

## Mesoporous Calcium Silicates with Ultrahigh Drug Loading Capacity and pH-Triggered Release Behavior

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**Abstract** A facile method for poly(allylamine hydrochloride) (PAH)-assisted synthesis of mesoporous calcium silicates (PAH-CS) with a large specific surface area (BET = 348.4 m<sup>2</sup>/g) and pore volume (V<sub>p</sub>=1.42 cm<sup>3</sup>/g) has been developed. Tetraethyl orthosilicate (TEOS) was employed as a silicon source, which was rapidly hydrolyzed and reacted with the amine groups of PAH to form spherical SiO<sub>2</sub> nanoparticles (PAH-Si). Subsequently, Ca<sup>2+</sup> ions reacted with the silicate anions produced during the dissolution of SiO<sub>2</sub> in basic media, leading to the formation of the highly porous 3D networks of calcium silicates (PAH-CSs) that were synthesized only under optimized reaction conditions. The PAH-CSs containing an excess of Ca<sup>2+</sup> and NH<sub>3</sub><sup>+</sup> enriched the surfaces with a very high cationic charge ( $\zeta = +65.66$  mV) and resulted in an extremely high loading capacity for anionic drugs and proteins. Ibuprofen (IBU) and FITC-labeled bovine albumin (FITC-Albumin) were chosen as a model drug and model protein, respectively, to test the loading and delivery efficiencies of the PAH-CS carriers. The ultrahigh drug loading capacities (DLC) and their release patterns were investigated under controlled pH conditions. Strikingly, the highest DLC reported to date (IBU/carrier, 3.35 g/g) was achieved in this work due to the large specific surface area and pore volume of the carrier. Furthermore, the PAH-CS carriers could be entirely transformed to hydroxyapatite after releasing the drug in simulated body fluid (SBF), implying good bioactivity and biodegradability of the PAH-CS carriers.

### References

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