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Radiation Development of (Polyvinyl Pyrrolidon/Acrylic Acid)- Silver Nanocomposite for the Disposal of Phenolic Compounds from their Aqueous Solutions

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Nitroaromatic compounds are considered to be amongst the most prevalent organic pollutants in waste water. They are intermediates or side products of many industrial products such as dyes, pharmaceuticals, agrochemicals, cosmetics, photographic chemicals, additives, chelating agents, and other products. 4- nitrophenol (4-NP) is a notorious industrial pollutant exhibiting a high solubility and stability in waste water. The direct exposure to these pollutants causes inflammation of eyes, skin and respiratory tract and prolonged contact with skin may cause an allergic response. Much effort has been expended to develop methods for removing the aromatic pollutants from wastewater. The reduction of nitroaromatic compounds to the benefit amines is considered to be the most efficient, green, and economical approach to disposing of the nitro-compounds. The reduction product, 4-aminophenol (4-AP), can be reused because it is important intermediate for the synthesis of drugs and dyes. Therefore, various nano-particles have been employed as an effective catalyst for the reduction of nitroaromatic compounds in aqueous solutions under mild conditions. The main issue hinders the pervasive use of homogeneous metal nano-particles as a catalyst is their high tendency to aggregate as a result of the size and high surface energy of metal nano-particles. Moreover, the problems in separating the products contaminated with unstable residuals and recycling the expensive catalysts. To prevent aggregation of metal nano-particles, diverse supportive materials such as hydrogels are widely employed. Hydrogels are hydrophilic polymeric three-dimensional networks capable of absorbing a large amount of water. The catalytic reactions can take place within the boundaries of hydrogels, no need to change many reactor conditions in industrial applications; just a right choice of hydrogel-composites can supply all the necessary conditions. In this study poly vinyl pyrrolidone/acrylic acid (PVP/AAc) hydrogels were prepared via gamma irradiation technique. (PVP/AAc) hydrogel was utilized as a supporting material to stabilize Ag nano-particles by employing in situ method to obtain (PVP/AAc)/Ag nanocomposite. The catalytic activity of (PVP/AAc)/Ag nano-composite was investigated in the reduction of (4-NP) in sodium borohydride solution (NaBH4). Parameters that affect the reduction rate were investigated. It was found that the reaction proceeded with the conversion exceeding 99.8% at a reaction time of about 5 min for (PVP/AAc)/Ag nano-composite loaded with 231.76mmol/L Ag. The rate of the reduction reaction decreased with increasing the concentration of 4-NP and the optimum concentration of NaBH4 was found to be 0.16mol/L.

Country/Organization invited to participate

Egypt

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