Plasmonic gold biosensors for quantitative determination of aflatoxins in corn matrix

Andrea Majzik[1], Tibor Bartók[2], Imre Dékány[1]

[1] Supramolecular and Nanostructured Mat. Research Group of the Hungarian Academy of Sc. Department of Medical Chemistry, University of Szeged H-6720 Szeged, Dóm t. 8. Hungary
[2]Faculty of Engineering, University of Szeged H-6725 Szeged, Moszkvai krt. 5-7. Hungary

E-mail: maja@chem.u-szeged.hu

We developed a new selective sensor for detection of aflatoxins. Aflatoxins are carciogenic and harmful for gene and occur in nature. The aim of our work to detect this toxin with selective sensors. We use functionalised gold nanoparticles and gold nanofilms and the surface modification of gold surface was made with cyclodextrines which are modified by thiol groups.

Sodium borohydride reduced gold nanoparticles in presence of modified cyclodextrin by thiol groups (AuSH□CD_$NaBH_4$): Materials used for the preparation of Au nanoparticles were: $HAuCl_4*3H_2O$ (Sigma-Aldrich), sodium borohydride (Sigma), MQ water and SH-modified cyclodextrin (Cyclolab Ltd.). Identification and characterization of sodium borohydride reduced gold nanoparticles were performed by their XRD diffractograms, UV-Vis spectra and TEM images. We could establish uniform conductive films on silica crystal and glass surfaces by spray-coating technology from the prepared gold nanodispersion if the SiO_2 surfaces were treated previous by PEI (positive charged layer). These specifically produced films are suitable for biosensors.

The attachment of aflatoxin molecules to bare gold surface and to those covered gold thin films was studied by SPR and QCM measurements. The adsorbed amount of gold surface (full coverage ~140 ng/cm^2 was achieved at 0,05 mg/ml SH□CD) SH□CD was attached. AfB2 molecules could attach neither to gold surface nor AuSH□CD_$NaBH_4$ covered surface contrary to AfB1 (~50 ng AfB1 attach to 1 cm^2 pure gold surface, while if it is covered by AuSH□CD_$NaBH_4$. The adsorbed amount is ~530 ng AfB1).

For comparison a quantitative analysis of aflatoxin molecules on surfaces of modified gold nanoparticles will be done by ELISA (Enzyme-Linked ImmunoSorbent Assay) method. Validation of thiol modified gold nanosensors on silica crystal will be performed by HPLC-MS method. To compared the ELISA results against the SPR measurement, we established that the Toxi watch ELISA kit for AfB1 sensitivity limit is 30 ppt and the SPR sensitivity limit is (54 nm/ RIU) ~1 ppt.

Acknowledgements
The authors are thankful for the financial support of PIMFCS_H, ERANET_hu_09-1-2010-0033 and TÁMOP-4.2.2.A-11/1/KONV-2012-0047, TÁMOP-4.2.2/B-10/1-2010-0012

References

[1] J. Turkevich, *Gold Bulletin*, 1985, 18, 3
[2]F. Fernández, K. Hegnerová, M. Piliarik, F. Sanchez-Baeza, J. Homola, M.-P. Marco, *Biosensors and Bioelectronics*, 26, 4, pp. 1231-1238, 2010
[3] E. Pál, V. Hornok, D. Sebők, A. Majzik, I. Dékány, *CollSurfB,*, 79, pp. 276–283, 2010
[4] J. H. Kim, K. S. Kim, K. M. Manesh et al., *CollSurfA,* 313-314, pp. 612-616, 2008