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Prometryn and atrazine herbicide detection via SERS using silver nanoparticles functionalized with humic substance

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The growing demand for food and the increase world population have led to the need of large cultivable areas and increased the productivity in agriculture, which resulted in the increased use of pesticides, especially in Brazil where the tropical weather (hot and humid) contributes to the proliferation of pests and weeds. The uncontrolled use of these chemical compounds causes damage to the environment, contaminating vegetables, soil, groundwater and other fountains. This contamination may cause health problems for those who come in contact with the contaminant agents and may harm the areas where the pesticides were used even in the case of more distant areas, due to their permanence in the environment. The functionalization of metal NPs leads to the modification of the chemical properties of the surface that further potentiate the performance of plasmonic devices. Functionalization of surfaces is an important process in the analytical applications of SERS due to the large increase of the affinity of many pollutants toward the metal surface is highly affected by the nature of the metal interface. Humic substances are interesting natural macromolecules which can be employed in the functionalization of NPs due to two main factors: a) they can be easily adsorbed onto the metal surface, and b) they can link a large list of pollutants existing in the environment. Among these pollutants we find polycyclic aromatic hydrocarbons (PAHs), and pesticides. In this work we report the functionalization of AgNPs with the shape of nanospheres with standard humic substances (HS) extracted from soils. These substrates were employed to detect atrazine and prometryn, two of the most used triazine pesticides used in agricultural practices in order to increase the sensitivity and selectivity of the SERS analysis.

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