Dissolution kinetics of mesoporous silica nanoparticles in different simulated body fluids

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Mesoporous silica nanoparticles exhibit several attractive characteristics of importance for drug delivery. Particle size and shape can be adjusted and the surface chemistry of the particles can be modified to fit a given application. Furthermore, the particles are biodegradable and biocompatible. However, a detailed understanding of the particle degradation kinetics as a function of fluid composition is needed in order to optimize particles suitable for different means of administration. Optimally, the degradability should be studied *in vivo* using relevant administration routes and dosings, but such studies are complicated and expensive. Thus, the biodegradability is often studied in vitro using simulated body fluids.[3] The aims of the present study were to (a) determine the influence of the composition of different simulated body fluids on the observed silica dissolution rates and (b) to establish morphological key parameters that determine the dissolution kinetics of silica nanoparticles. As dissolution media, simulated body fluid (SBF), simulated lung fluid (SLF), simulated gastric fluid (SGF) and phosphate buffered saline (PBS) were used, and the silica concentration was kept below the silica saturation limit. Three mesoporous silica particles of different sizes were studied together with one non-porous Stöber-type silica particle. The observed silica dissolution rates followed the order SLF > SBF ≈ PBS >> SGF, which can be rationalized based on differences in pH and chemical composition of the fluids.[4] Furthermore, the specific surface area of the particles rather than their size was identified as the key parameter controlling particle dissolution rates.

References

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