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Investigation of the effect of polyethyleneimine and dextran coatings on the structural and magnetic properties of magnetite nanoparticles

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Abstract
In this study, the effects of polyethyleneimine and dextran polymers as polymeric coatings on the structural, morphology, and magnetic properties of magnetite iron oxide nanoparticles were investigated using the co-precipitation method. The samples were prepared using standard methods, and their structural and magnetic properties were examined through analyses such as XRD, FTIR, FESEM, SAED, HRTEM, and VSM. The findings of this research indicate that both coatings maintain the spinel structure of Fe_3O_4; however, the polymeric coatings induce differences in surface spin canting and magnetic anisotropy. The results show that the nanoparticles coated with polyethyleneimine are significantly larger than the pure magnetite and dextran-coated magnetite nanoparticles, and they exhibit reduced agglomeration and better stability. On the other hand, the dextran coating, due to its thinner organic layers, leads to greater particle aggregation and higher saturation magnetization. In fact, dextran-coated nanoparticles create steric hindrances that result in different aggregation behaviors.

Keywords: Fe_3O_4 magnetite nanoparticles, dextran coating, polyethyleneimine coating, structural, morphology, and magnetic properties

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