

Molecularly imprinted polymers for the miniaturized analysis of drug and neurotransmitter traces in biological samples

An important part of the research in analytical chemistry is related to the miniaturization and integration of different analytical steps in a single device in order to meet, among other things, portability and automation issues. However, solutions for the analysis of complex samples with limited volumes containing various analytes of interest that may be found at trace levels are still required. One approach consists in the in situ synthesis of imprinted monoliths within capillaries and their on-line coupling with a separation and/or detection step. This was the objective of this thesis work. After the study of the state-of-the-art concerning the integration of molecularly imprinted polymers in miniaturized extraction and separation devices, the development of miniaturized imprinted monolithic supports and their on-line coupling with a nano-liquid chromatography separation or directly with UV detection were performed for biological applications. Different synthesis pathways were screened by varying the nature of the reagents (template, cross-linking agent, and solvent), their ratio and the mode of initiation. The characterization of the obtained supports was carried out in terms of morphology, permeability and synthesis repeatability. The selectivity of MIP monoliths was evaluated with nano-liquid chromatography by confronting their extraction potential with the one of non-imprinted monoliths synthesized in the same conditions but without the introduction of the template. The extraction protocols and coupling conditions were successfully optimized for the analysis of cocaine in saliva and plasma or the detection of benzoylecgonine in urine (sample volume: 50-600 nL) with detection thresholds in agreement with the legislation around tens of ng/mL. By exploiting the know-how acquired, other miniaturized imprinted supports were also produced to target neurotransmitters and structural analogues.