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Facile synthesis of polyindole via emulsion polymerization: Effects of oxidant and surfactant types and doping

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Conductive polyindole (PIn) was synthesized by emulsion polymerization at room temperature under various synthesis conditions. The effects of oxidizing agents ($FeCl_3$, $(NH_4)S2O_8$) and surfactant types (cationic; cetyltrimethylammonium bromide (CTAB), anionic; sodium dodecylsulfate (SDS) and non-ionic; polysorbate 80 (TW80)) were investigated systematically. The PIn synthesized without surfactant was investigated and compared. The PIn/FeCl3 showed higher electrical conductivity by one order of magnitude compared to $(NH_4)S_2O_8$ due to a lower over-oxidation level as verified by X-ray photoelectron spectroscopy. Synthesis of PIn in the presence of a surfactant was determined by using difference of surfactant/monomer mole ratio, suitable ratio for the obtained smallest particle size was 1:0.05 for SDS and CTAB and 1:0.1 for TW80. In this work, the PIn with the nano-scaled size of 60.3 ± 10.8 nm in diameter was found in the emulsion system of SDS. Moreover, the SDS system provided higher electrical conductivity than the PIn synthesized with CTAB and TW80 since the anionic surfactant was an efficient dopant. To improve the electrical conductivity of PIn, $HClO_4$ was utilized as a doping agent for the doping process. The electrical conductivity of PIn clearly depends on doping mole ratio of dopant/indole, it was dramatically increased by 4-5 orders of magnitude with respect to PIn before doping. The highest electrical conductivity in this work obtained of the PIn after doping at 25:1 of doping mole ratio was as high as 14.56 ± 2.39 S/cm which has never been reported previously.

Biography

Katesara Phasuksom completed her B.Sc. with first class honours in Industrial Chemistry from King Mongkut's University of Technology North Bangkok (KMUTNB), Thailand in 2010 and her M.S. in Material Science from KMUTNB in 2013. She is received a PhD scholarship from the Royal Thai Government through the Royal Golden Jubilee Ph.D Program in 2015 and now is studying at Chulalongkorn University in Polymer Science.

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