

Magnetic solid-phase extraction for the determination of dyes in candies using high performance liquid chromatography coupled to mass spectrometry

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Colour is an important characteristic directly associated with food choice by consumers. The appearance, taste and safety of any food product are directly associated with its colour. Different types of natural and synthetic dyes are available in the food industry, where the latter have gained popularity because they are very stable and cheap [1]. The control of the addition of dyes in candies is a topic of great interest nowadays, especially due to their consumption by children.

The aim of this study was to develop an analytical method for the identification and quantification of fourteen dyes, including 13 synthetic dyes (amaranth, quinoline yellow, azorubine, brilliant blue, patent blue, erythrosine, indigotine, acid red 2G, allura red, ponceau red, sunset yellow, tartrazine and acid green) and one of natural origin (curcumin) in candies. The proposed method was based on liquid chromatography with tandem mass spectrometry (LC-MS/MS) using a triple quadrupole (QQQ) analyzer. The use of nano-adsorbents dispersed in the sample matrix for dye extraction has proven to be an effective method in different matrices [2]. In this case, the miniaturized sample preparation known as magnetic solid-phase extraction (MSPE) was applied for the isolation of analytes. A solid-liquid extraction in water was applied, before MSPE adsorption step, for what magnetized polyethyleneimine (PEI) modified nanoparticles with polydopamine (PDA) (PEI@PDA@Fe₃O₄) were used. Desorption of the dyes was carried out using a 70:30 acetonitrile:ammonia mixture and the extract was evaporated and reconstituted with 250 µL of water before being injected into the LC-MS/MS system.

The method was validated and limits of quantification in the 0.11 µg/kg to 0.92 mg/kg range were obtained, which allowed to verify that the samples comply with the maximum levels legislated for the dyes studied. Thirteen candy samples of different matrices were analyzed and concentrations between 0.01 and 5 mg/kg were obtained in several of them for azorubine, brilliant blue, patent blue, curcumin, allura red and tartrazine.

In conclusion, the method developed has proved to be suitable and effective for the quantification of dyes in candies, providing a useful analytical tool for the control of these additives in sweet products.

References

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- [2] W.A. Khan, P. Varanusupakul, H.U. Haq et al. Microchem. J. 208 (2025) 112419.

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