Spectroelectrochemical microRNA-155 biosensor on ITO/GNP nanopattern

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Since It has been recently proved that altered expression level of microRNA (miRNA) can have serious consequences leading variety of diseases, detection of miRNA is highly demanded. However, miRNA is difficult to detect because of their small size, low abundance, and high homology. To overcome these challenges, we fabricated a miRNA biosensor using the combination of surface enhanced Raman spectroscopy (SERS) and electrochemical (EC) techniques. In this biosensor, a single stranded 3′ methylene blue (MB) and 5′ thiol-modified RNA (MB-ssRNA-SH) is designed to detect the target miRNA-155 and immobilized onto the gold nanoparticle-modified ITO (ITO/GNP). For the first time, by combination of SERS and EC methods we can widen the dynamic range of specific detection of miRNA in single step without the need for the additional enzymes and reagents, which is relayed from SERS to EC from 10 pM to 450 nM. In conclusion, our approach for the combination of EC and SERS techniques to compensate each other's weaknesses can be a stepping stone in upgrading former bioelectronic devices and developing various switchable devices.