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Investigating the Binding Capabilities of Triazole-Calix[4]arene Functionalized Microcantilever Sensors Towards Heavy Metals in Aqueous Solution

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The main objective of this work was to investigate the binding capabilities of the newly synthesized bimodal triazole-calix[4]arene functionalized microcantilevers towards selected heavy metals in aqueous solution. Gold-coated microcantilever sensors were first modified with a self-assembled monolayer of a calix[4]arene modified at both its upper- and lower-rims. Selected target metal ions (e.g. Hg2+, Fe3+, Ni2+, Zn2+, and Pb2+) were then introduced into a cell containing the functionalized microcantilevers. The interactions between the calix[4]arene-functionalized microcantilevers and the target analytes resulted in the formation of differential surface stresses which, in turn, resulted in a mechanical deflection of the microcantilever. Results showed that microcantilever arrays modified with triazole-calix[4]arene were capable of detecting trace concentrations of Hg2+ions as low as 10-11 M, which is sufficiently low for most applications. Results also showed that triazole-calix[4]arene functionalized microcantilevers were capable of detecting the presence of different heavy metal ions with high sensitivity and selectivity.

A functionalization unit was also constructed in order to allow for the simultaneous functionalization of all eight microcantilevers in an array. By using this unit, it was possible to functionalize all microcantilevers with different sensing layers at the same time thus increasing the accuracy and reliability of the experimental results.

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