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Sonochemical Synthesis of Monodisperse Superparamagnetic Fe_3O_4 Nanoparticles using Lgepal CO-520

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Superparamagnetic iron oxide nanoparticles (NPs) have attracted tremendous interests due to their technological importance in the field of biomedical applications such as magnetically controlled transport of drugs and magnetic resonance molecular imaging contrast agent. Among the various preparation methods for synthesizing superparamagnetic NPs, sonochemical method offers rapid chemical reactions through the process of acoustic cavitation. In this study, we report a new synthetic route for the preparation of monodisperse Fe_3O_4 NPs by sonochemical method using non-ionic surfactant Igepal-CO 520 (Polyoxyethylene (5) nonylphenylether) as a modifier of the reaction environment. The ultrasonic processor with a maximum power of 1,500 W generating capacity at 20 kHz was used for the preparation of NPs. By optimizing the preparation conditions such as concentration of Igepal-CO 520 and reaction time, we successfully synthesize monodisperse Fe_3O_4 NPs with the average size of 5 nm which implies that the Igepal-CO-520 could be a good candidate to prevent oxidation and toxicity problem in typical sonochemical synthesis process. Superparamagnetic nature of the NPs was observed by measuring magnetic hysteresis loop using vibrating sample magnetometer (VSM). We will further discuss the growth mechanism and magnetic characteristics of the Fe_3O_4 NPs.