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Synthesis of TiO_2 Nanoparticles via Thermal Treatment of Alkaline Leachate of Ilmenite

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Abstract

Titanium dioxide (TiO_2) nanoparticles have presented relatively best performance amongst other known photocatalyst, and several characterization studies have been performed to verify affecting parameters on the structure of these nanoparticles or selectively production of particles with specific phase (rutile or anatase). In this paper, the synthesis of nanoparticles of TiO_2 from its natural source, ilmenite concentrate, was studied. As a first step, iron oxides were eliminated from the ilmenite using determined HCl concentrate and solution temperature, after grinding it with a planetary mill. Next, titanium was leached out from the residue using NaOH in assistance of H_2O_2. Finally, thermal treatment (room temperature boiling) was employed to produce the TiO_2. nH_2O. To improve the crystallization quality, the obtained solid sediment was calcined in the air at determined time and temperature. The XRD and SEM methods were used for characterization of the titanium dioxide nanoparticles. The results showed that, milling conditions as well as HCl leaching time have strong impact on the iron content of the synthesized TiO_2. In addition, the alkaline leaching conditions affected the final nanoparticle morphology. Finally, the calcination temperature was the key parameter determining the final crystallinity of titanium dioxide, the rutile or anatase phase.

Keywords: Titanium dioxide nanoparticle, ilmenite, Alkaline Leaching, anatase.

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