ABSTRACT

In this research, environmental problem of the removal of dissolved oxygen and dyes from water reduced by glucose and catalyzed by glucose oxidase (GOx) was the focus of attention. In order to maintain the enzyme in repeated or continuous runs, its immobilization in the magnetite nanoparticles support was carried out. In addition to enzyme immobilization support, iron oxide nanoparticles also play catalytic role in the decomposition of hydrogen peroxide produced during the glucose oxidation reaction. These particles are interested due to their oxidative stability and non-toxicity. Magnetic nanoparticles of Fe_3O_4 were prepared via green synthesis method. Fourier Transform Infrared Spectroscopy (FT-IR), Scanning Electron Microscopy (SEM), Particle Size Analyzer (PSA) and Ultraviolet Spectroscopy (UV-Vis) analyses confirmed the formation of these nanoparticles. Glucose oxidase immobilization was done by physical method; and percentage of immobilization was obtained 78% with specific activity of 680U/g. Deoxygenation of 150 ml of tap water with 6.9 mg/L O_2 which was catalyzed by the 0.15g immobilized glucose oxidase in the presence of twice stochiometric amount of glucose was completed in about 5 minutes and 30 seconds at 35 °C. Different parameters were also designed to optimize the best condition for the deoxygenation of water. These parameters include glucose concentration, GOX concentration and temperature. The efficiency of deoxygenation process increases with increasing the glucose initial concentration and the enzyme glucose oxidase concentration. This can be attributed to the more substrate-binding sites on the enzyme molecules thereby causing greater water deoxygenation rate, and the rate of reaction is limited by the rate of the catalytic process on the enzyme surface. The efficiency of deoxygenation process is accelerated with increasing the temperature but at certain limit. The generated H_2O_2 in the process of oxidation-reduction was used in the Fenton process (bio-Fenton) for methyl orange decolorization. It was found that the bio-Fenton process was an efficient method for the decolorization of methyl orange.