

NOVEL UV SPECTROSCOPIC METHOD FOR QUANTIFICATION OF CAFFEINE IN MARKETED ENERGY DRINKS

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ABSTRACT

Objective: This study is performed to quantitatively estimate caffeine in marketed energy drinks by using UV-Visible spectroscopic method.

Methods: This experiment was performed on various soft drinks and energy drinks available in the local market of India to determine the caffeine concentration. The quantitative method used was simple, easy UV-Visible spectrophotometric method by using carbon dichloromethane as diluent at 274 nm. UV-Vis spectroscopy is an analytical technique that measures the amount of discrete wavelengths of UV or visible light that are absorbed by or transmitted through a sample in comparison to a reference or blank sample.

Results: Among all the samples i.e. soft or energy drinks taken for this experiment sample 1 has low concentration of caffeine and the highest concentration was observed in sample 3.

Conclusion: Caffeine in an energy drink provides a stimulant effect, it gives energy. At lower levels, as it's typically used in soft drinks, it has less of a stimulant effect and is used mainly for its taste profile. However the concentration of caffeine should be within the limits specified. Excessive consumption of caffeine may lead to anxiety, caffeine dependence, increased urination, and may cause insomnia. Energy drinks can contain high levels of caffeine but are unlikely to be hazardous unless consumed with alcohol. This research is very important analytical process to safeguard the well being of people who are unaware to adverse effects of caffeine.

Keywords: Caffeine, Soft drinks, Energy drinks, UV visible spectrophotometer, Dichloromethane

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INTRODUCTION

Caffeine is a white crystalline xanthines alkaloid i.e. methyl xanthines group which is bitter in taste [1, 2]. The IUPAC name of caffeine is 1, 3, 7-trimethylpurine-2, 6-dione. Caffeine molar mass and density are 194.19 g/mol and 1.2g/ml respectively. In cold water caffeine has low solubility and it has better solubility in hot water, pyrrole, acetone, pyrimidine, and ethyl-acetate. Caffeine has very well solubility in petroleum ether, chloroform, benzene and ether. Chemical structure of caffeine is given in the fig. 1 below.



Fig. 1: Chemical structure of caffeine

Caffeine is present in leaves and seeds of different plants. Mostly it is derived from the tea leaves, coffee, cocoa or cola seeds. Big source of caffeine is tea. Higher concentrations of caffeine are present in black or oolong tea when compared with other kind of tea such as green tea. Tea was found in china and was initially used for medical purposes. It is extracted from *Cassia sinensis*, a plant that is indigenous to India and china. Tea has flavanoids and imparts anti-inflammatory and neuroprotective activity. In Asia green tea is most popular tea. It has large amount of caffeine, tastes bitter and is made of unfermented leaves. Black tea tastes much bitter and is made with fermented leaves. It has polyphenols such as flavanoids and has highest amount of caffeine. Flavanoids are effective against harmful agents [3].

In soft drinks like colas caffeine is most common ingredient. It is intentionally added to these drinks for the reason of their taste and to make the drink addictive. Depending on the drink type the content of caffeine in soft drinks varies which can be from 10 mg to 50 mg per serving portion [4]. The maximum amount of caffeine in carbonated drinks is restricted to 6 mg/ml by the USFDA [5]. In soft drinks the allowed amount of caffeine is in the range of 30 to 72 mg/335 ml or 8.45 to 20.28 mg/100 ml [6].

The popular drinks which contain caffeine are tea, coffee, soft and energy drinks. The most commonly used psychoactive compound worldwide is caffeine [7]. The amount of caffeine present in a cup of coffee is 100 mg. Even decaf coffee contains caffeine which can be 12 mg. The amount of caffeine present in a cup of tea is 85 mg. After 15 min of ingestion the effect of caffeine on human body may appear and can last for hours [8].



Fig. 2: Soft drinks

People will not have mood changes with consumption of less than 300 mg of caffeine. Consumption of caffeine causes dehydration due to its diuretic activity. Metabolism of caffeine takes place in liver by

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Table of Contents Method Estimation Caffeine In Drinks Manual

1. Understanding the eBook Method Estimation Caffeine In Drinks Manual
 - The Rise of Digital Reading Method Estimation Caffeine In Drinks Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Method Estimation Caffeine In Drinks Manual
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Method Estimation Caffeine In Drinks Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Method Estimation Caffeine In Drinks Manual

- Personalized Recommendations
 - Method Estimation Caffeine In Drinks Manual User Reviews and Ratings
 - Method Estimation Caffeine In Drinks Manual and Bestseller Lists
5. Accessing Method Estimation Caffeine In Drinks Manual Free and Paid eBooks
 - Method Estimation Caffeine In Drinks Manual Public Domain eBooks
 - Method Estimation Caffeine In Drinks Manual eBook Subscription Services
 - Method Estimation Caffeine In Drinks Manual Budget-Friendly Options
 6. Navigating Method Estimation Caffeine In Drinks Manual eBook Formats
 - ePub, PDF, MOBI, and More
 - Method Estimation Caffeine In Drinks Manual Compatibility with Devices
 - Method Estimation Caffeine In Drinks Manual Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Method Estimation Caffeine In Drinks Manual
 - Highlighting and Note-Taking Method Estimation Caffeine In Drinks Manual
 - Interactive Elements Method Estimation Caffeine In Drinks Manual
 8. Staying Engaged with Method Estimation Caffeine In Drinks Manual
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Method Estimation Caffeine In Drinks Manual
 9. Balancing eBooks and Physical Books Method Estimation Caffeine In Drinks Manual
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Method Estimation Caffeine In Drinks Manual
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Method Estimation Caffeine In Drinks Manual
 - Setting Reading Goals Method Estimation Caffeine In Drinks Manual
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Method Estimation Caffeine In Drinks Manual

- Fact-Checking eBook Content of Method Estimation Caffeine In Drinks Manual
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
- Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
- Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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