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Hydrothermally Developed Nanomaterials and Their Surface Modification Using APTES and TEOS.

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Synthesis method and coating material are correlated parameters to get a specific nanoparticle shape; core particles can be uni-dimentional such as spherical nanoparticles, nanofibers, nanorods or nanotubes (Chen et al. 2008). Coating selection and materials are important as synthesis election, but is necessary to emphasize on synthesis since nanoparticles shapes and homogeneity are influenced by temperature, reagents, pH also if the synthesis is controlled under an aqueous solution or the atmosphere (Oxidant or N2) in which the reaction is carry on. So many synthesis methods have been described to get spherical homogeneous nanomaterials two of the most used are solvothermal synthesis in which the aqueous reaction is controlled in a reactor with controlled temperature and pressure and other one is using ... it consist in apply ultrasonic waves during an aqueous synthesis, these waves will produce cavitation that large particles or aggregates will be fragmented intro smaller particles.

For Procedure #1 called “H1” these were the reagents used: (1) Manganese (II)- nitrate (Mn(NO3)2) purum p.a., ≥97% Sigma Aldrich; (2) Zinc nitrate (Zn(NO3)2·6H2O) reagent grade 98% Sigma Aldrich; (3) Iron (III) nitrate (Fe(NO3)3·9H2O) ≥98% Sigma Aldrich ; (4) Oleic acid (C18H34O2); (5)Ammonium hydroxide (NH4OH); (6) Ethanol 96% (C2H5OH) ; (7) Sodium hydroxide (NaOH); (8) Hexane (C6H14)

For Procedure #2 called “H2” these were the reagents used: (1) Manganese (II)- nitrate (Mn(NO3)2) purum p.a., ≥97% Sigma Aldrich; (2) Zinc nitrate (Zn(NO3)2·6H2O) reagent grade 98% Sigma Aldrich; (3) Iron (III) nitrate (Fe(NO3)3·9H2O) ≥98% Sigma Aldrich ; (4) Ethanol 96% (C2H5OH); (5) Ammonium hydroxide (NH4OH).

Mn-Zn ferrites synthetized by hydrothermal method were coated with (3-Aminopropyl)triethoxysliane (APTES) according with Hong et al. coating protocol. It consisted on weight 25mg of Mn-Zn ferrite nanoparticles, then they were re-dispersed in 100 mL of distilled water and ethanol in relation 3:7 respectively under sonication. When nanoparticles were completely dispersed, solution were placed into vigorous stirring at the same time 70 µL of APTES were added without stop stirring. The stirring continued overnight at room temperature.

Mn-Zn ferrites synthetized by hydrothermal method were coated with Tetraethyl orthosilicate (TEOS) utilizing the classical Stöber method described by Hong et al. and Wang et al.

Coating consisted on weight 25 mg of Mn-Zn ferrites nanoparticles and were placed in a vessel and re-dispersed under sonication in a mixture of 5 mL of ammonium hydroxide, 59.25 mL of ethanol and 25 mL of distilled water. In a second vessel an alcoholic solution of TEOS (0.5 mL of TEOS and 10 mL of ethanol) were placed under vigorous stirring. Then both solutions were mixed under vigorous stirring and were kept reacting 4 hours.

Finalized reaction time, nanoparticles were separated by magnetic precipitation and were washed more than 3 times with 20 mL of ethanol. Dried were effected under room conditions.

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