Low-cost, flexible, and highly sensitive SERS-based detection platform for nanoplastics

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Abstract

We report a low-cost, flexible, and highly reproducible SERS substrate, for the detection of nanoplastics (NPs). Commonly available kitchen foil (Aluminium tin foil (Al)) was used as a substrate over which a self-assembly monolayer (SAM) of sodium citrate stabilised gold nanostars (AuNSt) was deposited using the Marangoni effect-driven transfer process. The Limit of detection (LOD) of the substrate was found to be 5.64 parts per million (ppm) for 100 nm polystyrene nanoplastics. Further, a computational simulation-based SERS enhancement study between Silicon and Aluminium as a substrate was also done as a proof of concept. The plasmon coupling between Al and Au, which is leading to the third-generation hot-spot, was found to be the critical factor leading to the improvement in the Limit of detection of our reported substrate. As the current understanding regarding the abundance of NPs in various media is very limited, mainly due to the lack of an analytical method, hence we believe that the reported SERS substrate can be a robust and promising tool which can detect the presence of NPs in various conditions and contribute to fulfilling the knowledge gap about micro-and nanoplastic.

Keywords: SERS, microplastics, nanoplastics, Gold nanostars

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