



# 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 Caffeine<sup>1</sup>. 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.<sup>2</sup> 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 world<sup>3</sup>.

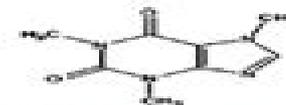
## OBJECTIVES

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 theobromine<sup>3</sup>. 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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# Caffeine Extraction And Characterization

**Alfred Henry Allen**



## **Caffeine Extraction And Characterization :**

*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

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*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

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