TRACE ELEMENTS AND PAHs SURVEY IN IMPORTED AND LOCAL *Camellia sinensis* COMMERCIALLY SOLD IN NIGERIA

BY

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CERTIFICATION

This is to certify that this project was carried out by FRED-AHMADU, Omowunmi Hannah (Matric No. 14PCC00651) under the supervision of Dr. N.U. Benson. The report has been read, approved and accepted as meeting the partial fulfilment for the award of the degree of Master of Science in Chemistry of the Covenant University, Ota, Nigeria.

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DEDICATION

To God Almighty, my Sufficiency and my all in all. Also dedicated to the memory of my late father, Apostle Ayodele Oki.

DECLARATION

I, FRED-AHMADU Omowunmi Hannah, hereby declare that this project report is based on the study undertaken by me in the Department of Chemistry, College of Science and Technology, Covenant University, under the supervision of Dr. N.U. Benson. This project report has not been submitted anywhere else for a degree award. The ideas and reviews are products of the research conducted by me. All sources of data and scholarly information of other researchers have been duly acknowledged.

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LIST OF ABBREVIATIONS

ANT – Anthracene

BaA - Benzo[a]anthracene

BaP - Benzo[a]pyrene

BbF - Benzo[b]fluoranthene

BeP - Benzo[e]pyrene

BghiP - Benzo[g,h,i]perylene

BjF - Benzo[j]fluoranthene

BkF - Benzo[k]fluoranthene

CHY - Chrysene

DahA - Dibenzo[a,h]anthracene

DBP - Dibenzo[a]pyrene

FLR - Fluorene

FLA - Fluoranthene

IP - Indo[123-cd]pyrene

NAP - Naphthalene

PHN - Phenanthrene

PYR - Pyrene

USEPA - United States Environmental Protection Agency

ABSTRACT

The influx of various brands of imported and locally produced Camellia sinensis into the Nigerian market coupled with weak legislation and growing concerns about contaminants such as polycyclic aromatic hydrocarbons (PAHs) and trace metals worldwide has heightened. In this study, twenty three (23) samples of local and imported branded Camellia sinensis commercially sold in Nigeria were randomly purchased from local retail outlets. Extraction of PAHs was carried out using GC grade n-hexane. A four-stage sequential extraction procedure recommended by the Community Bureau of Reference (BCR) and Aqua regia acid cocktail were used to study the metal speciation and pseudo-total metals, respectively. Analyses of PAHs and trace metals were performed using Agilent 7890A Gas Chromatograph equipped with Flame Ionisation Detector with an autosampler and Microwave Plasma Atomic Emission Spectrometer (MP-AES), respectively. PAHs were detected in all samples with concentrations (mg/kg) ranging between 1.63 to 73.53, 4.71 to 79.61 and 12.52 to 26.89 for green, herbal and black teas, respectively. Detected PAHs were dominated by 4-5 membered ring structures and source apportionment analysis indicated biomass burning and vehicular emission as the major sources of PAHs in the investigated tea samples. The aggregate measure of carcinogenicity and mutagenicity (BaP-TEQ and BaP-MEQ) values show a weak positive correlation and BaP-TEQ values were generally higher than BaP-MEQ with two herbal tea samples recording the highest values. The estimated lifetime cancer risk index due to PAHs (for children and adults in Nigeria) indicated that all samples investigated except two green tea samples exceeded the USEPA allowable limits (10^{-6} to 10^{-4} mg/kg-day). Trace metals were present in all Camellia sinensis samples. The total concentration sequence for the tea samples were different from that of the speciation, indicating the importance the chemical forms in which the metals exist within a sample matrix, a pointer to their mobility and toxicity. Mn was most accumulated and bioavailable.

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