



UNIVERSITI TEKNOLOGI MARA

**HEAVY METALS TOXICITY ASSESSMENT IN LOCAL  
AND IMPORTED CANNED VEGETABLES AND FRUITS  
IN KUCHING, SARAWAK**

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## TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	i
<b>TABLE OF CONTENTS</b>	ii
<b>LIST OF TABLES</b>	iv
<b>LIST OF FIGURES</b>	v
<b>LIST OF SYMBOLS</b>	vi
<b>LIST OF ABBREVIATIONS</b>	vii
<b>ABSTRACT</b>	viii
<b>ABSTRAK</b>	ix
<b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background and problem statement	1
1.2 Significance of study	4
1.3 Objectives of study	6
<b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Food canning process	7
2.2 Local and imported canned vegetables and fruits	8
2.3 Heavy metals contamination in canned food	9
2.3.1 Cadmium	10
2.3.2 Lead	11
2.4 Non-essential metals and their adverse health effects	12
2.5 Previous studies of heavy metals in canned vegetables and fruits	13
<b>CHAPTER 3 METHODOLOGY</b>	
3.1 Chemicals	16
3.2 Apparatus	17
3.3 Sample collection and location	18
3.4 Pre-treatment of glassware and samples	18
3.5 Sample preparation and preservation	18
3.6 Sample digestion	19
3.7 Standard solution preparation	20
3.8 Analysis of heavy metals	21
3.9 Computation	22
3.10 Toxicity assessment	23

## **ABSTRACT**

### **HEAVY METALS TOXICITY ASSESSMENT IN LOCAL AND IMPORTED CANNED VEGETABLES AND FRUITS IN KUCHING, SARAWAK**

Canned foods are among the most essential food sources for consumers because they are widely available, inexpensive, and need little preparation. The objectives of this study are to determine the concentration of Cd and Pb in local and imported canned vegetables and fruits sold in local market in Kuching, Sarawak by using Shimadzu AA-7000 Atomic Absorption Spectrometer (AAS) and compared it with the standard limit issued by the World Health Organization (WHO, 1972) and the Ministry of Health of Malaysia (MOH, 2011). The toxicity assessment for these samples were then analyzed based on estimated daily intake (EDI) and target hazard quotient (THQ). The acid digestion method of nitric acid (HNO<sub>3</sub>) and perchloric acid (HClO<sub>4</sub>) mixture was used in this study. Cd was the only metal detected in all samples analyzed. The lettuce sample showed the highest mean Cd concentration with 0.0113±0.0029 ppm. In contrast, lychee sample was observed with the lowest mean Cd concentration 0.00240±0.0010 ppm. All samples were recorded with Cd concentration below the permissible limit. The EDI values analyzes for adults and children were all lower than the oral reference doses (RfD) and the THQ analysis calculated in this study was found to be less than one (< 1). Pearson correlation analysis was used to examine the correlation between Cd and Pb in both local and imported samples. The result showed a weak positive correlation between Cd and Pb with the value of Cd/Pb ( $r = 0.178$ ).

# CHAPTER 1

## INTRODUCTION

### 1.1 Background and problem statement

Canned food signifies food preserved by canning. Canning is a technique of sterilizing food in airtight containers using heat, resulting in an economically sterilized product that may be stored at room temperature for months or even years while maintaining food safety and organoleptic quality (Huang *et al.*, 2016). Canned foods are deemed safe since they are easy to cook at home, have a long shelf life, and affordable (Ainerua *et al.*, 2020). Canned vegetables, fruits, meat, beverages, and fish are good sources of proteins, carbohydrates, minerals, vitamins, and trace elements (Massadeh *et al.*, 2018). Canned foods have nutritional content and need less preparation time, contributing to market expansion and a shift in dietary choices (Research and Markets Ltd, 2019). The most substantial components of a human diet are vegetables and fruits, and eating these foods regularly is one of the best ways to ameliorate one's health (Sultana *et al.*, 2017). Thus, vegetables and fruits are canned to make them readily available in canned form. However, several canned foods have been found to contain different contaminants (Massadeh *et al.*, 2018). Food additives, environmental contaminants such as dioxins, heavy metal residues,

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Food canning process

Depending on the canned food, the initial preparation differs. Fruit and vegetables can be peeled and cut or washed. Vegetables are blanched at a temperature slightly below boiling to kill enzymes that could cause the foods to discolor or have an unpleasant flavor. In most cases, food is put into cans in a continuous production line. Depending on the menu, the can may be topped up with syrup, juice, sauce, or brine, leaving a small headspace to allow for expansion. The can's lid is sealed, and the contents are cooked. To retain the texture quality, lower temperature and shorter processing time are needed. According to Huang *et al.* (2016), the required cooking temperature varies depending on the acidity of the canned food and there are two most common canning methods which are in-container sterilization, and out-of-container sterilization. In addition, in-container sterilized food uses a retort technique, such as steam, to heat packed goods in containers such as metal cans or glass jars until the center of the product achieves sterilization protocol temperatures while separate sterilization of the food and product, followed by packing, filling, and sealing under aseptic conditions, is referred to as out-of-container sterilized food, and only liquid foods can be