UV-absorbing Organosilica Nanoparticles for Sunblock without Skin Penetration and Whitening effect

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With increasing ozone depletion, ultraviolet (UV) exposure from sunlight has become a significant health risk. Although sun protectants in general use provide reasonable protection, they have limitations in terms of toxicity and aesthetics. In this study, we developed UV-absorbing organosilica nanoparticles (o-SNPs) by using phenylsilane precursors to synthesize highly effective biocompatible and biodegradable sunscreen agents. The physical structure of o-SNPs was elaborately controlled such that they are large enough to reflect UVA, but small enough to be imperceptible when applied on the skin. The chemically attached phenyl groups facilitated the absorption of UVB by o-SNPs because of their delocalized π-orbitals without releasing from o-SNPs. The o-SNPs generated a negligible amount of reactive oxygen species under UV exposure. *Ex-vivo* two-photon microscopy revealed a slight penetration of o-SNPs into the dermal layer of porcine skin, resulting in less skin irritation. Furthermore, *in-vivo* anti-UV protection tests confirmed the excellent sunscreen effect of o-SNPs compared with conventional organic and inorganic UV filters.