

**CAFFEINE CONCENTRATION IN ENERGY DRINKS AVAILABLE ON THE  
UGANDAN MARKET (A REVIEW)**

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**A REPORT SUBMITTED TO THE DEPARTMENT OF CHEMISTRY AS A  
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**Declaration**

I, Nakiwala Olivia, declare that the work has been collected by myself and in addition the work has not been submitted for any other degree or professional qualification. I confirm that the work submitted is my own. My contribution and those of the other authors to this work have been explicitly indicated below. I confirm that appropriate credit has been given where reference has been made to other people's work.

Signature.....

Date .....

Nakiwala Olivia

**Approval**

This is to certify that the review report has been carried out under my own supervision and this report is ready for submission with my approval.

Supervisor:

Mr. Egor Moses

Signature: ..... Date: .....

**Dedication**

I dedicate my work my loving mother Ms. Nabyonga Kate and my lovely guardian and father Mr. Kyeyune Daniel for the unendless efforts and supports towards my education. I also dedicate my research work to my supervisor Mr. Egor Moses whose support, words of encouragement, technological advice and his mastery has enhanced my creativity, research skills and thinking skills

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## List of Acronyms

CNS:	Central Nervous System
DAD:	Diode Array Detection
ED:	Energy Drink
FDA:	Food and Drug Administration
GC:	Gas Chromatography
GC-MS:	Gas Chromatography Mass Spectroscopy
GRAS:	Generally Regarded as Safe
HPLC:	High Performance Liquid Chromatography
IUPAC:	International Union of Pure and Applied Chemistry
NLEA:	Nutrition Labelling and Education Act
Ph:	Potential of Hydrogen
THF:	Tetrahydrofuran
UNBS:	Uganda National Bureau of Statistics
US:	United States
USDA:	United States Department of Agriculture
UV - Vis:	Ultra Violet Visible

## **Abstract**

The consumption of energy drinks increasingly becoming a world's threat owing to the different energy drinks being introduced on market daily. Most of these drinks lack the UNBS Stamp and therefore lack legal permission to be on market. The review carried out on caffeine concentration in four different energy drinks available on Ugandan market indicated that out of the four energy drinks only energy drink E1 qualifies to be marketed in Uganda. Table 3 showed that energy drink E3 contained the highest concentration of caffeine per 100 mL. According to the volumes of most energy drinks available on Ugandan market it indicates that in about 250 mL of a given drink, an individual consumes about 750 mg per intake. The caffeine in E3 ranges from 290.87 to 301.37 in 100 mL being the one with the highest concentration, followed by E4 ranging between 110.49 – 113.25, and E2 ranging between 100.97 - 115.47 and E1 with the lowest caffeine concentration ranging from 95.29 to 108.19 per 100 mL of energy drink.

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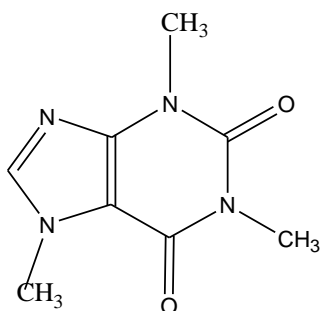
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## Introduction

### 1.1 Background

Caffeine is a naturally occurring organic substance found in various plant species like cocoa, coffee, tea leaves and kola nuts (Khalid et al., 2016). Caffeine is part of a group of compounds called xanthine. Caffeine with the molecular formula,  $C_8H_{10}N_4O_2$  was first discovered and isolated by a German chemist Friedrich Ferdinand Runge in 1819 (Sepkowitz, 2013; Yunusa & Ahmad, 2011). Caffeine is white crystalline xanthine alkaloids which is a Central nervous system mild- stimulant by temporarily warding off drowsiness and restoring alertness According to the IUPAC system, coffee is known as 3,7 dihydro-1,3,7-trimethyl-1H-purine-2,6-dione with the systematic name being 1,3,7,Trimethylxanthine (Leah S Rosenfeld, Jeremy J Mihalov, Carlson, & Mattia, 2014).s Caffeine with a density  $1.23g/cm^3$  is very stable on heating with a boiling point of  $178^0 C$  and a melting point of  $235 ^\circ C$  (Pradhan, 2017)



**Figure 1: Structure of Caffeine ((Persad, 2011)**

Caffeine is one of the world's most used drugs which is consumed by most individuals knowing or unknowingly (Pomeranz, Munsell, & Harris, 2013; Seiferty & Schaechter, 2010; Yunusa & Ahmad, 2011). It is an ingredient in most of the beverages produced in Uganda like soft drinks, energy drinks, coffee and a cup of tea made at home but every individual (Bedi, Dewan, & Gupta, 2014; Persad, 2011; Sepkowitz, 2013). Energy drinks is a term used to refer to all beverages consumed by individuals to improve their performance and also boost their energy (Hoffman, 2010). Production of energy drinks is one of the rapidly growing commercial

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