A cascade amplifying microRNA detection based on graphene oxide-gold nanoparticles nanohybrid

Presenting Author Klaus Leifer[a]
Co-Authors Yuanyuan Han[a], Zhen Qiu[a], Ganesh N. Nawale[b], Oommen P. Varghese[b], Jöns Hilborn[b], Bo Tian[c]

a. *Department of Engineering Sciences, Uppsala University, Box 534, SE-751 21 Uppsala, Sweden*
b. *Department of Chemistry-Ångström, Uppsala University, Box 538, SE-751 21 Uppsala, Sweden*
c. *Department of Micro- and Nanotechnology, Technical University of Denmark, DK-2800 Kongens Lyngby, Denmark*

Klaus leifer@angstrom.uu.se

The graphene oxide- gold nanoparticles (GO-AuNPs) nanohybrid is a promising material in biosensors, due to its advantages in surface area, good biocompatibility and unique electrical and catalytic properties.[1,2] Herein, an electrochemical microRNA biosensor is designed and demonstrated based on the GO-AuNPs hybrid material, which contains a duplex-specific nuclease (DSN)-assisted target recycling process[3] and electrocatalytic measurement step (Fig. 1).

With addition of target microRNA, let-7b, the DNA probes on AuNPs surfaces were hydrolysed by DSN, leading to the exposure of the AuNPs surface. Then, these reacted AuNPs are built into a multi-layered GO-AuNPs hybrid structure which subsequently was deposited on electrode to catalyse the water splitting reaction. The value of catalytic current was determined by the exposed surface area of the AuNPs, which was proportional to the concentration of microRNA. By the proposed biosensor for let-7b detection, a linear detection range of 1 fM to 10 pM was obtained with a detection limit at 1.5 fM (Fig. 2). Moreover, despite the high sequence homology among the same microRNA family members, the detection still showed high specificity and could distinguish even one base mismatches.

References

[1] Mao, S., Lu, G., Yu, K., Bo, Z., and Chen, J., Advanced materials, 22 (2010)3521-3526.
[2] Rasheed, P.A., and Sandhyarani, N., Microchimica Acta, 184 (2017)981-1000.
[3] Anisimova, V.E., Rebrikov, D.V., Shagin, D.A., *et al.*, BMC Biochemistry, 9 (2008)14.

Figures

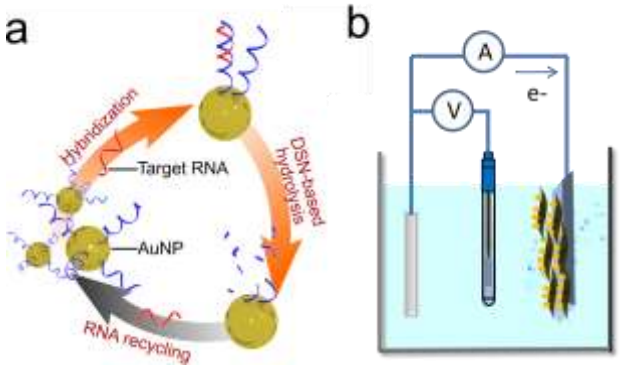

Figure 1: Schematic illustration of (a) DSN-assisted target recycling and (b) three-electrode system for water splitting and the GO-AuNPs modified electrode is the working electrode.

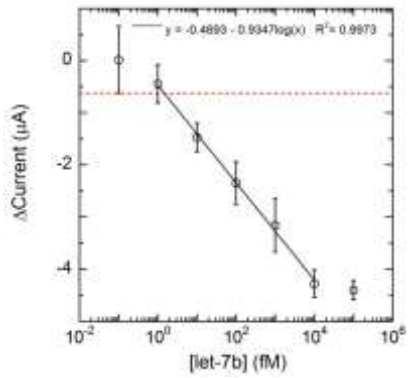

Figure 2: The dose-response curve of microRNA let-7b detection. The solid and dashed curves correspond to the linear detection range and cut-off line, respectively.