



4-MERCAPTOBENZOIC ACID FUNCTIONALIZED SILVER NANOPARTICLES FOR THE DETECTION OF TRIVALENT CHROMIC IONS

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Chromium is one of the heavy metal ions which is significant due to its various roles and it commonly exists in trivalent (Cr^{3+}) and hexavalent ($\text{Cr}_2\text{O}_7^{2-}$) oxidation states. Trivalent chromium is an essential nutrient for humans and plays a major role in maintaining normal body metabolism. Nevertheless, high levels of Cr^{3+} can cause toxicity effects as it can damage cellular components. Moreover, it is also an environment contaminant, especially in water and food due to various industrial and other human activities. Therefore, development of novel sensitive and selective methods for the detection of trace chromium ions is of high importance. In this study, a facile and selective method for the colorimetric detection of trivalent chromic ions using 4-mercaptobenzoic acid (4-MBA) functionalized silver nanoparticles (AgNPs) is introduced. AgNPs were synthesized by the chemical reduction method and they were surface functionalized with 4-MBA under optimum experimental conditions. Bare and 4-MBA modified AgNPs were characterized using UV-Vis spectroscopy, dynamic light scattering measurements and scanning electron microscopy (SEM). 4-MBA contains a thiol group which displays high affinity for Ag surfaces and a carboxyl group which can interact with the surrounding, or in this case, to act as a sensor for Cr^{3+} ions since it forms a very stable complex with Cr^{3+} ions, when compared with other metal ions. The presence of Cr^{3+} ions induces the aggregation of 4-MBA functionalized AgNPs as they get linked together by “carboxylate- Cr^{3+} -carboxylate” coordinative coupling, resulting in a colour change from yellow to deep orange. This Cr^{3+} induced aggregation was first monitored by the naked eye and then it was further verified by UV-Vis spectroscopy and SEM. This novel detection system could be successfully applied to determine Cr^{3+} ions in real water samples in heavy metal analysis.

Keywords: Chromic ions, 4-mercaptobenzoic acid, silver nanoparticles, UV-Vis spectroscopy

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