

**SYNTHESIS OF SILICA NANO PARTICLES WITH
CUSTOM-MADE MORPHOLOGY FOR
CONTROLLED DRUG DELIVERY**

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ABSTRACT

SYNTHESIS OF SILICA NANO PARTICLES WITH CUSTOM-MADE MORPHOLOGY FOR CONTROLLED DRUG DELIVERY

The purpose was to have nanosized particles with low energy perimeters which function as non-reacting transporters for targeted delivery along with high energy sites inside the pores to achieve controlled release of specialized chemicals. Surfactants were used in combination with both base and acid catalyzed methods to achieve desired structural properties and the characterization studies such as SEM, TEM, FTIR, BET surface area, pore size, size and zeta potential measurements were conducted.

The effect of surfactants on mesoporous silica production changed depending on the type of methods. In the case of base catalysed method in alcohol, formation of stabilized emulsions with different sizes and their effect on the size and shape of silica particles was proposed. The effect of surfactants was attributed to their effect on a) the emulsification process and b) silica-silica and silica-surfactant interactions involved.

In the case of base catalysed silica production in water, however, surfactant micelles were used as templates to produce pores. The effect of surfactant type and concentration was attributed to their effect on the CMC, micelle shape and size. Rod-like (~400 nm) at high and spherical (~200 nm) particles at low concentrations were synthesized. Here the surface area of ~1000 m²/g and average pore size of ~3 nm were obtained. Carbonization of these materials were performed to obtain nanosized silica particles with low energy perimeters successfully. Acid catalysed silica production in water was similar. Rod-like (600-800 nm) and cubic (800-1000 nm) nanoparticles were produced. These particles exhibited lower surface area of ~700 m²/g and larger pore size of ~5 nm.

ÖZET

KONTROLLÜ İLAÇ SALINIMI İÇİN ÖZEL MORFOLOJİYE SAHİP SİLİKA NANO TANELERİN SENTEZLENMESİ

Amaç, kontrollü ilaç salınımında kullanmak üzere, hem hidrofilik hem de hidrofobik özelliklere sahip yapıları sentezlemektir. Asit ve baz ortamında yüzey aktif maddelerin varlığında istenen özellikte malzemeler sentezlendi ve SEM, TEM, FTIR, BET yüzey alanı, gözenek boyu, parçacık boyutu ve zeta potansiyeli ölçüm ve analizleri yapıldı.

Kullanılan metoda bağlı olarak, yüzey aktif maddeler silika oluşumunu farklı şekillerde etkiledi. Bazik ortamda ve alkol içerisinde farklı boylarda oluşan emülsiyonların, silika taneciklerin boyunu ve şeklini etkilediği öne sürüldü. Bu etkiler, hem emülsiyon oluşumuna, hem de silika taneciklerinin kendi aralarında ve yüzey aktif maddelerle olan ilişkilerine dayandırıldı.

Su ortamında bazik katalizörle sentezlenen yapılarda, yüzey aktif maddeler şablon malzeme olarak kullanıldı. Yüzey aktif madde derişimi, misel boyu ve şeklini etkilediği için farklı özellikte malzemeler sentezlendi. Yüksek konsantrasyonlarda çubuk şeklinde (~400 nm), düşük konsantrasyonlarda ise küresel (~200 nm) tanecikler sentezlendi. Bu yapılar, 1000 m²/g civarında yüzey alanına ve yaklaşık 3 nm gözenek çapına sahiptiler. Bu malzemelerin karbonla kaplanması işlemi başarıyla gerçekleştirildi. Asit katalizör yardımıyla elde edilen silika tanecikleri de benzer özellikler gösterdi. Çubuk (600-800 nm) ve kübik (800-1000 nm) yapılar elde edildi. Bu tanecikler, daha düşük yüzey alanına (~700 m²/g) ve daha büyük gözeneklere (~5 nm) sahiptiler.

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