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Methylmercury detection through changes in the electrical conductivity across gold films with MerB (Organomercurial-lyase) functionalized nanoparticles

A. F. P. ALLWIN MABES RAJ[1,2,3], TOMAZ RIJAVEC[2], MILENA HORVAT[2], ALEKSANDRA LOBNIK[3,4], ALJOSA KOSAK[4] AND ALEŠ LAPANJE[5]

[1]Jožef Stefan International Postgraduate School
[2]Jožef Stefan Institute
[3]Institute of Environmental Protection and Sensors
[4]University of Maribor
[5]Jožef Stefan Institute, Department of Environmental Sciences
Presenting Author: allwinamc10@gmail.com

Mercury is a highly toxic and mobile element that has had a pronounced and adverse effect on organisms. Accordingly, bacteria have evolved mer operons to meliorate the toxic action of different chemical forms of mercury. The bacterial mercury detoxification system contains two proteins, organomercurial lyase (MerB) and mercuric ion reductase (MerA). MerB specifically catalyzes the protonolysis of the carbon-mercury bond of methylmercury (MeHg), resulting in the formation of a reduced carbon compound and inorganic ionic mercury (Hg2+) [1]. We intend to develop a simple solid-state sensor for detecting MeHg through changes in the electrical conductivity across gold films of nanoparticles (NPs) protected with MerB (Organomercurial lyase) functionalized nanoparticles. Since MerB is a highly specific organomercurial lyase, we plan to use its Met-Hg-specific binding characteristics as a sensing/receptor component of the sensor. On binding of MeHg, the current fluctuation in the conductive paths ultimately percolate the entire gold film [2]. To achieve that, we have prepared an expression system that will enable us to obtain a high enough amount of MerB enzyme. The expressed MerB enzyme with his-tag would be purified and evaluated for use in preparing the Met-Hg-specific sensor. The activity of the translated MerB will be characterized through the measurement of converted MeHg into Hg2+ using cold vapour atomic fluorescence spectroscopy (CVAFS).

References

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