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Hollow-fiber supported liquid membrane microextraction and voltammetric determination of neuroblastoma biomarker vanillylmandelic acid

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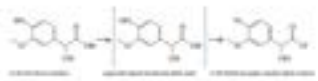
Vanillylmandelic acid is an end-stage catecholamine metabolite in the human body and important biomarker of various diseases with excessive or lowered catecholamine excretion. Levels of urinary VMA are elevated in patients with tumors of catecholamine producing glands, including pheochromocytoma and neuroblastoma, most common extra cranial cancer in infants. Lowered concentrations of VMA are typical for neurological disorders such as autism or depression. Determination of urinary VMA is used for treatment monitoring as well as preliminary screening tests. In this study, novel method of hollow fiber based three-phase liquid/liquid/liquid microextraction is used in combination with differential pulse voltammetry on boron doped diamond electrode. Due to acidic nature of VMA, extraction is carried out from acidified donor solution to the basic acceptor solution in the lumen of the fiber through organic phase immobilized inside the fiber pores. Optimized parameters included different organic phases (1-octanol, dihexylether, dodecane, phenyldecane, isoamylbenzoate and propylbenzoate), extraction time, volume of donor phase, pH and ionic strength of donor and acceptor phases and stirring rate. Obtained enrichment factors were up to two orders of magnitude with error of repeated measurements RSD ≈ 15 % (n = 10). For determination of VMA after the extraction, DPV on cathodically pretreated boron doped diamond electrode was used with very good repeatability: RSD <2% (n=10). Limits of detection and determination in the absence of the extraction step were 1.2 μmol/l–1 (LOD) and 3.6 μmol/l–1 (LOQ). Simultaneous determination of VMA and another clinical biomarker homovanillic acid was also possible, even in the excessive content of uric and ascorbic acid – common urinary interferences.



Biography

Vojtech Hrdlicka is postgraduate student at the Faculty of Science of Charles University in Prague, Czech Republic. Aim of his study is Development of Novel Extraction and Electrochemical Methods for determination of Biologically, Toxicologically, Pharmaceutically or Medicinally relevant substances.

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