Review Article

Spectrophotometric Analysis of Caffeine

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The nature of caffeine reveals that it is a bitter white crystalline alkaloid. It is a common ingredient in a variety of drinks (soft and energy drinks) and is also used in combination with various medicines. In order to maintain the optimum level of caffeine, various spectrophotometric methods have been developed. The monitoring of caffeine is very important aspect because of its consumption in higher doses that can lead to various physiological disorders. This paper incorporates various spectrophotometric methods used in the analysis of caffeine in various environmental samples such as pharmaceuticals, soft and energy drinks, tea, and coffee. A range of spectrophotometric methodologies including chemometric techniques and derivatization of spectra have been used to analyse the caffeine.

1. Introduction

As we know, caffeine (Figure 1) is the most versatile compound in the sense that almost every human being is exposed to this compound via various beverages and medicines. Caffeine is widely used in many soft drinks as flavouring agent and is deliberately added to make people addicted to these drinks. Caffeine is a naturally occurring alkaloid and it can be found in at least 63 plant species and is present in their leaves, seeds, and fruits [1]. The amount of caffeine varies according to species and origin of plants [2]. Caffeine belongs to the family of naturally occurring powerful xanthines and possibly the oldest known stimulants. Therefore, this property exhibits its ability to provide alertness, put off sleep, and increases the alertness in the study [3].

It is a well-established fact that caffeine acts as a stimulant to the central nervous system and heart and also increases the activity of brain through its adenosine antagonist action. Nowadays, it is most commonly used in various pharmaceuticals. Caffeine is used in the treatment of mild respiratory depression caused by narcotics and for the treatment of circulatory failure [4]. It is used with aspirin in some preparations for the treatment of headache and with ergotamine in antimigraine preparations in order to produce a sense of alertness [5].

The determination of caffeine in various natural products is also very important aspect from an economic point. Decaffeination of various natural products provides a valuable byproduct such as caffeine and that can be used in preparation of various drugs.

It is a well-established fact that the spectrophotometric determination in UV-vis region is less expensive, follows a simple procedure, and provides a high accuracy and reproducibility from a small number of samples. Spectrophotometry is widely used in all the schools, colleges, universities, and research institutes. Almost all the researchers are capable of handling this instrument. A wide variety of sophisticated instruments are available such as HPLC [6–8] and GC [9–11] and are frequently used for the analysis of caffeine. But every researcher is not able to access these sophisticated instruments. The contents of this review will boost the knowledge of the researchers working on caffeine in small scale industries, colleges, and universities.

2. Different Validation Methods for Quantification of Caffeine

Spectrophotometric measurement is the most popular analytical tool in the field of analysis of a variety of compounds in