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Atomic absorption measurement of heavy metal in dried longan

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Abstract

This study of this research is based on determination of heavy metals in dried longan by Flameless Atomic Absorption Spectrometry. The heavy metals, Arsenic Cadmium Copper Zinc, and Lead (As, Cd, Cu, Zn and Pb) were determined in pulp of three samples. There was no significance difference of concentrations in the mean difference of the 5 heavy metals. By considering after the Codex Stan 230-2001, there was found that 4 heavy metals Cd, Cu, Zn and Pb not higher than the standard value but as, which making harmful to the lungs, skin, kidneys, and liver of the human body, was higher. However, Cadmium and Lead level being found in three samples, making it harmfuls as a food since lead is toxic at even small level. The result showed that Cadmium and Lead level were no significance difference. By the way, their levels below 0.50 and 0.1ppm in order (Codex Stan 230-2001), thus they were not produced cancer cells in human being. This data should be used to build database for dried longan in order to ensure the quality of food.

Keywords: Dried longan; atomic absorption spectrometry; heavy metal.

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1. Introduction

Longan is a crop that is highly critical economy of Thailand by planting them in the north. As a most productivity, they cannot be sold on time. So, these fruits will rot damage as a result. Moreover, the most products have also made a low price more than it should be. As a result, the agriculture contributes the longan to be food preservation. One popular method is to do by drying, and bring on the market a lot.

The report of the fruit crops show that there are heavy metals such as Lead, Cadmium, Copper, Zinc and Arsenic mixing in the fruits including longan. Since longan cultivation area will absorb the heavy metal and accumulate in the fruit (Data from the Ministry of Agriculture of Thailand, 2016). So when we eat theses fruits, whether fresh or dried, it may be gotten the toxic heavy metals from them.

Atomic absorption spectrometry (AAS) is an analytical technique that measures the concentrations of elements. This technique is so sensitive that it can measure down to ppb in a sample. The technique makes use of the wavelengths of light specifically absorbed by an element. They correspond to the energies needed to promote electrons from one energy level to another, higher energy level. A detector measures the wavelengths of light transmitted by the sample, and compares them to the wavelengths which originally passed through the sample. Farrukh (2012) stated that Atomic Absorption Spectrometry, which was used to determinate the metal, has been introduced in recent years.

Heavy metal which extended accumulate in the human body, they could act up poison symptoms. By interfering with the cell functions that it inhibit the activity of certain enzymes. Thus, the amount of heavy metals which contained in the dried longan will harmful to the human body. This information should be informed to the consumers. Therefore, this report presented the result of concentrates of heavy metals in the dried longan meat. This could be useful to the consumers.

2. Materials and Method

2.1. Sample preparation

Samples of dried Longan meat were purchased from local markets or retail stores for analysis. An amount of 5-15 g of the homogenized sample was dried in an air oven at 95 ^{o}C for 4 hours. The dried sample was next charred as much as possible. The charred sample was then ashed in a muffle furnace at 550 ^{o}C until a whitish or greyish ash was obtained. The ash was treated (digested) with concentrated 98 % nitric acid and transferred to a volumetric flask and made up to 10 ml and stayed for 24 hours in smoky cupboard. After digestion, put in jars volumetric size 10 ml and then adjust the volume with 0.01 M of nitric acid (0.01 M HNO_3) until the volume of solution was 10 ml. Filter the solution with Buchner funnel using filter paper and then put to 30 ml glass bottle. Finally, the solutions of samples were analyzed by AAS.

2.2 Prepare a standard curve was used to create the solution

Prepare standard solutions each respectively including As, Pb, Cd, Cu, Zn from a stock solution at a concentration of 0.5, 1.0, 3, 10.0, 15.0 ppm. Pipette them by using Micropipette of stock solution 1000 ppm and adjust volume with 0.01 M with nitric acid (0.01 M HNO_3) until 10 ml in vial volumetric size 10

ml in order to make the various concentrations of solution for analyzing for standard curve has been shown in Figure 1, 2, 3, 4 and 5

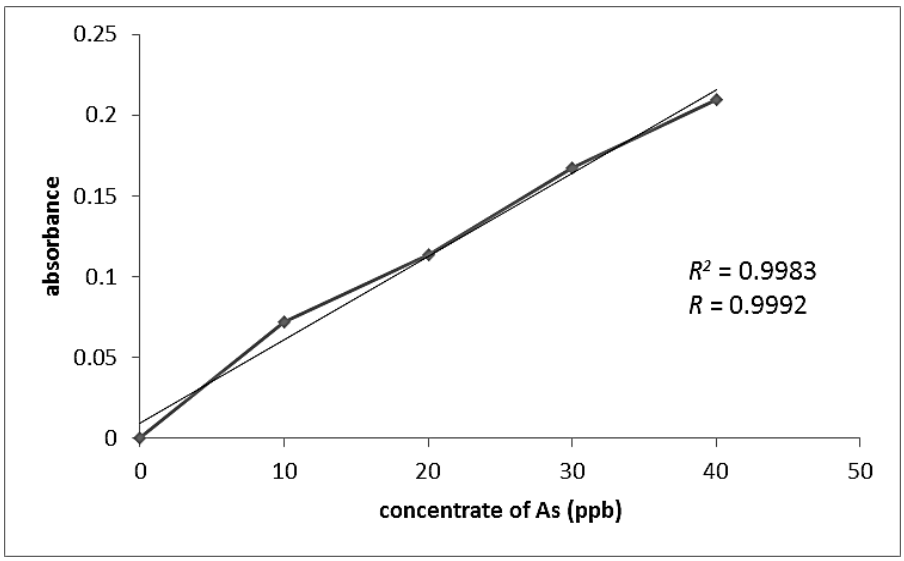

Figure 1. Standard curve for as

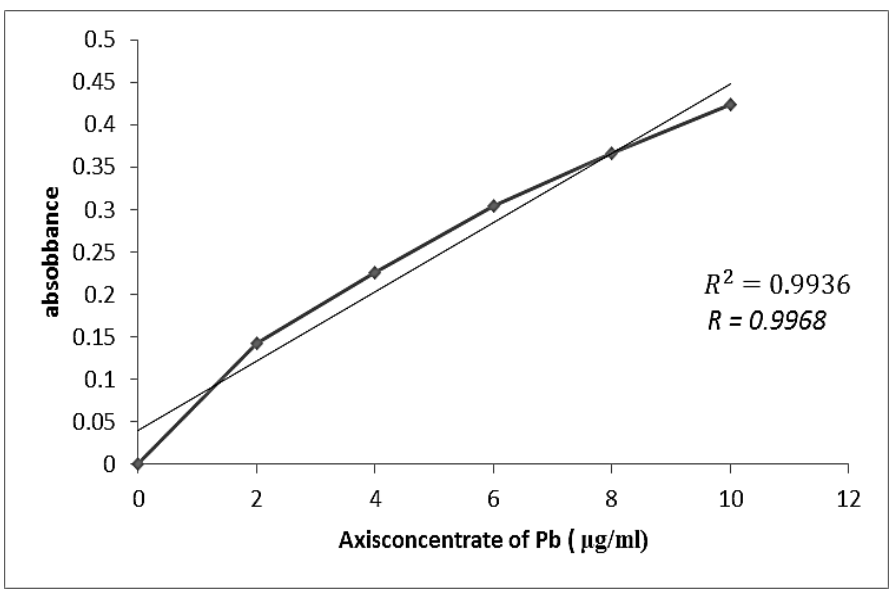

Figure 2. Standard curve for Pb

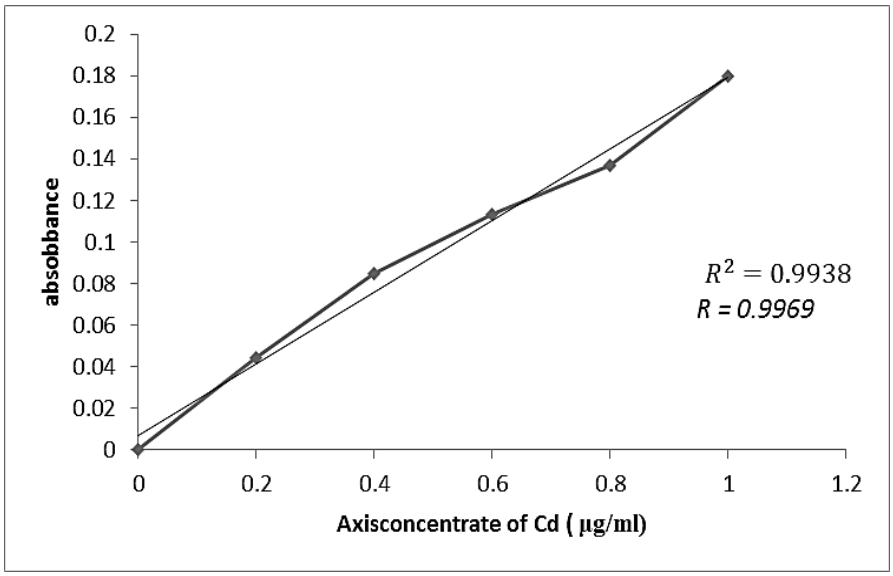

Figure 3. Standard curve for Cd

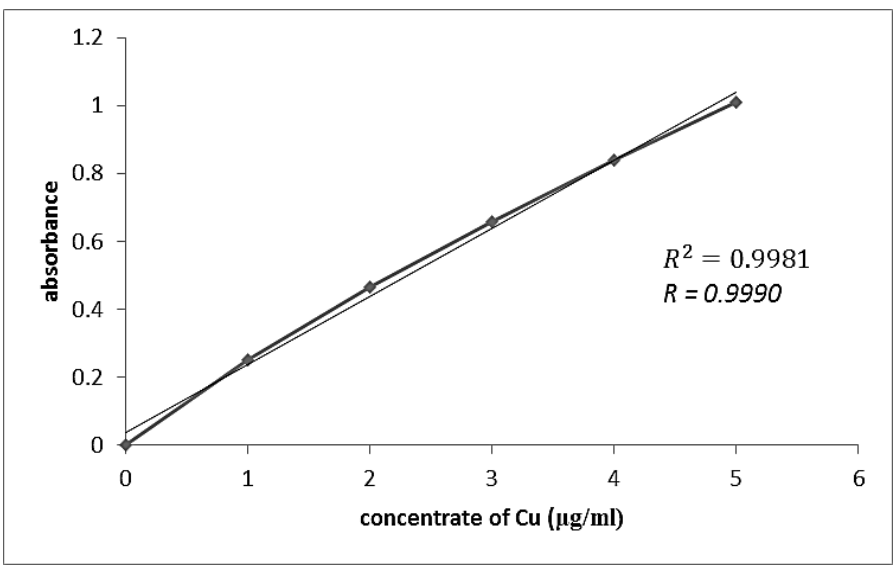

Figure 4. Standard curve for Cu

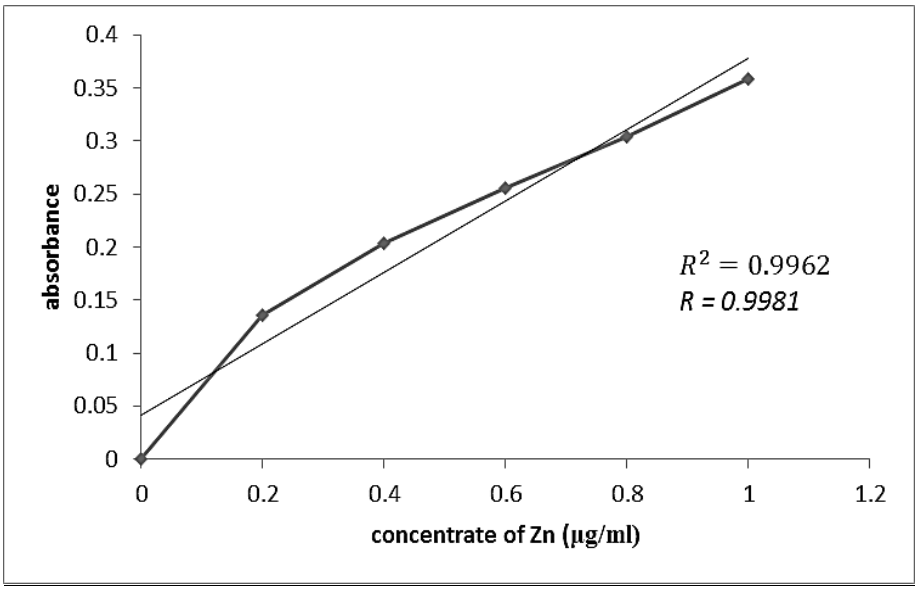

Figure 5. Standard curve for Zn

2.3. Set up AAS meter

A Varian Atomic Absorption Spectrophotometer was set up as shown in Table 1.

Table 1. Set up AAS meter

Samples	Wavelength nm	The electricity in bulb mA	The duration of time for measuring the concentration of samples sec
As	193.70	8.00	3.00
Cd	228.80	3.00	3.00
Cu	324.70	3.00	3.00
Zn	213.90	5.00	3.00
Pb	217.00	5.00	3.00

3. Results and Discussion

The analysis of three samples of dried longan with 5 kinds of heavy metals As Cd Cu Zn Pb by calibration standard curve, the results of concentration were shown in Table 2.

Table 2. Heavy metal concentration (mg/kg)

Metal	Sample1	Sample2	Sample3	Standard value
As	0.6657	0.9164	0.9026	0.50
Cd	0.0010	0.0004	0.0007	0.005
Cu	0.0046	0.0023	0.0006	10.00
Zn	0.0049	0.0033	0.0028	20.00
Pb	0.0087	0.0040	0.0072	0.10

The analysis found the As, Cd, Cu, Zn Pb in the samples of dried longan. The data showed the most concentration of heavy metal was arsenic (As).

From Table 1, the result showed that every sample contained Arsenic Cadmium Copper Zinc, and Lead. There was no significance difference in the mean difference of concentrations of the 5 heavy metals. By considering after the Codex Stan 230-2001, there was found that 4 heavy metals Cd, Cu, Zn and Pb not higher than Codex Stan 230-2001but As, which making harmful to the lungs, skin, kidneys, and liver of the human body, was higher. However, the Cadmium and Lead level being found in three samples, making it harmful as a food since lead is toxic at even small level. The result showed that Cadmium and Lead level were no significance difference. By the way, their levels below 0.50 and 0.1ppm in order (Codex Stan 230-2001), thus they were not produced cancer cells in human being. This data should be used to build database for dried longan in order to ensure the quality of food.

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