

Electrochemical detection of nitromusk fragrances

Lourdes Agüí, Paloma Yáñez-Sedeño*, Jose M. Pingarrón

*Department of Analytical Chemistry, Faculty of Chemistry, Complutense University of Madrid,
28040 – Madrid, Spain*

**yseo@quim.ucm.es*

Fragrance additives such as synthetic musks are used in a wide range of cleaning agents, detergents, and personal care products. They belong to the class of PPCPs (pharmaceutical and personal care products) that form a variety of emerging pollutants in urban activities. The occurrence of these species in municipal sewage effluent and other environmental samples could negatively impact the health of humans, due to persistent and long-term chronic exposure [1]. For example, various of these compounds have been suspected of endocrine-disrupting activity [2]. The development of sensitive analytical procedures together with more efficient extraction techniques and better detectors are needed for determine trace levels of these species and degradation products in the environment.

Two major categories of synthetic musks, nitromusks and polycyclic musks, are used as substitutes of natural compounds because these last derive from endangered wildlife species and are very expensive [2]. Musk xylene (1-*t*-butyl-3,5-dimethyl-2,4,6-trinitrobenzene), musk ketone (4-*t*-butyl-2,6-dimethyl-3,5-dinitroacetophenone) and musk moskene (4,6-dinitro-1,1,3,3,5-pentamethylindane) are examples of nitromusks.

Activation of carbon fibre electrodes by repetitive SWV scans increased dramatically the reduction current of nitro compounds, also producing shifts on the potential values and improving selectivity. These effects were firstly observed by our group and applied to the determination of nitroaromatic explosives (TNT) [3]. In this communication, a method for the electrochemical detection of nitromusk fragrances, which is based on the detection of cathodic signals at an activated carbon felt electrode, is described. The material used for the fabrication of the electrode (carbon felt) is composed of multiple disordered carbon fibres that were activated by immersion in a 0.05 mol l⁻¹ PBS of pH 7.8, and by applying five successive SWV scans between 0.0 and +2.6 V vs. Ag/AgCl. Cyclic voltammograms obtained for five nitro musks at 1 mg L⁻¹ level in PBS of pH 7.0, showed a non-reversible behaviour with two or three cathodic peaks corresponding to the number of nitro groups present in the molecule. Repetitive measurements with a single electrode gave RSD values near to 4.5 % (n = 10), and reproducibility electrode-to-electrode (n = 5) was of 5.6 %. Preconcentration of musk fragrances on the electrode from vapor phase or aqueous solutions provides a very useful way for their sensitive determination. A high current density, i_c / AC , where A is the exposed electrode area, with values around 90 mA /cm² M, was obtained. Kinetic studies of biodegradation of nitro musk to electroactive amino derivatives were also made on the basis of the high selectivity of the detection method.

1. J.Regueiro, M.Llompart, C.Garcia-Jares, R.Cela, J. Chromatogr. A, 1174 (2007) 112
2. L.Duedahl, T.Cederberg, K.H.Pedersen, A.Hojgard, Chemosphere, 61 (2005) 422
3. L.Agüí, D.Vega, P.Yáñez-Sedeño, J.M.Pingarrón, Anal. Bioanal. Chem.382 (2005) 381