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on Microelectronics,
Devices and Materials*

*& The Workshop on Chemical Sensors:
Materials and Applications*



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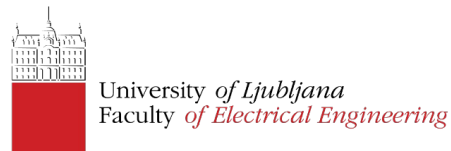
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ELECTROCHEMICAL SENSOR FOR DETECTION BISPHENOLS IN THERMAL PAPER

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ABSTRACT: The substances of very high concern (SVHCs) can be found in a wide range of consumer products. These substances can negatively influence human health depending on the route of exposure, exposure time and duration, amount of intake the substance by body and other factors. Increased number of carcinoma, sterility, diabetes can be due to the contact with SVHCs in our everyday life. Bisphenol A (BPA) is one of the most commercialized SVHC chemicals and is used in many different products such as plastic packaging for water and food, storage media, and even in thermal paper. Thermal paper is used for receipts in stores and tickets for parking, bus, and trains. BPA is applied on thermal paper as a dye developer. As a dye developer, it is not chemically bound to the paper so it can easily migrate and be absorbed by the skin (fingers, palm). Studies showed that typical occupational exposures of work cashiers can increase concentrations of BPA and its metabolites in urine several times. Toxicokinetic studies showed that the route of exposure has a big effect on the concentration of BPA that circulates in the body. If BPA enters the body through dermal exposure, it metabolizes as unconjugated BPA, while oral exposure leads to a conjugated form of BPA. Studies showed that only the unconjugated form can bind to estrogen receptors, leading to the conclusion that the unconjugated form is hazardous. Due to that European Commission restricted usage of BPA to 0.02 mas%. The paper manufacturers replaced BPA with bisphenol S (BPS). It is expected that 61 % of all thermal paper in the EU will be BPS-based till now. However, the wide use of BPS in thermal paper raises concern because it was shown that BPS is also toxic. New studies of urine samples collected around the world showed the presence of BPS. Due to increasing production of BPS there is a need for the development of analytical methods for the detection of SVCHs. The most used are HPLCs with mass spectrometric detection, which are expensive and time-consuming. On a another hand, electrochemical

sensors are low-cost and simple method for detection of SVCHs. The present study represents fast, reliable and commercial detection of bisphenols via screen-printed electrodes (SPEs) as receptor elements. Scanning electron microscopy (SEM) was used to study the surface of the SPEs working electrodes. SPE electrodes showed very good electrochemical responses toward BPA and BPS oxidation with linear ranges between 0.5 and 50.0 μM and lower limits of detection of 0.15 μM and 0.37 μM , respectively.

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