



CAFFEINE EXTRACTION AND CHARACTERIZATION

Pradeep S.¹, G. N. Rameshaiah², Hadagali Ashoka¹

¹Department of Biotechnology, ²Department of Chemical Engineering BMS College of Engineering, Bull Temple Road, Bangalore- 560019, Karnataka, India.

ABSTRACT

Caffeine extracted and characterised from tea (black) leaves and coffee beans. Isolation was done by liquid-liquid extraction using di-chloromethane as an extracting agent. This extraction was done in four steps: steeping, evaporation, liquid-liquid extraction and recrystallization. The recrystallization was done using anhydrous sodium sulphate. The technique used for purity analysis and characterisation were: High performance liquid chromatography, Differential scanning calorimeter, Fourier transform infrared spectroscopy and Melting point. First, the analysis was done using melting point analysis. The melting point of caffeine extracted from coffee beans and tea leaves was found to be 238°C. The absorption bands were compared with that available in literature and were found to be similar. Further, the purity check was done using High performance liquid chromatography method. Effective characterization of caffeine was achieved by determining Infrared spectrum, and employing a melting point apparatus and differential scanning calorimeter. The purity showed that the results that the extracted coffee was 90% pure. Further improvements in extraction efficiency will increase the yield and minimize wastage.

Key Words: Caffeine, Methyl xanthine, Theophylline, Differential scanning calorimeter, Fourier transform infrared spectroscopy, High performance liquid chromatography

INTRODUCTION

Caffeine is a psychoactive CNS stimulant drug discovered by German chemist Friedrich Ferdinand Runge in 1819. He coined the term "Kaffein" which became Caffeine¹. Caffeine is a methyl xanthine along with theophylline and theobromine. It is a natural pesticide. Caffeine does not counteract the effects of alcohol. Caffeine is a xanthine alkaloid compound that acts as a stimulant in humans. It is a central nervous stimulant, having the effect of temporarily warding off drowsiness and restoring alertness.² Every time we drink tea, coffee, cocoa, chocolate or cola we are giving our body a "hit" of caffeine. Along with nicotine and alcohol, caffeine is one of the three most widely used mood – affecting drugs in the world³.

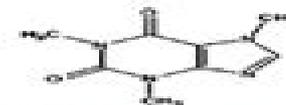
OBJECTIVES

1. To extract caffeine from tea leaves and coffee beans by liquid-liquid extraction method.
2. To characterize the obtained caffeine by melting point, Infrared spectroscopy and Differential scanning calorimeter method.

3. To develop an easily adaptable method for the qualitative or purity analysis of caffeine

PHYSICAL AND CHEMICAL PROPERTIES

Caffeine is sparingly soluble in most polar solvents but is highly soluble in less polar solvents. The melting point is 234°C-239°C and the chemical formula is $C_8H_{10}N_4O_2$. It is an intensely bitter, white powder in its pure state. Caffeine is an alkaloid of the methylxanthine family, which also includes the similar compounds theophylline and theobromine³. The structure of caffeine is



ADMET OF CAFFEINE

Absorption & Distribution

Caffeine is absorbed orally with a max blood peak after 120 mins spreading quickly in all tissues. Caffeine is

Corresponding Author:

Pradeep S., Department of Biotechnology BMS College of Engineering, Bull Temple Road, Bangalore- 560019, Karnataka, India
E-mail: padees@gmail.com

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Caffeine Extraction And Characterization

Henry Edward Cox



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The Study and Determination of Accurate Micro Methods of Caffeine Analysis in Decaffeinated Coffee Winston Fields Allen,1929

Direct Analysis in Real Time Mass Spectrometry Yiyang Dong,2018-04-09 Clear comprehensive and state of the art the groundbreaking book on the emerging technology of direct analysis in real time mass spectrometry Written by a noted expert in the field Direct Analysis in Real Time Mass Spectrometry offers a review of the background and the most recent developments in DART MS Invented in 2005 DART MS offers a wide range of applications for solving numerous analytical problems in various environments including food science forensics and clinical analysis The text presents an introduction to the history of the technology and includes information on the theoretical background for example on the ionization mechanism Chapters on sampling and coupling to different types of mass spectrometers are followed by a comprehensive discussion of a broad range of applications Unlike most other ionization methods DART does not require laborious sample preparation as ionization takes place directly on the sample surface This makes the technique especially attractive for applications in forensics and food science Comprehensive in scope this vital text Sets the standard on an important and emerging ionization technique Thoroughly discusses all the relevant aspects from instrumentation to applications Helps in solving numerous analytical problems in various applications for example food science forensics environmental and clinical analysis Covers mechanisms coupling to mass spectrometers and includes information on challenges and disadvantages of the technique Academics analytical chemists pharmaceutical chemists clinical chemists forensic scientists and others will find this illuminating text a must have resource for understanding the most recent developments in the field

Microbial Bioprocessing of Agri-food Wastes Gustavo Molina,Minaxi Sharma,Rachid Benhida,Vijai Kumar Gupta,Ramesh Chander Kuhad,2023-06-16 This book gives a comprehensive overview of recent advances in the valorization of agri food waste and discusses the main process conditions needed to overcome the difficulties of using waste as alternative raw materials It also discusses specific methodologies opportunistic microbes for biomass valorization the sustainable production of agri food waste as well as examines the assessment and management of bioactive molecules production from microbial valorization of agri food waste The authors provide technical concepts on the production of various bio products and their commercial interest including agri food waste utilization in the microbial synthesis of proteins the valorization of horticulture waste the sustainable production of pectin via microbial fermentation as well as other food and pharmacological applications This book is intended for bioengineers biologists biochemists biotechnologists microbiologists food technologists enzymologists and related professionals and researchers Explores recent advances in the valorization of agri food waste Provides technical concepts on the production of various bio products of commercial interest Discusses the main process conditions to overcome the difficulties of using waste as alternative raw materials Introduces technical economic details on the advantages and disadvantages of exploring the waste recovery chain

Explores the main technological advances in the recovery of residues in functional products *Allen's Commercial Organic Analysis* Alfred Henry Allen,1917 *Allen's Commercial organic analysis v. 9, 1917* Alfred Henry Allen,1917 *Official and Tentative Methods of Analysis* Association of Official Analytical Chemists,1925 **Allen's Commercial Organic Analysis**,1912 **Sustainable Production of Bioactive Pigments** Wee Sim Choo,Laurent Dufossé,Lourdes Morales-Oyervides,2021-05-24 Official Methods of Analysis of the Association of Official Analytical Chemists Association of Official Analytical Chemists,1925 Allen's Commercial Organic Analysis Alfred Henry Allen,1923 Achieving sustainable cultivation of coffee Dr Philippe Lashermes,2018-01-09 Covers recent research on coffee genetics physiology and genetic diversity Reviews the latest developments in breeding new varieties Assesses advances in measuring and understanding the chemical composition and nutraceutical properties of coffee Handbook of Coffee Processing By-Products Charis M. Galanakis,2017-05-05 Handbook of Coffee Processing By Products Sustainable Applications presents alternative and sustainable solutions for coffee processing by products and specifies their industrial potential both as a source for the recovery of bioactive compounds and their reutilization in the pharmaceutical biotechnological food biotechnology and cosmetic industries also covering environmental and agronomic applications This book addresses key topics specific to sustainable management in the coffee industry placing an emphasis on integrated solutions for the valorization and upgrade of coffee processing by products biorefinery and different techniques for the separation extraction recovery and formulation of polyphenols Specifies potential for the use of by products as a source for the recovery of bioactive compounds and their reutilization in the pharmaceutical biotechnological food biotechnology and cosmetic industries Places emphasis on integrated solutions for the valorization and upgrade of coffee processing by products biorefinery and different techniques for the separation extraction recovery and formulation of polyphenols **Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists**,1925 *The Chemical Analysis of Foods* Henry Edward Cox,1926 **Quantitative Chemical Analysis** Daniel C. Harris,Chuck Lucy,2015-05-29 The gold standard in analytical chemistry Dan Harris Quantitative Chemical Analysis provides a sound physical understanding of the principles of analytical chemistry and their applications in the disciplines Notes on the Analysis of Coffee Anthony McGill,1887 **Allen's Commercial Organic Analysis** Davis, W. A., ed,1912 **A Course in food analysis** Andrew Lincoln Winton,1917 **Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists** Association of Official Agricultural Chemists (U.S.),1925 **Allen's Commercial organic analysis v. 6, 1912** Alfred Henry Allen,1912

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