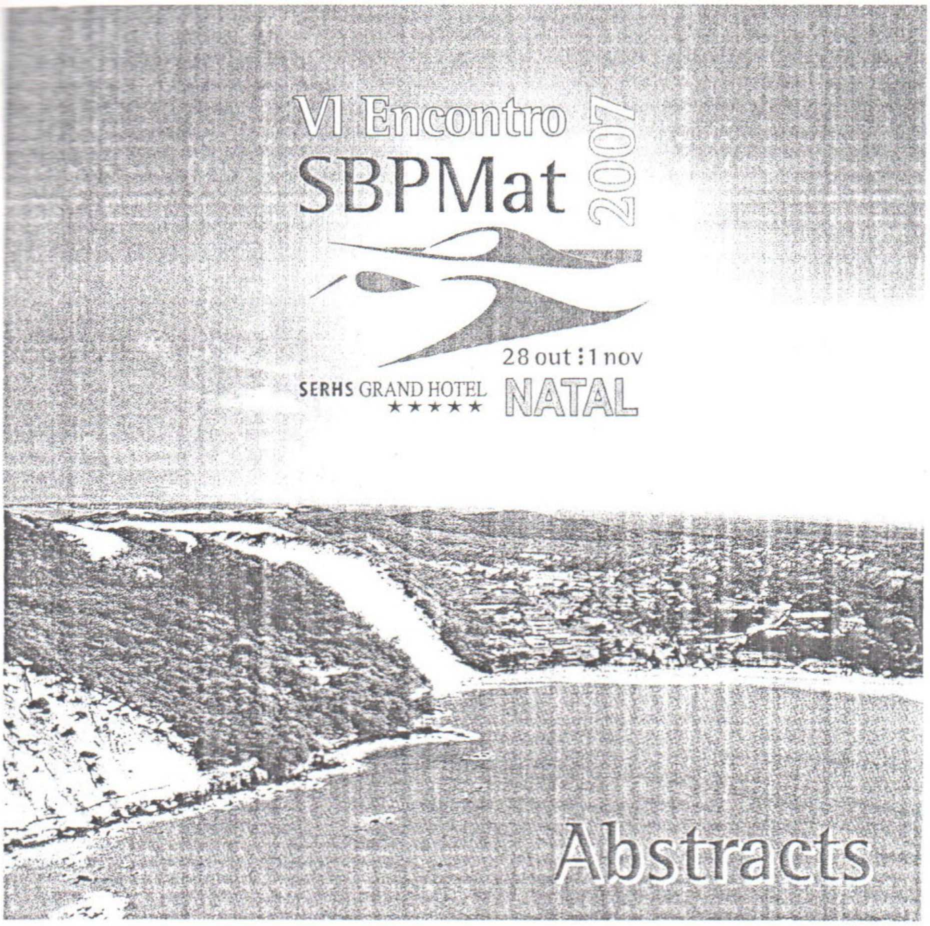
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Nanobiosensors for detecting Herbicides

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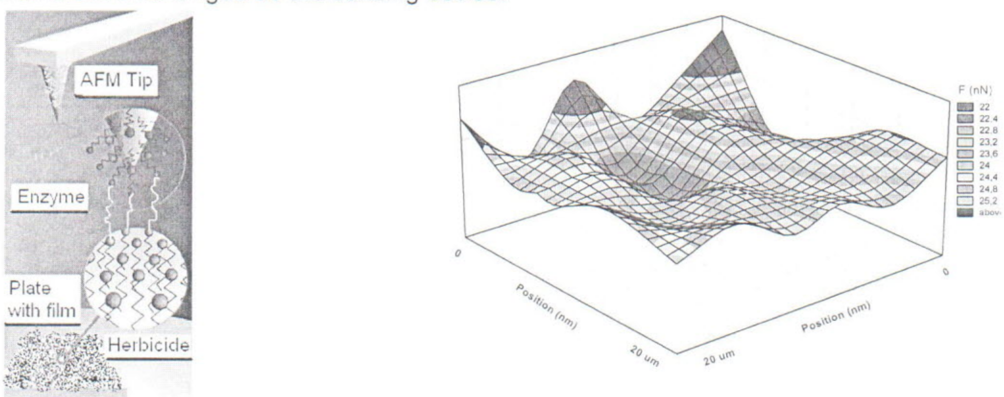
Abstract

The aim of this work was to generate a nanobiosensor to detect herbicides and other environmental pollutants. These biosensors [1] are expected to provide new opportunities for the rapid screening of environmental samples. We use enzyme-inhibitor herbicides, particularly acetyl-Coa carboxylase (ACCase), which is necessary for the synthesis of fatty acid in plants. We use cantilever biosensors to transduce the recognition event from its receptor-coated surface into a mechanical response. The receptors (enzymes) were covalently anchored to the cantilever (tip surface functionalization) and adsorbed on interdigitated electrodes.

Enzyme inhibitors bind to enzymes and decrease their activity. Since blocking an enzyme activity can kill a pathogen or correct a metabolic imbalance, many drugs are enzyme inhibitors. They are also used as herbicides and pesticides. Specific interactions between surfaces can be studied at the molecular scale using Atomic force microscopy (AFM). Adhesion, in particular, is governed by short-range intermolecular forces that may be controlled by appropriate surface modification, thus leading to the so-called Chemical Force Microscopy (CFM) [2]. One way to functionalize the AFM tip (Fig. 1a) is to cover it with an ordered monolayer of organic molecules (a self-assembled monolayer), in special, the enzyme ACCase. The force of interaction can be estimated from the excess force required to pull the tip free from the surface. For the case of an electronic tongue used here, we adorb an enzyme monolayer on interdigitated electrodes using a self-assembly method. With atomic force spectroscopy we could distinguish between nonspecific adhesion and specific interactions – brought about by the herbicide- as shown in Fig. 1b. This adhesion map was acquired with a thin film of diclofop-methyl in contact with ACCase for 5 hours. The interaction is not homogenous, as indicated by the adhesion map, and the regions with higher forces are those that were probably most contaminated with the herbicide, since the tip was functionalized (self-assembled) with the protein ACCase where the interaction is higher and specific (Fig. 1b). These results will now be compared with those obtained with an electronic tongue as the sensing device.



(a) (b)

Figure 1. (a) Chemical force microscopy (Functionalization) and (b) Adhesion map (20x20 μm) illustrating the variability of adhesion forces onto a polyaniline surface in contact with an herbicide (diclofop-methyl).

References

[1] International Union of Pure and Applied Chemistry. "biosensor". *Compendium of Chemical Terminology* Internet edition.
[2] Fiorini, M. Mackendry, R., Cooper, M. A., Rayment, T., Abell, C. Biophys. J. 80 (2001), 2471-2476.