Induced inflammation on in vitro lung model

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Abstract

To bring exhaled breath analysis into clinical practice, we need a better fundamental understanding of molecular marker origins. A better understanding of the metabolic pathways producing volatile molecules will provide valuable insights for future developments.

In this study, lung inflammation was simulated in vitro using A549 epithelial cells. We compared the VOC production from cells after a chemically induced oxidative stress in vitro, exposing the cells to H_2O_2, and a biological stress, exposing the cells to an inflammatory pool of sputum supernatants. Special attention was devoted to define proper negative and positive controls (8 different types), including healthy sputum co-culture. Sputum from 25 asthmatic and 8 healthy patients were collected to create each pool of supernatants. Each sample type was analyzed using solid-phase microextraction (SPME) comprehensive two-dimensional gas chromatography hyphenated to time-of-flight mass spectrometry (GC×GC-TOFMS). This approach offers high resolving power for complex VOC mixtures.

According to the type of inflammation induced, significantly different VOCs were produced by the epithelial cells compared to all controls. For both chemical and biological challenges, an increase of carbonyl compounds (54%) and hydrocarbons (31%) was observed. Interestingly, only the biological inflammation model showed a significant cell proliferation together with an increased VOC production linked to asthma airway inflammation. This study presents a complete GC×GC-TOFMS workflow for in vitro VOC analysis, and its potential to characterize complex lung inflammatory mechanisms.

Reference: Zanella D, Henket M, Schleich F, Dejong T, Louis R, Focant J-F, Stefanuto P-H. Comparison of the effect of chemically andbiologically induced inflammation on the volatile metaboliteproduction of lung epithelial cells by GC×GC-TOFMS. Analyst.2020;145:5148–57.