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Elaboration and grafting of gold nanoparticles functionalized for a better sensibility of the biosensors of cancer with multiple detection

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The lowering of thresholds for exposure to certain contaminants, the prevention of epidemics and the early diagnosis of severe pathologies such as cancer are major public health challenges that require ever more efficient detection tools. It has recently been demonstrated that nanostructuring of the sensitive zone of the sensors makes it possible to improve their performance significantly. The gain of the sensitivity, results from the increase in the accessible surface and from the better orientation of the capture ligands. The nanoscale structuring of the sensitive zone of a sensor can be achieved by the immobilization of nanoparticles at its surface. Due to the excellent control of the interfacial reactions provided by the electrochemical techniques, the electrochemical grafting of gold nanoparticles appears perfectly adapted to improve the sensitivity of the detection. This strategy requires the synthesis of nanoparticles functionalized by electroactive groups. In this perspective, we have adapted, by adapting the Brust's protocol, the synthesis of gold nanoparticles coated with a layer of organic thiols terminated by an aromatic primary amine. The resulting nanoparticles form stable colloids at pH<3. The presence of the primary aromatic amine functions is essential since their conversion to the diazonium salt by a diazotization reaction in an acid medium allows the electrochemical grafting of the entities carrying these functions by reduction of the diazonium salts as the work of Pinson and Bélanger. The *in situ* conversion of the aromatic primary amine functions carried by the gold nanoparticles into the phenyldiazonium salt leads to the grafting of the gold nanoparticles on the cathode. The grafting of gold nanoparticles was validated by electrochemistry, elemental analysis and atomic force microscopy (AFM) when grafting took place on vitreous carbon, indium tin oxide (ITO) electrodes, and golden terrace. The nanostructuration which results from the grafting of these nanoparticles on the gold surfaces has made it possible to improve by a factor of 2 the sensitivity of the Biotin/Streptavidin recognition test demonstrated by chemiluminescence of luminol.

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