

Summary:

The prevalence of psychoactive substances misuse, as well as chasing unfair advantage by a means of doping in sports, are burdening the mankind since ancient times. However, just recently thanks to the novel scientific advancements, we are able to control and effectively fight against the aforementioned issues. As of now, the World Anti-Doping Agency spearheading the efforts to combat doping in sports controls the competitors by exclusively testing blood and urine samples.

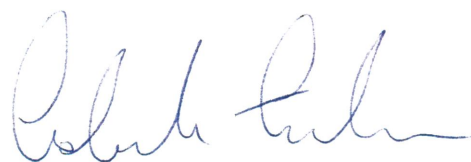
Research presented in the following doctoral thesis aims at providing arguments for promoting the use of oral fluid as an excellent testing specimen for combating the misuse of prohibited substances. However, the special emphasis is put on introduction of new solutions for analytical sample preparation. The scope of this goal ranges from improving the current solutions in used in microextraction methods, to establishing the brand new sample processing method.

The presented study involved in-depth evaluation of all currently available solutions for oral fluid sample collection (in total 15 different solutions). Moreover, investigated sample preparation solutions involved as many as 15 different chemistries of the microextraction devices, as well as 11 unique adsorptive polymers used for fabrication of the innovative extraction devices prepared exclusively with 3D printing technique. Many of these solutions were introduced to the analytical chemistry for the very first time. Major part of the research was conducted with oral fluid samples collected from volunteers and with a broad (30–49) selection of model compounds (that were physicochemically diverse, as well as highly relevant for the actual applications). For laboratory testing, the methods of high-performance liquid chromatography and tandem mass spectrometry were used.

The attained results confirmed applicability of oral fluid as a testing specimen. However, at the same time they highlighted the great demand for the improved sample collection methods. Moreover, the studies presented the benefits of using novel microextraction chemistries, especially comprised of mixed octyl and 3-cyanopropyl (1:1) -bound particles, as well as entitled with polar end-capping groups. Yet undoubtedly, the greatest amongst the presented achievements was the introduction of a brand new sample preparation method – PANDA microextraction – accomplished exclusively with a 3D printing technique from carbon fiber-reinforced polyamide

Keywords:

sample preparation, microextraction, 3D printing, anti-doping control, drugs of abuse

A handwritten signature in blue ink, appearing to read 'Robert Taylor'.

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