

Estimation of Caffeine Content in Coffee of Malaysian Market Using Fourier Transform Infrared (FTIR) Spectroscopy

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ABSTRACT

This study reports the caffeine content in seven locally available coffee. The caffeine was extracted with chloroform and analysed using Fourier Transform Infrared (FTIR). The method reports an average recovery of 101% with the limit of determination established at 0.1%. The absorption band at 1654 cm^{-1} was used to construct the calibration curve for quantification of caffeine where the regression was fitted with satisfactory linearity. An average of 0.55% of caffeine was detected in the seven coffee products with Arabica coffee demonstrating lower caffeine concentration. The study evidenced that caffeine content in coffee is determined by the coffee types. The caffeine content found in the local coffee products was relatively lower likely due to the solvent types, extraction procedure and analytical method used.

Keywords: Arabica coffee, decaffeinated, chloroform extraction, Robusta coffee

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INTRODUCTION

Caffeine (1,3,7-trimethylxanthine) is an alkaloid of the methylxanthine family which is widespread in plants. It is a stimulant that acts on the central nervous system to give off numerous effects, primarily to boost the physical and mental performance (Glade, 2010). Caffeine is most commonly found in coffee bean, cocoa bean, tea leaves and soft drinks (Frary, Johnson & Wang, 2005). Typically, coffee beans contain 0.8-2.8 % caffeine contributing to bitter taste of coffee brew (Eggers & Pietsch, 2001). The caffeine level depends on the species and origin of coffee beans as well as the brewing methods (Alves, Casal & Oliveira, 2007). The caffeine content in brewed coffee was found the highest, in the range of 56 – 100 mg/100 mL, followed by instant coffee and tea (20-73 mg/100 mL) (Nawrot *et al.*, 2003).

Coffee comes from the genus of *coffea* from *Rubiaceae* family. In the global market, there are three most widely traded coffee species. They are *coffea arabica*, *coffea canephora* (Robusta) and *coffea liberica* of which the varieties of robusta (10%) and liberica (90%) are commercially grown in Malaysia (Mohammad Nor & Abd Wahap, 2016). Essentially, there is a marked positive growth of 30% in the coffee industry in Malaysia annually (The Malaysian Reserve, n.d.). Many coffee chains are seen to spring up in the street mainly as a result of the changes in lifestyle, boosted by the young consumers and professionals.

The coffee culture penetrates the society of Malaysia rapidly; a survey shows that Malaysians drink an average of 2.38 cup of coffee daily (Essays, 2013). The amount of caffeine consumed is not normally of interest. As a matter of fact, excessive caffeine intake could lead to toxicity, cardiovascular effects, alteration in calcium balance, changes in behaviour, increased risk of cancer and effects on male fertility. As recommended, a daily intake of up to 400 mg of caffeine/day is considered safe for an adult (Nawrot *et al.*, 2003).

According to Malaysian Standard MS 1360 (1994), all coffee species are expected to contain averagely 0.9% caffeine nevertheless, the caffeine content in most local coffee products are undeclared. Hence, it is the objective of the study to determine the caffeine content in the coffee products available locally using the rapid Fourier Transform Infrared (FTIR) spectroscopic method. The method has been widely used for quantification of caffeine with promising accuracy (Garrigues, Bouhsan, Garrigues & de la Guardia, 2000; Paradkar & Irudavaraj, 2002; Weldegebreel, Redi-Abshiro & Chandravanshi, 2017). Garrigues *et al.* (2000) reports the detection limit of FTIR for caffeine at 3 mg/L with recovery between 94.4 – 100.1%. Singh, Wechter, Hu and Lafontaine (1998) on the other hand reports at sensitivity of 5 mg/L.