OPTIMIZATION OF SPME METHOD FOR THE DETERMINATION OF ACETONE IN URINE SAMPLES

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Diabetes is a chronic disease in which the body does not produce or properly use insulin. Insulin is a hormone that is needed to convert sugar, starches and other food into energy needed for daily life [1]. In case of diabetes, glucose could not be transferred into the cell and the blood glucose level will be higher due to the insulin deficiency. The energy deficiency leads to a betaoxidation of fatty acids, producing an excess of acetyl CoA. The resulting excess of acetyl CoA synthesizes the so-called ketone bodies, i.e., acetone, acetoacetate and beta-hydroxybutyric acid. This symptom is well-known as diabetic ketoacidosis (DKA). DKA is a typical symptom found in type-1 diabetes, although it can be also found in the patients of type-2 diabetes [2]. As the result of DKA, the resulting ketone bodies will be accumulated in the blood of the patient, and typically excreted in the urine.

Human urine analysis was also used for the diagnosis of several diseases because of its simple and inexpensive features. Ketone bodies in urine have been widely measured for diabetic patients in clinical practice using a test strip. With this test strip, urine ketone level could be approximately monitored, where one can check the level by the color change of the strip, although the detectability is not satisfactory for the level of less than 50 mg/L (50ppmv) for acetoacetate [2]. Acetone is normally detected in healthy human urine at about 1ppmv, and a higher concentration could be found from diabetic patient. Headspace-solid phase microextraction (HS-SPME) introduced by Pawliszyn is very useful for the assay of volatile compounds, since it is easy to overcome interferences arising from the sample matrix [3].

In this study a SPME method was applied for the determination of acetone in synthetic urine samples by using polyacrylate fiber by GC-MS system. Operational parameters, mainly, sample volume, adsorption temperature and time, stirring rate and salt amount were optimized to be as 10 mL, 70°C, 5 min and no stirring, respectively. Desorption was performed at 220°C for 5 min. Calibration curves were linear in a range of $5 \times 10^{-5} - 3 \times 10^{-4}$ M with the detection limit and quantification limit (LOQ) of $2.5 \times 10^{-5}$ M and $8.1 \times 10^{-5}$ M. The method was validated with spiked matrix samples. The advantages of the method developed are the less solvent consumption, being cost effective and fast. As a result this method can easily be adopted by clinical laboratories.

KEYWORDS: Acetone, SPME, Polyacrylate, Diabetes, GC-MS

REFERENCES: