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Abstract

Electrical Control of the Receptor Affinity †

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Abstract: A concept of virtual sensor array based on an electrically controlled variation of affinity properties of the receptor layer was realized on the base of integrated electrochemical chemotransistor containing conducting polymer as the receptor layer. Electrical control of the redox-state of the polymer (polyaniline) was performed in a five-electrode configuration with four electrodes for conductivity measurements and Ag/AgCl reference electrode integrated on the same glass chip. An ionic liquid provided an electrical connection between the reference electrode and chemosensitive material. Conductivity measurements demonstrated potential controlled electrochemical conversions of the receptor material between different redox states. The binding of trimethylamine at three different potentials corresponding to these states was studied. The results demonstrated that both kinetic- and equilibrium-binding properties of the receptor are controlled by the electrical potential, thus providing a possibility to form a virtual sensor array using only a single sensing element. The concept was applied for monitoring fish headspace. Using three characteristics of the sensor response measured at three different redox states of the same sensor material, we obtained signals from a virtual sensor array consisting of nine chemosensitive elements. The sensor displays systematic changes of its nine signals during fish degradation. This approach can be applied also for the electrical control of the affinity of immunoglobulins. Development of new materials with electrically controlled affinity is in progress.

Keywords: conducting polymer; affinity; virtual sensor array

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