# Human biomonitoring of emerging organic pollutants through non-invasive matrices: prognostic insights and future potentials

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Human biomonitoring is an efficient way for the assessment of a population's exposure to environmental contaminants by directly measuring substances or their metabolites. However, the challenge of sampling, such as ethical issues, limited sample amount and the willness of participants, limited the extensive application of this way. In that case, non-invasive matrices (e.g., urine, hair, nails as well as skin) are emerging as valid alternatives since they provide many advantages while ensuring similar reliability and sensitivity.

In our study, an efficient method was developed to simultaneously analyze multi-class organic pollutants including polybrominated diphenyl ethers (PBDEs) and their metabolites (OH-PBDEs and bromphenols), polycyclic aromatic hydrocarbons (PAHs) and their metabolites (OH-PAHs), in human hair, and nail as well as skin deposit. The main efforts were also dedicated to distinguish internal (incorporated into hair matrix via blood and deep skin compartments) from external (atmospheric deposition, sweat or fatty secretions) exposure to various pollutants, such as PAHs, PBDEs and OPFRs as well as their metabolites. Moreover, the occurrences and correlations of the hydroxylated metabolites in hair and nail, as well as those in paired urine and blood were also investigated.

The results show that organic pollutants as well as their hydroxylated metabolites were frequently detected. The concentrations and congener profiles of the metabolites such as OH-PAHs and debrominated products of BDE-209 provide useful clues in distinguishing internal and external exposure (Fig.1). In addition, the metabolites of BDE-209, for example, 2,3,4,6-tetrabromophenol were first identified in hair and nail, and have been successfully applied as a biomarker of human exposure. From the multiple contaminants studied in paired samples, we concluded that those hydrolytic metabolites with limited half-lives should receive more attention, as it originates almost exclusively from of metabolism human body and thus more accurate as predictions of human risk. Furthermore, the exposure from skin deposit was also carried out and some compared results obtained in our recent works.

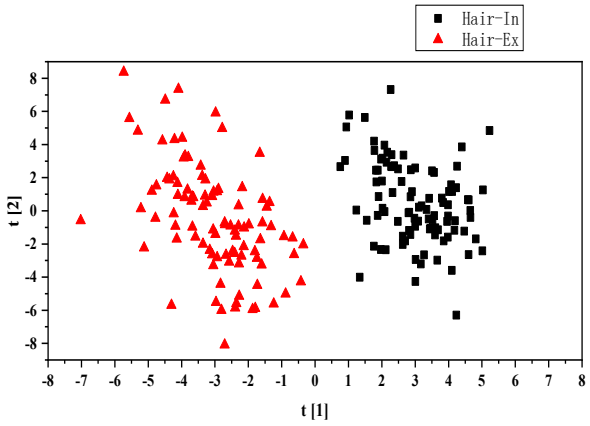


**Fig.1 First and second score plot of PLS-DA for internal and external exposure of hair**

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**Acknowledgement:** This work was financially supported by the National Natural Science Foundation of China (41731279, 41425015 and 41703092) and Local Innovative and Research Team Project of Guangdong Pearl River Talents Program (2017BT01Z032).