Electrochemical Detection of Theophylline through Adsorption of Silver Ion on the Solid Surface

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We successfully developed novel, label-free, electrochemical sensing system for detection of theophylline. In our new system, a duplex DNA probe containing an abasic-site was conjugated on the surface of gold electrode. The abasic site plays a role of binding pocket for both silver ion and theophylline. This sensor utilizes the electrochemical signal caused by redox reaction of silver ion bound on the pocket near the surface of electrode, which is controlled by theophylline. When theophylline does not exist, silver ion paired with cytosine at the abasic site in duplex DNA causes electrochemical signals. Contrastively, when theophylline interacts with the abasic-site pocket to pair properly with empty cytosine, it works as an obstacle for binding of silver ion. As a consequence, redox reaction of silver ion on the surface of electrode does not occur, which reduces the electrochemical signal. In addition, the new system shows high selectivity over structurally similar substances such as caffeine and theobromine. Finally, diagnosis of theophylline in human blood serum was successfully manifested for practical utilization.