Composite coatings based on rGO modified TiO_2 nanoparticles and a natural polymer, with a strong antimicrobial activity under visible-light irradiation and stimuli-renewable properties.

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Hybrid, polymer-inorganic, films exhibiting an effective antimicrobial action under visible-light irradiation and stimuli-renewable properties are presented [1]. The films were prepared using a chitosan derivative bearing permanent quaternary ammonium salt (QAS) groups along the polymer chains and photocatalytically active TiO_2 nanoparticles modified with reduced graphene oxide (rGO). An acid-degradable, acetal-based crosslinker was used to cross-link the polymer chains forming stable coatings on glass substrates. The hybrid films exhibited an effective biocidal activity in the dark for both Gram-negative and for Gram-positive bacteria, assigned to the biocidal QAS sites and a superior biocidal action upon visible light irradiation, due to the synergistic antimicrobial effect of the QAS moieties and radical oxygen species photocatalytically generated via the irradiation of the rGO modified TiO_2 nanoparticles. The stimuli-renewal behaviour of the hybrid films was verified by the gradual decrease of the film thickness upon immersion in neutral and slightly acidic aqueous media, attributed to the hydrolysis of the acetal-based crosslinker. Importantly, the hybrid films exhibited a high biocompatibility against mammalian cells, and retained their effective antimicrobial action even after self-polishing. The proposed approach underlines the facile development of highly functional polymer-based coatings, exhibiting strong and long-lasting bactericidal activity for prolonged use in a variety of applications.

1. T. Manouras, E. Koufakis, E. Vasilaki, I. Peraki, M. Vamvakaki, *ACS Appl. Mater. Interfaces* **2021**, *13*,17183.