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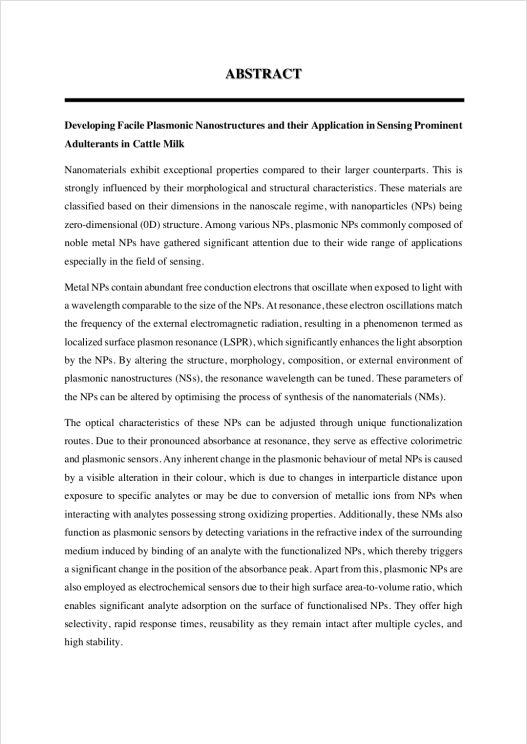

**ABSTRACT**

**Developing Facile Plasmonic Nanostructures and their Application in Sensing Prominent Adulterants in Cattle Milk**

Nanomaterials exhibit exceptional properties compared to their larger counterparts. This is strongly influenced by their morphological and structural characteristics. These materials are classified based on their dimensions in the nanoscale regime, with nanoparticles (NPs) being zero-dimensional (0D) structure. Among various NPs, plasmonic NPs commonly composed of noble metal NPs have gathered significant attention due to their wide range of applications especially in the field of sensing.

Metal NPs contain abundant free conduction electrons that oscillate when exposed to light with a wavelength comparable to the size of the NPs. At resonance, these electron oscillations match the frequency of the external electromagnetic radiation, resulting in a phenomenon termed as localized surface plasmon resonance (LSPR), which significantly enhances the light absorption by the NPs. By altering the structure, morphology, composition, or external environment of plasmonic nanostructures (NSs), the resonance wavelength can be tuned. These parameters of the NPs can be altered by optimising the process of synthesis of the nanomaterials (NMs).

The optical characteristics of these NPs can be adjusted through unique functionalization routes. Due to their pronounced absorbance at resonance, they serve as effective colorimetric and plasmonic sensors. Any inherent change in the plasmonic behaviour of metal NPs is caused by a visible alteration in their colour, which is due to changes in interparticle distance upon exposure to specific analytes or may be due to conversion of metallic ions from NPs when interacting with analytes possessing strong oxidizing properties. Additionally, these NMs also function as plasmonic sensors by detecting variations in the refractive index of the surrounding medium induced by binding of an analyte with the functionalized NPs, which thereby triggers a significant change in the position of the absorbance peak. Apart from this, plasmonic NPs are also employed as electrochemical sensors due to their high surface area-to-volume ratio, which enables significant analyte adsorption on the surface of functionalised NPs. They offer high selectivity, rapid response times, reusability as they remain intact after multiple cycles, and high stability.

# Developing Facile Plasmonic Nanostructures and their Application in Sensing Prominent Adulterants in Cattle Milk

*by* Upama Das

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