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In-line carbon nanofiber reinforced hollow fiber-mediated liquid phase microextraction using a 3D printed extraction platform as a front end to liquid chromatography for automatic sample preparation and analysis: A proof of concept study

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Abstract

A novel concept for automation of nanostructured hollow-fiber supported microextraction, combining the principles of liquid-phase microextraction (LPME) and sorbent microextraction synergically, using mesofluidic platforms is proposed herein for the first time, and demonstrated with the determination of acidic drugs (namely, ketoprofen, ibuprofen, diclofenac and naproxen) in urine as a proof-of-concept applicability. Dispersed carbon nanofibers (CNF) are immobilized in the pores of a single-stranded polypropylene hollow fiber (CNF@HF) membrane, which is thereafter accommodated in a stereolithographic 3D-printed extraction chamber without glued components for ease of assembly. The analytical method involves continuous-flow extraction of the acidic drugs from a flowing stream donor (pH 1.7) into an alkaline stagnant acceptor (20 mmol L^{-1} NaOH) containing 10% MeOH (v/v) across a dihexyl ether impregnated CNF@HF membrane. The flow setup features entire automation of the microextraction process including regeneration of the organic film and on-line injection of the analyte-laden acceptor phase after downstream neutralization into a liquid chromatograph (LC) for reversed-phase core-shell column-based separation. Using a 12-cm long CNF@HF and a sample volume of 6.4 mL, linear dynamic ranges of ketoprofen, naproxen, diclofenac and ibuprofen, taken as models of non-steroidal anti-inflammatory drugs,