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Halloysite clay nanotubes as biocompatible multi-functional tablet compression excipient

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Statement of the Problem: There are wide varieties of nano scale materials that are being developed for drug delivery. Commercial use of some of these materials is limited by accelerated clearance and toxic side effects. We introduce natural aluminosilicate halloysite clay nanotubes as potential pharmaceutical tablet compression filler. This abundantly available, cheap and biocompatible tubule material has outer diameter 50±10 nm; inner lumen 10-15 nm; length of 700±300 nm. A number of researchers developed HNTs as a nanovehicle for the loading of drugs with 5-10 wt.% loading efficiency and release for 5-20 hours at a sustained rate. Halloysite being a non-biodegradable material cannot be used for intraperitoneal delivery and oral (tablets, capsules) and transdermal (cosmetics) delivery is a plausible approach.

Methodology & Theoretical Orientation: We demonstrated halloysite nanoclay as a dual purpose tablet filler i.e. vehicle for drug and compression excipient. Flow and compressibility properties such as Hausner ratio, Carr's index and brittle fracture index were determined as similar to the best industrial formulations. Nifedipine and paclitaxel were loaded at 6-8 wt. % capacity in unmodified halloysite lumen and incorporated in a 100 mg tablet formulation. Release studies were conducted in simulated gastric and intestinal fluids which allowed to employ pH 1-7 switch due to the tubes' PMMM coating.

Findings: Hausner ratio, Carr's index and BFI were 1.1, 13 and 0.08, correspondingly, and release studies demonstrated pH-switchable and sustained drugs' release for more than 20 hours, a tenfold increase compared to commercial formulations.

Conclusion & Significance: We introduced natural aluminosilicate halloysite clay nanotubes as a pharmaceutical tablet compression and demonstrated this nanoclay as a dual purpose tablet filler i.e. vehicle for extended drug release and tablet compression excipient.

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