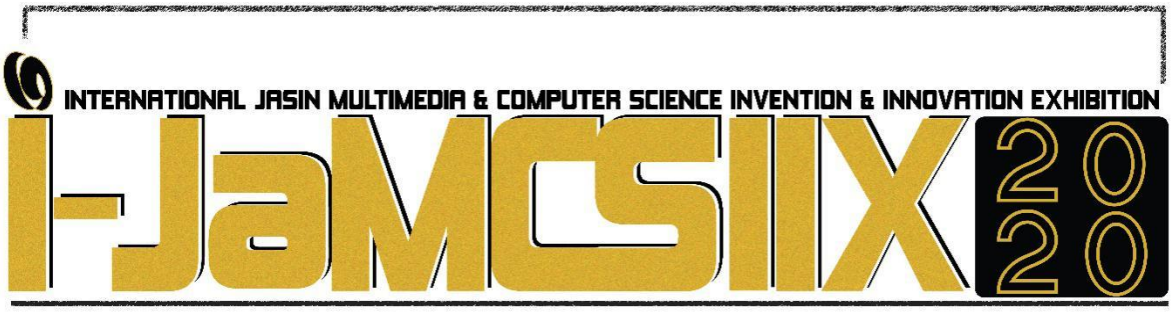

Evaluation of Heavy Metals Content in Pineapple Waste

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ABSTRACT

Heavy metals can exist in many types of food crop including fruits and vegetables which may lead to human and animal health. Crop waste such as pineapple can be used as animal feed and fertilizers. The objective of this study is to evaluate several heavy metals (Cu, Fe, Cr, Ni) content in pineapple waste using Flame Atomic Absorption Spectroscopy (FAAS). The concentration of heavy metals content in three different parts (core, crown, peel) was determined and compared with WHO permissible limit. Wet digestion method was applied during sample preparation using mixture of HCl and HNO_3 acid. Results show that the concentration of iron was higher in all parts of pineapple waste which were 0.553, 3.975 and 1.285 mg/L for core, crown and peel respectively while the concentration of nickel was the lowest in all parts of pineapple waste which were 0.028, 0.076 and 0.043 mg/L for core, crown and peel respectively. The calibration curves were linear for all heavy metals ranging between 1- 5 mg/L with correlation determination (R^2) which 0.9999, 0.9999, 0.9998, 0.9998 for Cu, Fe, Cr and Ni respectively. In conclusion, the concentration of all heavy metals that obtained in this study were lower as compared to WHO permissible limit value. Therefore, it can be considered safe for human and animal to consume.

KEYWORDS: Heavy metal, Pineapple, Waste

1 INTRODUCTION

Food crops such as fruits, vegetables and grains which provide food for human and animals consumption are considered as a major part of human nutrition and health [1]. With modern urbanization and industrialization, heavy metals may contain naturally or as inherent components of plant.

Contamination of the food crops can cause serious problems to all organisms. Heavy metals bioaccumulation in the food chain especially can be highly dangerous to human health [2]. Uptake of heavy metals by plants through absorption and accumulation along the food chain is a potential threat to animals and human health [3].

Fruits such as pineapple rich with vitamins and mineral salts can be used for treatment of various diseases as it can reduce risk of cancer, cardiovascular and stroke [4]. However, human only eat the mesocarp and the waste including crown, core and peel will be discarded.

As time goes by, there will be a huge amount of pineapple waste that need to be eliminated. Thus, it can lead to serious environmental pollution since disposal of these wastes are expensive due to high cost of transportation and limited availability of landfill [5]. Nutrient in fruits can be diminished by heavy metals contamination. It occurs when the fruit plant absorbs heavy metals from the contaminated soil and polluted air [6]. Besides that, method used during the analysis must be correctly chosen as it may introduce error due to volatilization of the heavy metals.

2 OBJECTIVE

In this study, the concentration of heavy metals such as copper, iron, chromium and nickel in pineapple waste including core, peel and crown were determined by using Flame Atomic Absorption Spectroscopy (FAAS) and were compared to the World Health Organization (WHO) permissible limit.

3 SIGNIFICANCE (S)

Pineapple waste contain many components of simple sugar example sucrose, glucose and fructose. Hence, the waste can be useful such as it been used as animal feed in order to recycle the waste instead of discarding or burning the waste [7]. Farmers usually used this waste because it is cheaper compared to maize germ, wheat or barley. Other than that, it can be used in fermentation process and can undergo pyrolysis process (biomass convert into organic charcoal and pyroligneous acid [8]. Therefore, it can reduce the transportation cost, burning process and the limitation of landfill availability. It is important to determine whether it is free from heavy metals as it safe to be consume in future.

Heavy metals are not harmful when they are below the limit. As example, Cu beneficial in the production of red blood cells, regulation of heart rate and blood pressure. These metals also important in survival and microbes growth. However, higher concentration of these metals may inactivate the protein molecules [9].

4 METHODOLOGY/TECHNIQUE

4.1 Material

Raw material was purchased from selected supermarket located in Kuala Pilah, Negeri Sembilan. Several chemicals were used such as HNO_3, HCl, standard solution of Cu, Fe, Cr and Ni.

4.2 Sample preparation and heavy metal standard solution

Pineapple peel, crown and core were cut into small pieces, dried under sunlight for a few days and blended using food blender. The paste then was kept in a food container in a dry place. A series of different concentration of standard solution were prepared for each heavy metals (Cu, Fe, Cr, Ni).

4.3 Sample digestion and analysis

Sample was digested using mixture of HNO_3 and HCl. 3 g of sample was mixed into 3 mL of 37% HCl and 10 mL of 65% HNO_3. The mixture then was heated using hot plate in the fume

hood until white fumes was evolved and turned brown. The flask that contain the white residue was cool down and was filtered using Whatman filter paper. Lastly, the filtered residue was transferred into 50 mL volumetric flask and diluted with deionised water until calibrated mark. Analysis of sample and standard were done using Perkin Elmer Analyst 700 AAS Spectrometer.

5 RESULT

As shown in Fig. 1, Fe was found to be the highest concentration detected in all parts of pineapple waste (core, crown, peel) while the lowest concentration was showed by Ni. All heavy metals showed high value of concentration in crown as compared to the other part of waste. Different with Cr, the concentration value was highest in peel of the pineapple waste. However, all concentration detected for each heavy metal was still below the WHO permissible limit as shown in Table 1. Moreover, the concentration of iron in the samples still does not exceed the maximum permissible limits which was 5.6 mg/L. The calibration curves were linear for all heavy metals ranging between 1- 5 mg/L with correlation determination (R^2) which 0.9999, 0.9999, 0.9998, 0.9998 for Cu, Fe, Cr and Ni respectively. Therefore, all parts of pineapple waste can be recycled and were safe to consume.

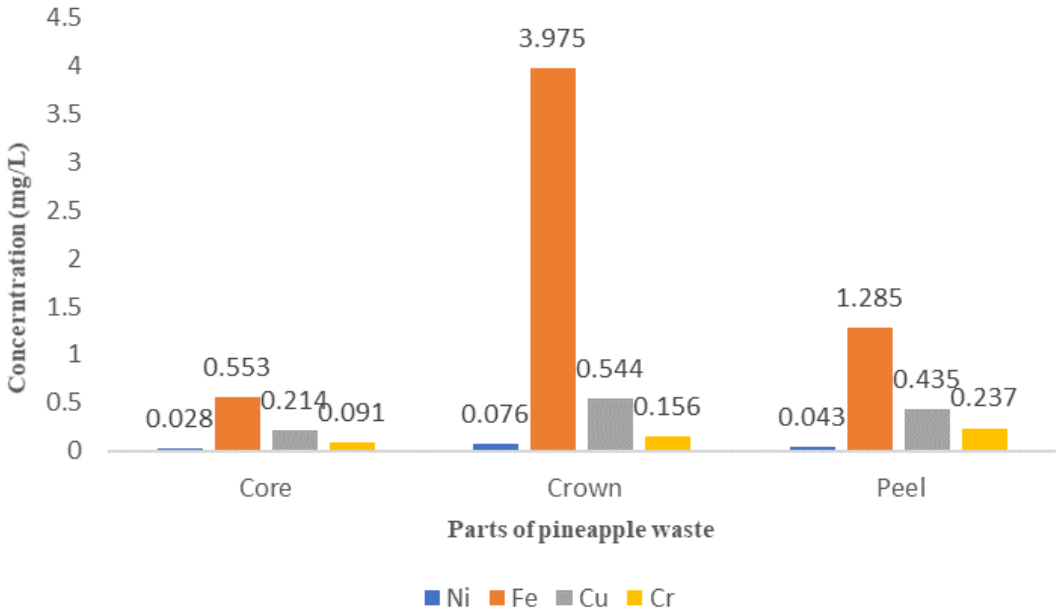

Fig. 1 Heavy metals concentration in different parts of pineapple waste

Table 1: WHO permissible limit

Part of pineapple waste	Concentration (mg/L)
Fe	5.6
Ni	5.0
Cr	0.7
Cu	3.5

6 CONCLUSION

Results obtained show that all four heavy metals (Cu, Fe, Cr, Ni) being studied has the concentration below the limit as compared to the WHO permissible value. It can be concluded that the pineapple waste is consider safe to be consumed by human and animals. Moreover, this study may beneficial to the environmental issues which associated with the solid waste disposal.

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