Timed Release of Medicine Using Halloysite Clay Nanotubes

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Halloysite nanotubes

External siloxane surface (-Si-O-Si-)

Internal aluminol surface (-Al-OH)

50 nm outer and 15 nm inner diameters
Halloysite - Biocompatible “Green” Nanoparticles
(in collaboration with S. Leporatti, NNL, Lecce, Italy)

Made halloysite tubes fluoresce with aminopropyl triethoxysilane-FITC

Trypan Blue test of HNTs in HeLa (and MCF-7 tissue cells. % Cell Viability vs HNTs concentration for 24-48-72 hours. It is much less toxic than usual table salt - NaCl (which kills cells at concentration of 5 µg/ml)
Selective etching of inner alumina allows for the tube loading capacity increase from 15 to 40%.

Halloysites were stirred 8 hours in 1 M sulfuric acid solution at 80°C.

Longer treatment gives porous tube surface and surf area of 300 m²/g.
Sustained drug release

NAD, dexamethasone, furosemide, nifedipine release from halloysite (15 wt % loading, 10-20 hours complete release)
Biocell LbL encapsulation with polyelectrolyte and halloysite clay nanotubes

Algae cell coated with halloysite

Green: Daughter cell without tube-skin and
Antiseptic: Brilliant Green sustained release
Loading brilliant green in halloysite rinsed sequentially with benzotriazole and copper sulfate to form stoppers on the leaking pores.

Staphilococcus aureus was grown in TSB, incubated for and 48 h at 37°C. Bg:50mg brilliant green loaded halloysite, stB:50 brilliant green loaded halloysite with stoppers

Antibiotic ciprofloxacin sustained release from 8% halloysite and P. aeruginosa 48 h-inhibition with ciprofloxacin-halloysite (MDR-gangrene)
Research Procedure

1. Set up nutrient agar in Petri dishes (24 hrs)

2. Using the Kirby Bauer method, inoculate dishes with bacteria (E. coli – 24 hrs) & treatments
   a) Control (water)
   b) Nanotubes
   c) Eukalyptol
   d) Eukalyptol & nanotubes
   e) Dakin’s solution
   f) Dakin’s solution & nanotubes
   g) Iodine in alcohol
   h) Iodine in alcohol & nanotubes

3. Analyze and record results – Zone of Inhibition
Results

Eukalyptol & Nanotubes
# Cologne & Nanotubes
*(Old Spice off brand)*

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Acknowledgements

• Dr. Yuri Lvov & Yafei Zhao
• Kris Kelley & Soil Analysis Lab
• LaSIGMA
• IfM @ LaTech
Lab Activity – Potpourri bags

1. Choose bag
2. Add one pinch of nanotubes into bag
3. Add **only 2** drops of scent into bag
4. Tie off bag and allow to dry