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Ultrasound-Assisted Emulsification Microextraction Followed by Gas Chromatography-Flame Ionization Detection for Urinary Methylmalonic Acid Determination

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Abstract

An efficient microextraction technique followed by gas chromatography-flame ionization detector (GC-FID) analysis was developed for the determination of methylmalonic acid (MMA) concentration in human urine samples. This method was based on ultrasound-assisted emulsification microextraction followed by derivatization with a low density alcoholic solvent which performs both as an extraction solvent and as a derivatization agent, simultaneously. In this procedure, 80 μL of 1-heptanol was injected slowly into a 10 mL acidified aqueous sample of MMA placed inside an ultrasonic water bath. The resulting emulsion was centrifuged and after derivatization, 2 μL of the organic phase was injected into a GC-FID. Several factors affecting the derivatization and the extraction were optimized. Under the optimal conditions, linearity was in the range of 1 to 250 and 3 to 200 $\mu\text{mol/L}$ corresponding to the limits of detection (LOD) 0.8 and 2.4 $\mu\text{mol/L}$ in water and urine samples, respectively. The inter-day and intra-day precision of the proposed method were evaluated in terms of the relative standard deviation (RSD), which were $<11\%$ ($n = 4$). The proposed method presented an acceptable LOD for urinary MMA analysis with satisfactory RSD.

Keywords: Methylmalonic Acid; Ultrasound-assisted Emulsification Microextraction; Gas Chromatography-Flame Ionization Detection; Urine Analysis

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