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Analysis of Caffeine in Various Brands of Instant Coffee using Dispersive Liquid-Liquid Microextraction and High-Performance Liquid Chromatography

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Structured Abstract

Background: Caffeine is found in various beverages, including coffee, tea, soft drinks, and energy drinks. Food analysis is crucial for evaluating nutritional value and monitoring food additives. However, challenges in analysing caffeine in commercial products include insufficient clean-up, expensive solvents, large sample amounts, longer analysis times, and complex purification processes. Dispersive liquid-liquid microextraction (DLLME) is utilised in this study because it is a simpler, faster and more advanced method for the analysis of caffeine. The purpose of this study is to determine caffeine content in three types of commercial instant coffee brands using DLLME coupled with high-performance liquid chromatography (HPLC). Optimum DLLME parameters was used to assess caffeine content in different commercial instant coffee brands.

Methods: The caffeine content from instant coffee samples was extracted and analysed using developed DLLME method and HPLC. The important parameters for DLLME were optimized using one-factor-at-a-time-method (OFAT). Five (5) type of parameters (type of disperser solvent, volume of disperser solvent, type of extraction solvent, volume of extraction solvent and the addition of salt) were investigated and evaluated to obtain the optimum conditions. The three (3) types of instant commercial coffee brands which were Nescafe (sample X), Kopiko (sample Y) and Aik Cheong (sample Z) were analysed under developed DLLME method and HPLC.

Results: Optimization of DLLME was successfully performed. Methanol is the best disperser solvent with the volume of 400 µL. Chloroform is identified as a good extraction solvent with the volume of 100 µL. The efficiency of DLLME in extracting caffeine is not influence by the addition of salt. This study showed that the caffeine content is different for the three samples. The caffeine concentration obtained is the highest in sample Y (53.2±6.6 ppm), followed by sample X (42.6±2.5 ppm) and sample Z (28.8±2.1 ppm).

Conclusion: The levels of caffeine in commercial instant coffee of different brands vary due to factors such as different sources of coffee bean and formulation. The optimization of the DLLME method was successfully conducted. The is considered accurate with the percent recovery of 89.9%.

Keywords: Caffeine, Dispersive Liquid-Liquid Microextraction, High-Performance Liquid Chromatography

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