INFLUENCE OF THE TYPE OF AMOUNT OF PLASTICIZER ON THE SENSORY PROPERTIES OF MICROSPHERES SENSITIVE TO LIPOPHILIC IONS

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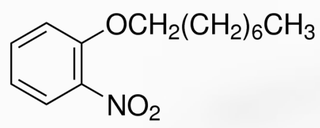
INTRODUCTION

A plasticizer is a substance that, when introduced into a solution, is intended to increase e.g. its flexibility, as well as susceptibility to further processing. A plasticizer compound in the simplest sense is considered to be an organic solvent. There are many types of such compounds, such as animal fats, petroleum fractions, or all kinds of plant extracts. Their classification can be carried out from different angles, both for the functions performed in the solution and their type. Plasticizers can be used in the process of creating micro/nanospheres that are incorporated with chemical indicators. With the change of environmental conditions, such systems can change their optical properties, becoming optodes in the micro/nanoscale. In this work, the influence of two plasticizers – polar (o-NPOE) and non-polar (DOS), on the optical response of microspheres sensitive to lipophilic ions was investigated. In addition, studies were also carried out on the impact of the amount of plasticizer on the created microspheres - systems were prepared with a standard amount of the compound, its five-fold amount and without a plasticizer.

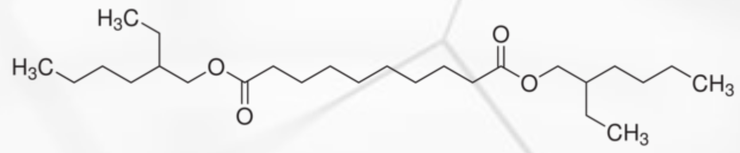
METHODS

To test the sensory properties of the obtained systems, the absorbance and fluorescence measurements modes were used. Due to the fact that the composition of microspheres includes chromoionophore, it was possible to perform tests with the use of a confocal microscope to evaluate particles' sizes.

The element that plays a main role in the research are plasticizers:



2-Nitrophenyl octyl ether
(o-NPOE)



Bis(2-ethylhexyl) sebacate
(DOS)

- a solvent generally used to transfer ions at the liquid / liquid interface
- low solubility in water

- commonly used for the production of ion-selective electrodes
- insoluble in water

RESULTS

Fig. 1 (B)

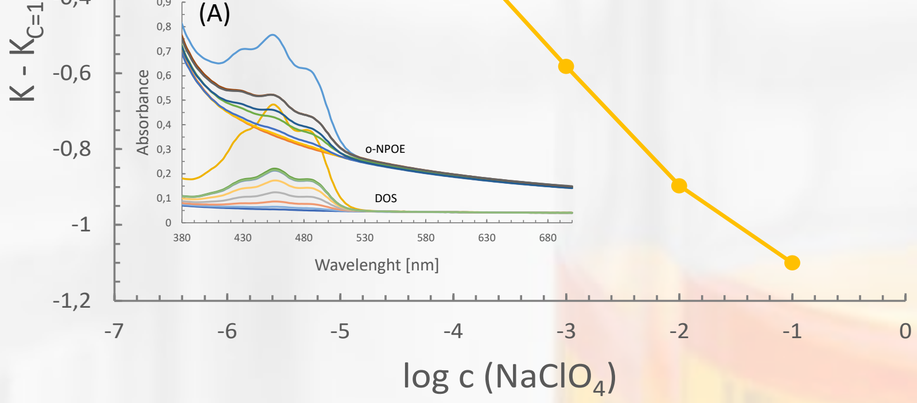


Fig. 2

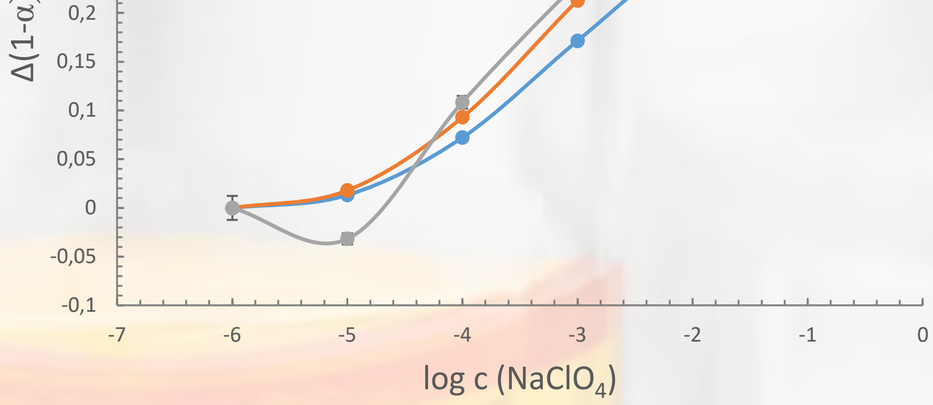


Fig. 3

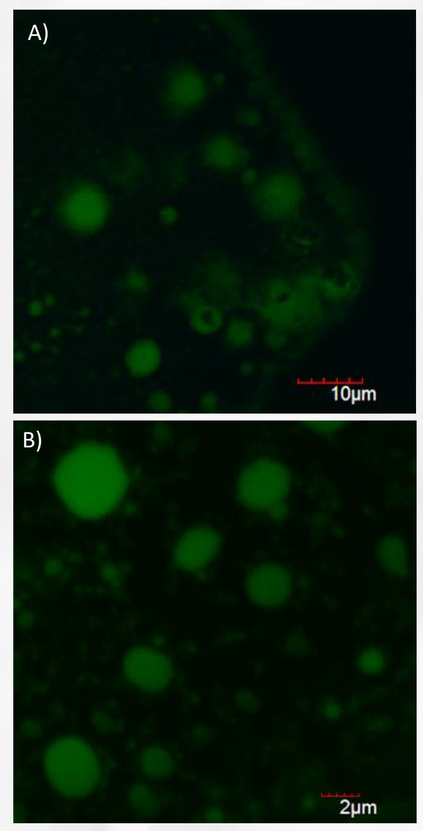


Fig. 1. Sensory properties of microspheres with various plasticizers: (A) Absorbance spectrum of microspheres with various plasticizers obtained in the presence of NaOH (deprotonated form of chromoionophore), in HCl (protonated form of chronoionophore), in 0.01M PBS pH = 7.4 (control sample) and when $NaClO_4$ was added (calibration solution 1 µM-0.1 M); (B) Baseline correction for A454/A380 nm in 0.01M phosphate buffer pH = 7.4 for anion-selective system with DOS and o-NPOE plasticizers.

Fig. 2. Protonation degree of chromoionophore for the studied three types of microspheres with different amount of a plasticizer.

Fig. 3. Confocal microscope pictures of microspheres: A) without plasticizer; B) with a standard amount of plasticizer; C) with its five-fold amount.

CONCLUSIONS

The obtained results suggest (Fig.1.) that in the case of the microsphere type used in the research (anion-selective), the better plasticizer is bis(2-ethylhexyl) sebacate (non-polar plasticizer). Its use made it possible to determine perchlorates in entire studied concentration range while maintaining good sensitivity of the system. The analysis of Fig.2. suggests that the change in the amount of the plasticizer in the system does not radically change its performance, as it is still at a similar level of sensitivity and analyte quantification limits. However, too large amount of plasticizers narrows linear range of sensory response. Without DOS addition, slightly higher sensitivity was noticed. Observation of the formed microspheres under a microscope confirmed the formation of spherical forms with sizes ranging from 2-10 µm, both in the case of spheres with the content of plasticizer and without its participation.

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