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BRID ORGANIC-INORGANIC NANOPARTICLES FOR AQUACULTURE COATINGS HYDROPHILICITY/HYDROPHOBICITY TUNNING

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Abstract: Organic-inorganic hybrid nanoparticles. Silica / polyethyleneimine (PEI) nanoparticles were prepared through a silicification progress, forming hydrophilic nanospheres. An increase of the hydrophobicity of these materials is achieved through alkylation of PEI, by reacting the amino end groups of the Silica / PEI with octadecyl isocyanate (ODI). Also, hydrophobic nanoparticles were formed through alkylation of PEI dendrimers using ODI in various PEI/ODI ratios. Silicifcation of these nanocomposites using silicic acid increased the amphiphilicity and improved their dispersion in water. FT-IR spectroscopy and thermogravimetric analysis (TGA) confirmed the successful synthesis of the nanoparticles and scanning electron microscope (SEM) was used to confirm the size and structure of the resulting nanomaterials. The hydrophilic/hydrophobic character of the nanoparticles was investigated by contact angle measurements. Biological evaluation of the synthesized materials was performed in vitro by using MTT and wound healing assays in healthy human cell lines. According to our results no toxicity was observed.





SEM IMAGES OF NANOPARTICLES







WATER CONTACT ANGLE OF NANOCOCMPOSITES







Figure 1: SEM Images of (a) PEI 5K / TEOS 25K (20-70 nm), (b) PEI/TEOS 5K (80-150 nm), (c) PEI 25K / TEOS Alkylated, (d) Alkylated PEI 25K 1:80 (120-300 nm) and (e) Alkylated PEI 25K 1:80 / TEOS (200-450 nm)









Figure 2: *In vitro* cytotoxicity of nanocomposites on human cell lines HaCat and HEK 293 is evaluated performing MTT Asasy.

Figure 3: Wound Healing Assay to estimate the impact of nanocomposites on proliferation and migration of HaCat cells.

Conclusions:

Higher MW PEI dendrimers form smaller PEI/TEOS nanospheres than lower MW PEIt. Smaller nanoparticle cores tend to agglomerate in larger spheres.
Alkylation of PEI dendrimers and PEI/TEOS nanoparticles increases the nanoparticles' hydrophobicity leading to reduced agglomerates and smaller sized spheres.
Silicization of Alkylated PEI forms nanoparticles with improved dispersion in water, breaking the agglomerates of the nanocomposites alkyl-groups.
Nanocomposites do not cause cytotoxicity up to 25 µg/ml, and do not significantly affect the migration potential of human cell line, HaCat. Wound healing process is disrupted when compositions include DMOAP, as depicted in Figure X2.

SiO2@PEI 25K

SiO2@PEI 5K

TEOS@DMOA

5K@DMOAP

PEI 25K

PEI 5K

Arkas M., Tsiourvas D. Journal of Hazardous Materials 170, 35-42 (2009).
Tsiourvas D., Stathopoulou K., Sideratou Z., Paleos C. M., Macromolecules 35, 1746-1750 (2002).