

Polymeric and Inorganic Nanoparticles for Environmental Applications

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ABSTRACT

Nanomaterials fabricated via nano-technology (NT) are giving new hopes for various technologies because of their very unique properties. Recently these nanomaterials have also been using at environmental technology (ET) field. Environmental application of nanoparticles, one of representative nanomaterials, can be divided into three categories: (i) nano-sensor for monitoring environmental pollutants, (ii) nano-sized materials for separation/extraction and removal of pollutants, (iii) nano-sized filler for improving performance of environmental friendly energy system, such as fuel cell and secondary battery. In this study, synthesis and environmental applications of polymeric nanoparticles are first presented. Polymeric nanoparticles dispersed at aqueous phase or organic solvent, were fabricated using amphiphilic polymer precursor chains, urethane acrylate nonionomer (UAN) chains which have propylene oxide-based hydrophobic segment and polyethylene oxide-based hydrophilic segment at the same backbone. UAN chains have amphiphilicity and interfacial activity like a surfactant. On contacting with water, UAN chain could form polymeric nanoparticles at aqueous phase. These nanoparticles (45 – 60 nm) have micelle-like structures which is permanently locked-in by chemical crosslinking. Like surfactant micelles, these nanoparticles could absorb hydrophobic pollutants from aqueous phase and soil grains with extremely low loss of particles. Unlike surfactant molecules, these nanoparticles could be almost 100% recovered by ultrafiltration process. Amphiphilic UAN chains could also make silica or clay nanoparticles nano-dispersed and stabilized at organic solvents, which are nano-dispersed within proton exchange membrane or solid polymer electrolyte, resulting in improved conductivity and reduced methanol permeability of pristine membranes. In addition, magnetic, silver, semiconductor nanoparticles, which can be used as nano-sensor, could be fabricated within hydrophilic nano-domains formed by UAN chains, and these nanoparticles dispersed at organic solvent such methanol, toluene, DMAc were stabilized by UAN chains.