Composite Materials with Immobilized AgNPs: A Sustainable Approach to Combat AMR

Jana Soukupová
Palacký University, Czech Advanced Technology and Research Institute (CATRIN), Šlechtitelů, Olomouc, Czech Republic

Kateřina Poláková
Palacký University, Czech Advanced Technology and Research Institute (CATRIN), Šlechtitelů, Olomouc, Czech Republic

Soňa Jančíková
Palacký University, Czech Advanced Technology and Research Institute (CATRIN), Šlechtitelů, Olomouc, Czech Republic

Lucie Ligasová
Nanoprogress–The Nanotechnology Cluster, Nová, Pardubice–Polabiny, Czech Republic

Jaroslav Lev
ASIO TECH, spol. s r.o., Kšírova, Brno, Czech Republic

Radek Zbořil
VSB–Technical University of Ostrava, Centre for Energy and Environmental Technologies, listopadu, Ostrava–Poruba, Czech Republic

Abstract:

Composite materials offer a promising route for advanced biomaterials, enabling tailored composition and surface properties. Silver nanoparticles (AgNPs) provide strong antimicrobial activity but raise toxicity concerns. Anchoring AgNPs onto solid, ideally polymer, pre-treated substrates via covalent bonding preserves their nanoscale size (≤50 nm) while improving safety and stability. We present a variety of composite materials, on the fundamental bases of substrate@AgNPs with high antimicrobial efficacy and controlled nanoparticle release, applicable in medical (implant protection, biofilm prevention) and environmental contexts (biofouling-resistant surfaces). This approach supports global efforts to combat antimicrobial resistance—a crisis responsible for 1.27 million deaths annually and projected to reach 10 million by 2050 (WHO).

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