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Migration and human exposure assessment of silver from an antimicrobial spray coated low density polyethylene nanocomposite material into milk

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Silver (Ag) nanoparticles (NPs) have been reported to have good antimicrobial activity against a wide range of microorganisms and the use of antimicrobial Ag nanocomposite films can potentially extend the shelf life of food products. Despite these benefits, concerns exist related to the potential human exposure to nanoparticles released from food contact materials into food destined for human consumption. In this study, Ag precursor was spray coated on a low-density polyethylene (LDPE) film surface, treated using UV/ozone containing 0.85 wt.% Polystyrene-*b*-polyethylene oxide (PS-b-PEO) to increase adhesion of Ag NPs on the surface modified LDPE films. The manufactured antimicrobial nanocomposite LDPE films were immersed in pasteurised whole milk and stored at +4°C for 15 days. The release of Ag over time and the effects on the shelf life of milk was monitored. Preliminary results demonstrated that the use of LDPE coated with Ag NPs extended the shelf life of milk. Silver release quantified by Inductively Coupled Plasma-Atomic Emission Spectrometry was found to reach an equilibrium concentration of 6.07 mg/kg$_{milk}$ after 4 days of storage. Scanning Electron Microscopy coupled with Energy Dispersive X-ray analysis indicated that Ag NPs were observed in the LDPE surface coating but no Ag NPs were observed in the milk. Considering the absence of Ag NPs in milk, the human exposure was predicted for ionic Ag in milk. Although human exposure to Ag was predicted to exceed the ingestion limit of 0.005 mg/kg$_{bw}$/day, as outlined by the World Health Organization, this study highlights the potential for further optimisation of this novel packaging material to reduce migration while also extending shelf life.

Biography

Joseph C Hannon attended the Dublin Institute of Technology, where he obtained an Honours degree in Mechanical Engineering in 2013. He is currently carrying out a PhD in the area of Nanoparticle Food Packaging Risk Assessment at University College Dublin.

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