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Synthesis, investigation and toxicity of nanocrystalline pow-der of dysprosium oxide

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The starting chemicals for the synthesis of dysprosium oxide were dysprosium metal and commercially available reagent grade nitric acid. Immediately after the cleaning four grams of the as-pretreated dysprosium metal were dissolved in the nitric acid water solution, the amount of which was that the molar ratio of the reagents would be consistent with the stoichiometry of the following reaction:

$Dy + 6HNO_3 = Dy(NO_3)3 + 3NO_2 + 3H_2O$

which is commonly assumed to predominantly proceed when a metal reacts with 63%-concentrated nitric acid.

Highly dispersed powders of dysprosium sesquioxide Dy_2O_3 were synthesized by template added incipient wetness impregnation method. According to this method hydrated cellulose fibers (medical cotton) were impregnated with a dysprosium nitrate water solution of the concentration 10 times as less as it corresponds to the maximal stoichiometric value obtained when dysprosium metal is dissolved in 63% nitric acid. These wet fibers were air-dried at 80°C for 3 hours and subsequently air-calcined for 9 hours at 550°C. Here three different samples were synthesized. They differ by whether ammonia as a reducing agent was used during the synthesis. The choice of the calcination temperature value was due to a requirement that this value should be as low as possible, since at low synthesis temperatures the formation of nanostructured particles is highly favorable, and because of that the complete thermal decomposition of cellulose fibers processed at temperature well above 500°C Alternatively, the calcination temperature was raised up to 700°C. The composition and structure of the prepared oxides were studied by advanced methods. XRD analysis of dysprosia samples obtained by the thermal decomposition at 550°C and 700°C of dysprosium nitrate taken at low concentration evidences the presence of one crystal phase of Dy_2O_3 with the structural bixbyite type of α-Mn_2O_3. The pharmacological screening of nano Dy_2O_3 was investigated. Analysis of combined effect and acute toxicity of the studied compound was made on muscles.

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