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Short Communication Open Access

QuEChERS: The Dispersive Methodology Approach for Complex Matrices

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Sample preparation is one of the most difficult and time-consuming parts of any analytical procedure. It has a big impact on the results and makes up a crucial step for the analysis of complex matrices. Recent trends, to comply with green analytical chemistry, demand for sample preparation protocols that are non-time consuming, low-cost, easy, environmental friendly and efficient. The development of alternative sample preparation techniques has been exploited aiming to better results.

QuEChERS (quick, easy, cheap, effective, rugged, and safe) methodology is a dispersive approach widely used for the extraction and subsequent determination of an extensive range of analytes especially in residues' analysis. QuEChERS was introduced in 2003 by Anastassiades for the determination of pesticides residues from fruits and vegetables [1]. The procedure includes two steps. The first step involves the extraction of the sample with an organic solvent such as acetonitrile followed by partitioning of a salt solution. The supernatant is subsequently purified by Dispersive Solid Phase Extraction (DSPE).

When applied in difficult food matrices, QuEChERS methodology showed better results than other existing sample preparation techniques. By combining liquid-liquid extraction (LLE) with DSPE, this approach results in very clean extracts and provides high recovery rates. Thus, it is suitable for the extraction of residues from complex matrices showing good reproducibility as well. It is also a very fast and green procedure as it avoids the consumption of toxic solvents and has great flexibility since it can be used in a wide variety of samples [2]. Typical applications include the extraction of pesticides, insecticides, fungicides, and herbicides from food products, drinks, and soil followed by analysis with either gas chromatography or liquid chromatography. In addition to the pesticides' analysis, QuEChERS has been used for other analytes and matrices as well. Published methods include the extraction of mycotoxins and PAHs from food, drinks, water samples and breast milk. Moreover, pharmaceutical drugs such as steroids, hormones have been extracted from sewage, wastewater and biological matrices. QuEChERS has been also applied in the analysis of veterinary drugs and antibiotics from food of animal origin, urine and soil [3].

Authors' research group has studied the use of QuEChERS for the determination of several antibiotics (penicillins, amphenicols, cephalosporins and quinolones) from eggs and milk [4,5] as well as for the simultaneous determination of melamine and cyromazine residues from eggs from laying hens, with better results than the classic extraction techniques [6]. A representative extraction scheme is illustrated in Figure 1, where a simple QuEChERS procedure is applied for the sample preparation of egg samples.

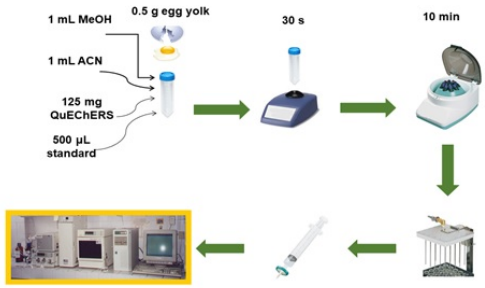

Figure 1: A representative protocol for QuEChERS application in food samples.

The application of this sample preparation technique in a wide range of matrices, led to modifications in the procedure. However, all relevant modifications include the two original steps (the extraction, and the DSPE), with the implementation of alternative modes with regards to the extraction solvent, salt and sorbent in the DSPE step. As such, various buffers can be used for the adjustment of pH. Moreover, innovative sorbents can ensure better performance and higher absorption capacity. These modifications were emerged from the need to obtain better results in very complex matrices.

In conclusion, QuEChERS has been used successfully in many kinds of samples and demonstrated better clean up ability and higher recovery rates than many other already existing methods. Nowadays, this methodology constitutes a common sample preparation for routine analysis in residue laboratories for the determination of various compounds, such as pesticides, pharmaceutical products and veterinary drugs. In general, this sample preparation technique fulfills the requirements of the modern laboratories because it provides efficiently very clean extracts, in less steps and time.

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