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Generation of droplets of liquid for mass spectrometry

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Applications of droplets for studies in small culture volume, especially microdroplets in microfluidics, have aroused the interests ofphysical, chemical and biological fields. During the last 10 years, various methods for forming and manipulating small droplets have been developed. Each droplet provides a compartment in which species or reactions can be isolated and therefore is suitable for quantitative studies. Furthermore, high-throughput experiments with extremely small volumes, single molecules, or single cells can also be achieved through droplet-based systems.Ambient ionization, which aims at direct sampling of analytes in the ambient state, has emerged rapidly in recent years. Among the latest progresses in atmospheric pressure Electrospray-based Ionization (ESI) techniques, paper-based ESI is highly promising in consideration of its simplified protocol of sample preparation and equipment. Capability of paper-basedESI-MS for the analysis of drugs, peptides, nucleotides and phospholipids in complex biological fluid samples, such as whole blood and raw urine, has been demonstrated recently. And the transport and ionization mechanisms, the appropriate substrate and solvent for effective paper-based ESI were investigated. Therefore, coupling microfluidics and mass spectrometry can combine the advantages of these two techniques, offering a new platform for scientific research. In this work, a paper, spray mass spectrometry combined with droplets generated by gravity and electrostatic attraction, microfluidic chip, and inkjet methods, was developed. The qualitative and quantitativeanalytical performances of this technique for single droplet were demonstrated. This manually controlled interface is straightforward, low-cost and simple to implement. Moreover, paper spray ionization mass spectrometry hold promises in direct analysis of real biological/chemical microreaction samples because of its tolerance with complex matrix. As a proof-of-concept example, the droplet-based acetylcholine hydrolysis werecarried out to demonstrate the validation of our method for direct analysis of micro-chemical/biological reactions..

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Sustainable chemistry/engineering innovation

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Remarkable opportunities to develop new sustainable technology processes are attractive due to the need of technology responsive to environmental limitations. It is important to be able to understand where the innovation of these new technologies was encountered and additional fertile areas for future contribution to sustainable technology. The inspection of innovation sources can be daunting. A research effort designed to connect green chemistry/engineering with innovation may assist the general needs for sustainable technology scrutiny. This investigation has developed a metric to permit an assessment of green chemistry components contributing to new chemical process development and innovation at several stages of development. Principles used to design green processes can be employed in the assessment of the new technology involved. The design of sustainable chemical processes and products aimed at the reduction or elimination of hazardous substance (chemical) use has been quite fruitful in the field of green chemistry/engineering. Complementary sets of green chemistry and green engineering principles have provided the directions involved in this paradigm shift. These metrics are used to evaluate the contribution of each feature of innovative process development. Features contributing to innovation are expected to vary across the landscape of discovery to established chemical processes. The importance of sustainability in the design of new molecules at various levels of new chemical development now becomes relevant to discovery, process economics and public acceptability.

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