



CAFFEINE EXTRACTION AND CHARACTERIZATION

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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.

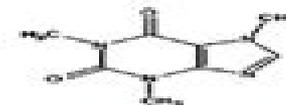
OBJECTIVES

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

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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 **Sustainable**

Production of Bioactive Pigments Wee Sim Choo, Laurent Dufossé, Lourdes Morales-Oyervides, 2021-05-24 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 *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 **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

Coffee: From the Field to the Cup Paulo Mazzafera,Sara Adrián López de Andrade,Sarada Krishnan,Herminia Prieto Martinez,Maria Beatriz A. Gloria,2022-08-08 *Coffee in Health and Disease Prevention* Victor R Preedy,2014-11-12 Coffee in Health and Disease Prevention presents a comprehensive look at the compounds in coffee their reported benefits or toxicity risks and also explores them on a health condition specific level providing researchers and academics with a single volume resource to help in identifying potential treatment uses No other book on the market considers all the varieties of coffee in one volume or takes the disease focused approach that will assist in directing further research and studies The book embraces a holistic approach and effectively investigates coffee and its specific compounds from the biochemical to the nutritional well being of geographical populations This book represents essential reading for researchers in nutrition dietetics food science biochemistry and public health Presents one comprehensive translational source for all aspects of how coffee plays a role in disease prevention and health Experts in nutrition diet and food chemistry from all areas of academic and medical research take readers from the bench research cellular and biochemical mechanisms of vitamins and nutrients to new preventive and therapeutic approaches Focuses on coffee composition nutritional aspects of coffee protective aspects of coffee related compounds specific coffee components and their effects on tissue and organ systems Features sections on both the general effects of coffee consumption on the body as well as the effects of specific coffee compounds on specific organ systems **Food Science and Technology Abstracts** ,1986 Monthly References from world literature of books about 1000 journals and patents from 18 selected countries Classified arrangement according to 18 sections such as milk and dairy products eggs and egg products and food microbiology Author subject indexes **Molecular and Computational**

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Table of Contents Caffeine Extraction And Characterization

1. Understanding the eBook Caffeine Extraction And Characterization
 - The Rise of Digital Reading Caffeine Extraction And Characterization
 - Advantages of eBooks Over Traditional Books
2. Identifying Caffeine Extraction And Characterization
 - 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 Caffeine Extraction And Characterization
 - User-Friendly Interface
4. Exploring eBook Recommendations from Caffeine Extraction And Characterization
 - Personalized Recommendations
 - Caffeine Extraction And Characterization User Reviews and Ratings

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