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New nanomaterials for enhancing detection of small molecules in cells by MALDI TOF mass spectrometry

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Matrix assisted laser desorption ionization mass spectrometry (MALDI MS) became a powerful platform for detection of small molecules in many analytical applications. However, in cell biology, precise detection of small molecules by MALDI MS is challenging due to high biological complexity of samples, unwanted interferences from salts and matrix, requirements of uniform sample deposition or simply minute amounts of the analytes. In the last years, the use of nanoparticles or nanocomposites as new matrices for improving the analysis of small molecules by MALDI TOF mass spectrometry demonstrated promising advantages. The metal organic frameworks (MOFs), graphene oxides (GO), and/or gold nanoparticles (AuNPs) represent new nanomaterials with unusual physico-chemical properties and great analytical potential as matrices for MALDI MS. In this work, we investigated properties of new generations of MOFs and their combinations with GO and AuNPs and demonstrated that they can be effective platforms for the adsorption of small biomolecules, facilitating the ionization in MALDI MS. Finally, application of MOFs, GO, AUNPs and/or their combinations significantly improved detection of small molecules by MALDI MS in complex experimental biochemical or biological systems, e.g. in cells.

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Time-dependent weathering of puparial hydrocarbons in the field in *Boettcherisca peregrina* for determining the time of death

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Time of death (TOD) is usually estimated based on corpse phenomenon in the early postmortem stage, and on the development of necrophagous flies in the late postmortem stage. However, after the adult emergence, the latter is not useful any more. Our previous studies found that composition of puparial hydrocarbon had significantly regular time-dependent changes during the weathering in the field in *Chrysomya megacephala* and *C. rufifacies*, indicating that puparial hydrocarbons have a great potential for determining the TOD in the late decomposition stage of corpses. Here, SIM mode of GC-MS was used to quantify the time-dependent changes of puparial hydrocarbons in the field in *Boettcherisca peregrina* in the autumn, 2013. We found that nearly all of the hydrocarbons decreased in the abundance during the 90-d weathering. Most of the peaks shared similar weathering profile. Their abundance decreased significantly during the first 10 days, changed hardly during the next 10 days or so, and decreased rapidly in the next 20 to 30 days, then changed very few. Even so, during the last 10 days, some significant changes still can be detected. Generally, most of the hydrocarbons weathered linearly during the first 40 days, and the weathering rate was found to correlate with hydrocarbon classes and ECL. Additionally, the specific weathering profile of the hydrocarbons is considered to correlate with the corresponding relative low temperature weather process during the weathering. Together with those in other two species flies, these results show that puparial hydrocarbons have a great value for determining the TOD.

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