

Stability Of Urinary Vocs And Optimization Of Sample Preparation For Cancer Detection

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Abstract

Cancer is one of the leading causes of death worldwide, (1) however, several cancers can be cured if they are detected early and treated effectively. (2) In this context, the URIDIAG (Detection of volatile URINARY biomarkers for cancer DIAGNOSTIC) project aims to identify urinary volatile organic compounds (VOCs) that could be used as cancer biomarkers. This non-invasive approach could contribute to earlier and more accessible detection of the disease. However, urine is a complex biological matrix, which requires the use of highly sensitive and high-resolution separation techniques. Comprehensive two-dimensional gas chromatography coupled with high-resolution mass spectrometry (GC×GC-HRMS) is therefore a major asset for urinary VOC analysis. Nevertheless, the reliability of the results does not only depend on instrumental performance: but also on sample stability during transport and storage, as well as on sample preparation before analysis, which are critical factors. In our study, access to samples from affected patients is limited; therefore, minimizing experimental bias during the pre-analytical steps is crucial to ensure reliable results. A study on the stability of urinary VOCs was conducted by examining key pre-analytical factors. The most critical parameters identified were the storage temperature before analysis, the time between sample collection and analysis, and the type of container used after the first thawing step. This work provides a better understanding of VOC stability in urine and highlights the conditions needed to reduce experimental bias, thereby improving the robustness of further analyses. Based on these results, the next step of this study aims to optimize sample preparation in order to achieve the best sensitivity and reproducibility for urinary VOC analysis. For this purpose, different extraction techniques like the Solid-Phase Microextraction (SPME), Dynamic Headspace (DHS), and Stir Bar Sorptive Extraction (SBSE) will be compared to identify the most suitable approach. The comparison will be based on sensitivity, reproducibility, extraction efficiency, and robustness, as well as practical aspects such as analysis time and ease of implementation.