

# Halloysite Clay Nanotubes for Loading and Sustained Release of Functional Compounds

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## Abstract

© 2015 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim. Halloysite is an aluminosilicate tubular clay with a diameter of 50 nm, an inner lumen of 15 nm and a length of 600-900 nm. It is a natural biocompatible nanomaterial available in thousands of tons at low price, which makes it a good candidate for nanoarchitectural composites. The inner lumen of halloysite may be adjusted by etching to 20-30% of the tube volume and loading with functional agents (antioxidants, anticorrosion agents, flame-retardant agents, drugs, or proteins) allowing for formulations with sustained release tuned by the tube end-stoppers for hours and days. Clogging the tube ends in polymeric composites allows further extension of the release time. Thus, antioxidant-loaded halloysite doped into rubber enhances anti-aging properties for at least 12 months. The addition of 3-5 wt% of halloysite increases the strength of polymeric materials, and the possibility of the tube's orientation promises a gradient of properties. Halloysite nanotubes are a promising mesoporous media for catalytic nanoparticles that may be seeded on the tube surface or synthesized exclusively in the lumens, providing enhanced catalytic properties, especially at high temperatures. In vitro and in vivo studies on biological cells and worms indicate the safety of halloysite, and tests for efficient adsorption of mycotoxins in animals' stomachs are also carried out.

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