

Group	:	Organic Chemistry
Project	:	Employing paper-microfluidics and mass spectrometry for on-site plant toxin detection
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Keywords : Paper microfluidics, LC-MS, data-analysis, 3D-printing, on-site analytical chemistry, Food safety

Introduction

Providing the growing world population with safe and nutritious foods in a sustainable manner is one of the major challenges mankind faces today. The safety of our food, however, is under pressure by a range of drivers like climate change, growing world population, alternative supply chains, and dietary transformations. These drivers are expected to increase the presence of food contaminants, like plant toxins, which are already a major food safety concern. Two of the most frequently occurring classes of plant toxins, regulated by the European union, are tropane alkaloids (TAs) and pyrrolizidine alkaloids (PAs). Traditionally used techniques for the analysis of these contaminates, such as high-performance liquid chromatography – tandem mass spectrometry (HPLC-MS/MS) or enzyme-linked immunosorbent assays (ELISA) are time-consuming, laboratory-bound, and expensive. There is therefore an urgent demand to develop rapid on-site devices that enable non-expert end-users to screen food commodities for the presence of these plant toxins. These devices should provide non-experts the tools to perform simplified sample preparation, contaminant detection, and data-interpretation on-site.

Currently, the gold standard in food extraction/matrix clean-up is a combination of a liquid-liquid extraction, and dispersive solid phase microextraction, typically referred to as 'QuEChERS'. QuEChERS is known to be Quick, Easy, Cheap, Effective, Rugged, and Safe, but the application of QuEChERS is still lab oriented. In this project, a miniaturized paper-based analytical device (µPAD) that can selectively extract food contaminants from a food matrix as a replacement of QuEChERS will be developed. In this µPAD, a newly in-house developed paper-immobilized liquid phase micro-extraction (PILPME) and paper-immobilized QuEChERs (PIQuEChERS) method will be further developed. Examples of follow-up research projects are:

A. Increasing the number of compound classes that can be extracted with PIQuEChERS. For example, pesticide contamination in food and feed is a reoccurring risk in food safety. Currently, QuEChERS is the preferred extraction method for these contaminants. However, QuEChERS is still lab oriented. Therefore, in this thesis project the student will examine the applicability of PIQuEChERS for a selective pesticide extraction.

B. Colorimetric methods often lack sensitivity and specificity. When combined with the selective extraction of PIQuEChERS these drawbacks could be overcome. Therefore, in this thesis project the student will examine the possibility of combining PIQuEChERS with a colorimetric test.

Are you an enthusiastic and motivated student with an affinity for analytical chemistry? Are you an ambitious go-getter, not afraid to be challenged? Then we are looking for you!

Techniques to be used

Developing a selective food extraction method; chemically modifying paper; chemical reactions to develop a colorimetric test; 3D-printing to assist the paper-based extraction; LC-MS to determine extraction efficiency.

Requirements

-MSc or BSc thesis student
-Full-time available