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## Synthesis and characterization of $\text{CaFe}_2\text{O}_4$ nanoparticles via co-precipitation and auto-combustion methods

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### Abstract

In this paper, the techniques for the synthesis of  $\text{CaFe}_2\text{O}_4$  nanoparticles using the auto-combustion and co-precipitation methods are discussed. The effects of both methods on the microstructure and magnetic properties of the  $\text{CaFe}_2\text{O}_4$  nanoparticles were compared. The  $\text{CaFe}_2\text{O}_4$  powder was obtained after drying the synthesized sample via co-precipitation overnight in an oven at 80 °C. For auto-combustion method, the sol that was initially formed was gradually converted into a gel, which was then combusted at 250 °C. Finally, the  $\text{CaFe}_2\text{O}_4$  nanoparticles were calcined at 550 °C. The different synthesis methods produced nanoparticles with different physical and magnetic properties in order to find an optimum size to be utilized for drug delivery applications. The results of the X-ray diffraction showed that both processes produced nanocrystals with an orthorhombic crystalline structure. It was noted from the measurements made with a transmission electron microscope (TEM) that the synthesis using the co-precipitation method produced nanoparticles with a size of about 10 – 20 nm, which was comparable with the size that was obtained when the auto-combustion method was used. The magnetic properties were investigated using a vibrating sample magnetometer (VSM), where the magnetic saturation ( $M_s$ ) of  $\text{CaFe}_2\text{O}_4$  for the sample synthesized using the co-precipitation method was 47.279 emu/g, which was higher than the magnetic saturation ( $M_s$ ) of 31.10 emu/g obtained when the auto-combustion method was used. The hysteresis loops ( $H_c$ ) for the samples

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