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Protective Composite Silica/Polyelectrolyte Shell with Enhanced Tolerance to Harsh Acid and Alkali Conditions

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ABSTRACT: Here we report a facile method to fabricate composite polymeric/inorganic shells consisting of poly(allylamine hydrochloride) (PAH)/poly-(sodium 4-styrenesulfonate) (PSS) multilayers strengthened by the *in situ* formed silica (SiO₂) nanoparticles (NPs), achieving an enhanced stability under harsh acidic and basic conditions. While the unsilicised PAH/PSS multilayers show a pH-dependent stability and permeability, the composite PAH/PSS/SiO₂ shells display significantly higher chemical tolerance towards a variety of harsh conditions ($1 \leq \text{pH} \leq 13$, high salinity). Upon treatment with either hydrochloric acid (HCl, pH=1) or 0.2 M ethylenediaminetetraacetic acid disodium salt (EDTA, weak acid, chelator), the (PAH/PSS)₆/SiO₂ shells are able to maintain the integrity of most calcium carbonate (CaCO₃) particles, as the shells are thickened and densified by sufficient SiO₂ NPs. When treated with NaOH solution at pH=13, the (PAH/PSS)₆/SiO₂ shells also display an intact morphology and maintain the ability to intercept rhodamin B (Rh-B) molecules, which is quite different to that observed with the unsilicised (PAH/PSS)₆ shells. Ultrasound is

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