube membranes, and isoporous block copolymer membranes, are typical for water purification. We reported various approaches used to produce nanocomposite adsorbents and membranes for water purification. Selected examples of fabrication and characterization (FTIR, SEM, TEM, EDS, BET, TGA, XRD and CAM) approaches in our research group include: (i) Synthesis and characterization of photocatalysts such as Ag, Ag₂O, ZnO and GO for degradation of organic pollutants in water; (ii) Electrospinning of polyvinylidene fluoride (PVDF) and polyacrylonitrile (PAN) composites functionalized with acrylic acid (AA) brushes; and functionalized lignin, cellulose and chitosan-based nanofibers, with 98% removal efficiency of metal ions (Pb, Cd and Cr); (iii) Nanocatalyst loaded polyvinylidene fluoride/polyacrylonitrile (PVDF/PAN) composite (Ag/PAN/PVDF-g-PAA-TiO₂/Fe-Pd) for the dechlorination and photodegradation of pesticides (dieldrin, chlorpyrifos, diuron and fipronil) with 95% degradation efficiency; (iv) Functionalized poly(ethersulphone) powders with carboxylic acid and amino acid groups as support for redox couples for e.g. Fe/Pd and Fe/Ni bimetallic nanoparticles for the electrocatalytic degradation of pesticides (within 30 min to attain 100% transformation) in water including chlorinated compounds (dieldrin, PCB 77 and DDT), confirmed with GCxGC-TOF-MS; and (iv) Polyethersulfone (PES) and magnesium oxide (PES-MgO) and PES-Ag@GO nanocomposite membranes to kill bacteria for e.g. E. coli. Further studies are on-going to reduce leaching of nanoparticles (NPs) from the nanofibers and nanomembranes, during water purification.

Biography

Jane Catherine Ngila has obtained BEdSci (1986) and MSc Chemistry from Kenyatta University (1992). She obtained her PhD from UNSW Sydney, Australia. She has worked at Kenyatta University, University of Botswana, University of KwaZulu Natal, and University of Johannesburg, as a Professor of Analytical/Environmental Chemistry. She has supervised and mentored over 90 Post-graduate students and Post-doctorates. She has published about 300 journal articles, book chapters and conference proceedings.

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