FUNCTIONALIZATION OF HALLOYSITE NANOTUBES USING TETRAETHYLENEPENTAMINE IN DIFFERENT SOLVENTS

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Halloysite nanotubes are aluminosilicate ($Al_2Si_2O_5(OH)_4$. $2H_2O$) clay minerals similar to kaolinite. Halloysite nanotube have been proposed in a number of applications: nanocarrier for drug delivery, cosmetics, packaging, corrosion inhibitors, adsorbents for pollution remediation

Halloysite is a naturally occurring dioctahedral 1:1 clay mineral that belongs to the kaolin groups. The unit layer of kaolin group minerals is composed of one SiO_4 tetrahedral sheet and one $AlO_2(OH)_4$ octahedral sheet. Therefore, the different inner and outer-compositions of these materials allow to accomplish different chemical reactions on either surface [1-4]. In recent decades, tubular halloysite has attracted significant scientific interest because of its excellent physicochemical properties. For instance, halloysite has been widely used as a filler in polymers, as a carrier for the loading and controlled release of guest molecules and as an adsorbent for pollution remediation [5].

Recently, grafting of new functional groups on halloysite nanotubes surface has attracted a great attention in order to fabricate versatile compounds with new potential applications in materials science and ecological engineering. In the current study, halloysite nanotubes was modified using (3-Glycidyloxy propyl) trimethoxy silane in order to create a new linkage of an epoxide (HN-GOPTM). A wide variety of basic nucleophiles can be used for the ring opening of an epoxide including, amines, hydrides, Grignard reagents, acetylide anions, and hydride. These ring openings generally take place by an SN2 mechanism. The current study focuses on grafting of Tetraethylenepentamine on halloysite nanotubes surface using different solvents. The functionalization has been conducted in Ethanol and water (polar protic solvent), Acetonitrile, Acetone, N, N Dimethylformamide, Dimethylsulfoxide (polar aprotic solvents), and n-Hexane, 1,4-Dioxane, Chloroform, and Toluene (non-polar solvents). The modified nanomaterials were characterized by using several techniques, including Fourier Transform Infrared Spectroscopy (FT-IR) and elemental analysis. The data obtained showed that the greatest modified material has been detected for the nanomaterials prepared in Ethanol as a dispersing medium.

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