Editorial

Analytical Methods and Application of Separation Techniques in Food Science

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1. Introduction

Food chemistry is a branch of chemistry that aims to characterize the chemical composition of food products, both qualitatively and quantitatively. Food products are complex matrices containing various micro-and macromolecules, which can be analysed based on various analytical techniques. In recent years, due to an enormous growth in the food sector, studies in food chemistry reported not only the composition of food products but also the changes caused by food processing.

There is a growing body of research dedicated to evaluating the beneficial or harmful effects of food ingredients on human health, determining the flavour of foodstuffs, and modifying their compositions to reduce food spoilage. All of these cannot exist without the development of analytical techniques. The progress in separation techniques resulted in a massive increase in studies focused on the analysis of compounds in food samples. Many researchers from the industry, academia, and the government are working to develop and validate analytical methods to extract, separate, identify, and quantitate a variety of analytes from food products using a wide range of analytical techniques. A better understanding of food chemistry is important to develop new, functional food products, confering the beneficial effects for our health.

The Special Issue “Analytical Methods and Application of Separation Techniques in Food Science” aimed to collect the latest research related to the development and application of separation techniques to determine the health-promoting potential, safety, authenticity and aroma of food products.

2. Summary of Published Articles

This Special Issue includes five research articles that covered various topics, including an analysis of components affecting the sensory quality of food [1], development of extraction techniques [2], the effect of processing on phytochemical compositions [3], metabolomics studies [4] and selection of the best extraction conditions for specific purposes [5].

The stability, sensory quality, and selected nutritionally interesting properties and their changes in cold-pressed blends of rapeseed and sunflower oils after fortification with chia and sesame seeds, and seed oils during repeated thermal treatments were the topics of the first study [1]. Cold-pressed oils, despite their health benefits, suffer from limited stability and palatability after storage and processing. Tauferova and co-workers decided to fortify cold-pressed oil with ingredients that have high antioxidant capacities, which in this case were chia and sesame seeds. Unfortunately, the procedure applied did not lead to better stability of oils during repeated thermal treatment. However, as long as only one
cycle of thermal treatment was applied, the sensory quality was not affected. The authors observed also that repeated heating cycles led to an increase in peroxide value and loss of chlorophyll, concluding that products of blended oils should be consumed with limited thermal processing.

An experimental design was applied by Borrás-Enríquez and co-workers to optimize the conditions of ultrasound-assisted extraction of polyphenols in mango residues [2]. The authors underlined that conventional methods of extraction, such as maceration, hydrodistillation and soxhlet extraction suffer from low efficiency and are not environmentally friendly. Therefore, alternative, novel technologies should be applied. In this study, ultrasound extraction was selected due to its reduced processing time, and lower consumption of energy and solvents. The optimal conditions of 50% ethanol as solvent relation, 60% amplitude and 20 min of sonication time allowed for better extraction of polyphenols compared with maceration. Notably, mangiferin was possible to detect only after ultrasound-assisted extraction.

Another study that focused on the extraction of by-products was written by Drabinski [5]. Here, an efficient extraction method for the analysis of free amino acids was proposed. Two of the most commonly applied extraction solutions (50% methanol vs. 25% acetonitrile in 0.1 M hydrochloric acid) were compared to evaluate the content of free amino acids in gluten-free sponge cakes fortified with broccoli leaf powder. Extraction with 50% methanol was found to be much more efficient, allowing the authors to detect more free amino acids (26 vs. 14) with a 14-fold higher concentration in broccoli leaves compared with another method. The topic of valorisation of food by-products gained a lot of attention in recent years [6]. It is of special importance for gluten-free products, which contain lower nutritional value compared with corresponding gluten-containing foodstuff. The fortified gluten-free sponge cakes were found to be a very good source of essential amino acids, including in a gluten-free diet.

Another article published in this Special Issue also focused on by-products of the food industry [3]. This time, the study focused on olive leaves, which are an important by-product of olive oil production, accounting for around 10% of the total weight of olives [7]. In the first step, Feng and co-workers [3] developed a simple chromatographic method to simultaneously detect the oleuropein and hydroxytyrosol contents in olive leaves, which was further applied to investigate the effect of drying and storage of olive leaves on the content of these compounds. The established method allowed for an analysis to be made within 33 min with good accuracy, repeatability and recovery. The authors found that air-drying at room temperature was the most suitable drying method to retain phenolic compounds, while storage temperature did not affect the content of the compounds analysed.

Finally, the potential of untargeted metabolomics focused on volatile organic compounds was applied for determining quality markers for the *Arctostaphylos uva-ursi* plant collected from various Spanish locations [4]. The authors reported the presence of 107 volatile organic compounds in the samples collected from nine locations in Spain. The chemometric analysis showed that location of collection, solar radiation and altitude had an important influence on the antioxidant properties of tea. The most interesting compounds proposed as potential antioxidant markers included fumaric acid 2-decyl dodecyl ester for Albarracín (Teruel), 4-(1-hydroxyallyl)-2-methoxyphenol for Chelva (Valencia), El Toro (Castellón) and both samples from Loarre (Huesca), dimethoxyphenyl-6-nitro-coumarin for the Huétor (Granada) and Los Vélez (Almería) samples, 5-pentyl-1,3-benzenediol for Lierta (Huesca), and oxalic acid 6-ethylcot-3-yl ethyl ester for Pina de Montalgrao (Castellón), which can provide the knowledge necessary to plan crop conditions to obtain extracts with select unique properties. Moreover, 20 quality markers were identified for the plants analysed, which can help in the development of procedures used for the authentication of *Arctostaphylos uva-ursi* tea.
3. Conclusions

Five articles published in this Special Issue presented recent developments and applications of separation techniques in food science. Due to the inclusion of well-designed and well-written articles, this Special Issue offers a valuable contribution to the field of food chemistry. Although many exciting findings have been reported in recent years, there is still a need for further improvements and developments in separation and sample preparation techniques in food science.

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