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Methyl-imogolite: a new hybrid nanotube for water remediation

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Imogolite is a natural aluminosilicate nanotube discovered in 1962 by Yoshinaga and Aomine in volcanic Japanese soils [1]. This nanotube has a monodisperse diameter ranging from 2 and 2.8 nm (depending on its formation and composition) and a polydisperse length (from a few tens of nanometers to several microns) [2]. In recent years, it has been realised that many structural and chemical modifications of imogolite-like structures can be achieved [3,4]. In 2010, Bottero et *al*. succeeded in modifying the tube internal surface by substituting the usual silicon precursor, tetraethoxysilane, with a methyltriethoxysilane [5]. This allows for the formation of a methyl-imogolite (imo-CH_3) with a hydrophilic external surface and a hydrophobic internal surface covered with methyl groups. This nanotube, transparent and dispersed in water even at high concentration, exhibits a 1D hydrophobic polar nanochannel [6].

In 2013, Amara et al. showed that such Janus nanotubes can capture small hydrophobic molecules in water [7]. Later on, we showed that these hybrid nanotubes can stabilise oil-in-water Pickering emulsion and extract a dye from an organic phase [8]. These properties were attributed to the ability of methyl-imogolites cavities to accommodate oil or oil/dye mixtures (figure 1).

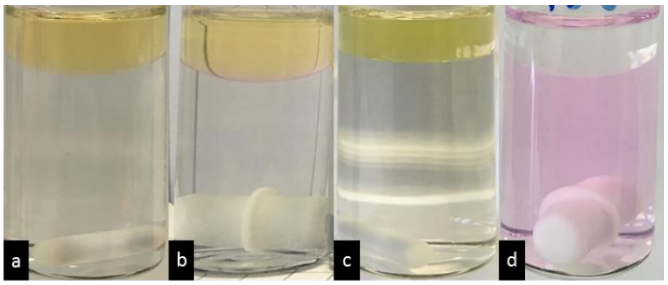

Figure 1: Hexane/Nile Red solutions in contact with water and with imo-CH_3 just after preparation (a) and (b) and three days after stirring (c) and (d)

In this presentation, we will show optimized recipes to produce imo-CH_3 and that it is possible to synthesize new hybrid imogolite nanotube with some of methyl groups substituted by exotic groups. The presence of these new groups is highlighted by the solvatochromic properties of Nile Red. Next, we will assess the water remediation potential of these new nanotubes through comparative trapping of atrazine between hybrid imogolites and activated carbon

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