Elemental Analysis of Corn at Mong Yawng Region by Using Energy Dispersive X-Ray Fluorescence Technique

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Abstract

In this research, the analysis of elemental concentration of corn during the rainy and cold season at Mong Yawng region in the Eastern Shan State was carried out by using energy dispersive X-ray fluorescence (EDXRF) techniques. The parameter method was used to determine the concentration of elements that contained in the black corn and yellow corn. According to experimental results, Potassium (K), Chlorine (Cl), Phosphorus (P) and Iron (Fe) elements were mostly found in the corns.

Keywords: Energy dispersive X-ray fluorescence (EDXRF) techniques.

Introduction

Energy Dispersive X-ray Fluorescence Technique

Energy Dispersive X-ray Fluorescence spectrometry is a well-recognized method for the qualitative and quantitative determination of major and minor elements in a wide range of samples types. Special applications are thickness and compose of single and multi-layer thin films. Energy Dispersive X-ray Fluorescence is versatile stems from its rapid, non-destructive, multi-element determinations from ppm levels to high weight percent of elements from sodium through uranium simultaneously. It can perform these measurements across a wide array of sample matrices: liquids, solids, slurries, powders, pastes, thin filers and many others. Energy Dispersive X-ray Fluorescence can be used to determine film thickness of one or several films on a substrate. The measurable film thickness varies depending on elements and sample but is generally less than 50um.

Energy Dispersive X-ray Fluorescence is also well suited for rapid determination of elemental content in complete unknown. Energy Dispersive X-ray Fluorescence is a nondestructive method for the elemental analysis of solids and liquids. The sample is irradiated by an intense x-ray beam and spectrum of emitted x-ray is detected by using a Si (Li) detector. It is a bulk analysis technique with the depth of sample which varies from less than 0.1mm to 1 cm depending on energy of the emitted x-ray and the sample composition. Energy Dispersive X-ray Fluorescence technique is used in a lot of fields and some of the common applications of Coating & Thin films, Environmental, Food & Drug, Forensics, Large Samples, Metallurgical, Mining & Minerals and Petroleum & Petrochemicals.

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Location and sample Collection

Mong Yawng city is the city of Golden Triangle in Eastern Shan state. It expands 154.767square mile and above sea level is 1875 ft highly. Mong Yawng is situated between 21° 25" and 21° 45", of north latitude, between 90° 33" and 100°15" east longitude. The city is alike a gateway of Eastern Shan state in the Union of Myanmar where China, Thailand and Laos are related. It has the population of 50000 in Mong Yawng and they especially work on agriculture. There are two kinds of corn for people and animal. The corn is produced essentially to export for foreign countries. Mong Yawng is on the way to China and is 750 miles far from Yangon. In this research, the black corn and yellow corn are collected from Mong Yawng region in Eastern Shan state. These samples were grown in rainy and cold season.

EDX-720 Systems

The energy dispersive X-ray fluorescent spectrometer in this investigation is a computer controlled EDX-720 spectrometer. The EDX-720 is released with improved sensitivity for Lead (Pb) and Cadmium (Cd) which are most important elements for the environmental analysis of green product. Furthermore, EDX-720 also has new attractive functions such as the auto-selection of suitable calibration curve. Energy Dispersive X-ray fluorescence spectrometer (EDX) is the instrument to perform qualitative and quantitative element analysis in the range from 6C/11Na to 92U and is the ideal tools for non-destructive applications. EDX is used in many different applications areas in the chemical, electronic and food industries as well as refineries. It can be used with solid, powder and liquid samples. This is achieved by applying X-ray to the sample and then analyzing the re-emitted element characteristic fluorescent X-ray. Figure (1) Photograph of EDX-720 spectrometer.

Samples Preparation

In this research work, the black corn and yellow corn were analyzed by EDX-720 energy dispersive X-ray Fluorescence (EXDRF) system. The black corn and yellow corn were collected in rainy and cold season at Mong Yawng region in eastern Shan state. The black corn and yellow corn were made dry by over 60°C and ground in order to get powder using pestle and motor show in

Figure (2) and Figure (3).These powders were poured into a die, made of steel and press in two tons with hydraulic press, model 250n, SPECAC Cambridge Industries. The diameter of each pallet is 2.5cm.

Experimental Results using EDXRF Analysis

From Table 1 the relative concentrations of elements contained in black corn are Potassium (K) 57.855%, Chlorine (Cl) 27.062% and Phosphorus (P) 15.083% found in rainy season. From Table 2 the relative concentrations of elements contained in yellow corn are Potassium (K) 54.843%, Chlorine (Cl) 27.108%, Phosphorus (P) 16.406% and Iron (Fe) 1.642% found in rainy season. From Table 3 the relative concentrations of elements contained in black corn are Potassium (K) 58.426%, Chlorine (Cl) 27.108%, Phosphorus (P) 12.303% and Iron (Fe) 1.909% found in cold season. From Table 4 the relative concentrations of elements contained in yellow corn are Potassium (K) 57.037%, Chlorine (Cl) 28.619% and Phosphorus (P) 14.344% found in cold season. The comparison relative concentration of the elements is contained in black corns and yellow corns of the rainy season and the cold season in Table 5.

Figure (2) Powder of black and yellow corn in rainy season

Figure (3) Powder of black and yellow corn in cold seas

Table 1 Relative Concentration (% wt) of element contained in black corn of the rainy season

Elements	Concentration (%wt)
K	57.855
Cl	27.062
P	15.083

Table 2 Relative Concentration (% wt) of element contained in yellow corn of the rainy season

Elements	Concentration (%wt)
K	54.843
Cl	27.108
P	16.406
Fe	1.642

Table 3 Relative Concentration (% wt) of element contained in black corn of the cold season

Elements	Concentration (%wt)
K	58.426
Cl	27.362
P	12.303
Fe	1.909

Table 4 Relative Concentration (% wt) of element contained in yellow corn of the cold season

Elements	Concentration (%wt)
K	57.037
Cl	28.619
p	14.344

Table 5 Comparison relative Concentration (% wt) of element contained in corn of the rainy and cold season

Elements	Rainy season		Cold season	
	S_1	S_2	S_3	S_4
K	57.855	54.843	58.426	57.037
Cl	27.062	27.106	27.362	28.619
P	15.083	16.406	12.303	14.344
Fe	-	1.642	1.909	-

S_1, S_2 = Sample of black corn in the rainy season and the cold season

S_3, S_4 = Sample of yellow corn in the rainy season and the cold season

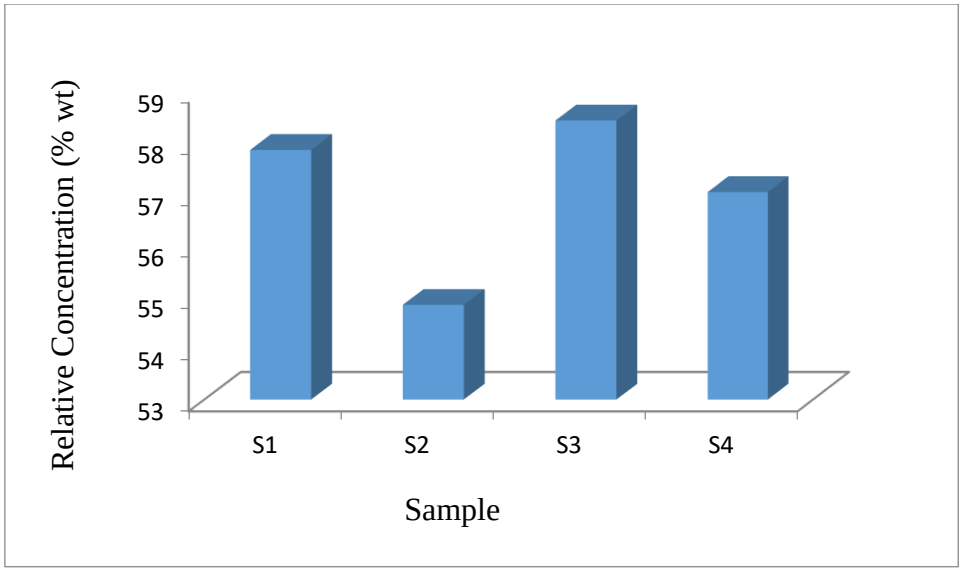

Figure (4) Comparison of relative concentration of (k) of the black and yellow corn samples

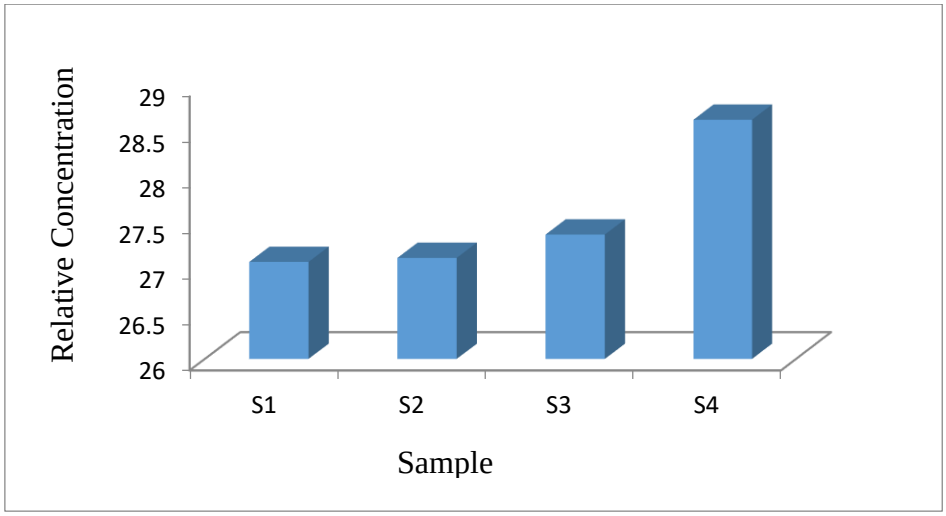

Figure (5) Comparison of relative concentration of (Cl) of the black and yellow corn samples

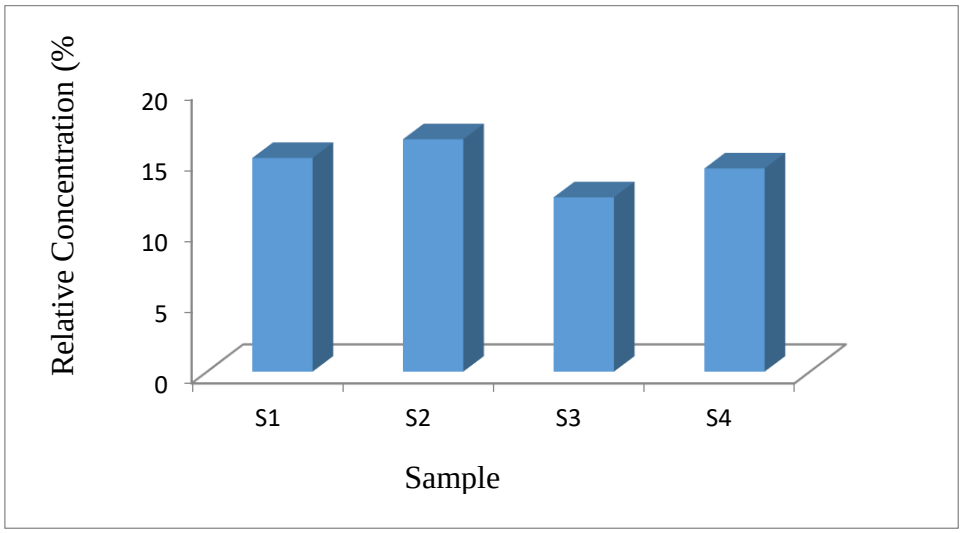

Figure (6) Comparison of relative concentration of (P) of the black and yellow corn samples

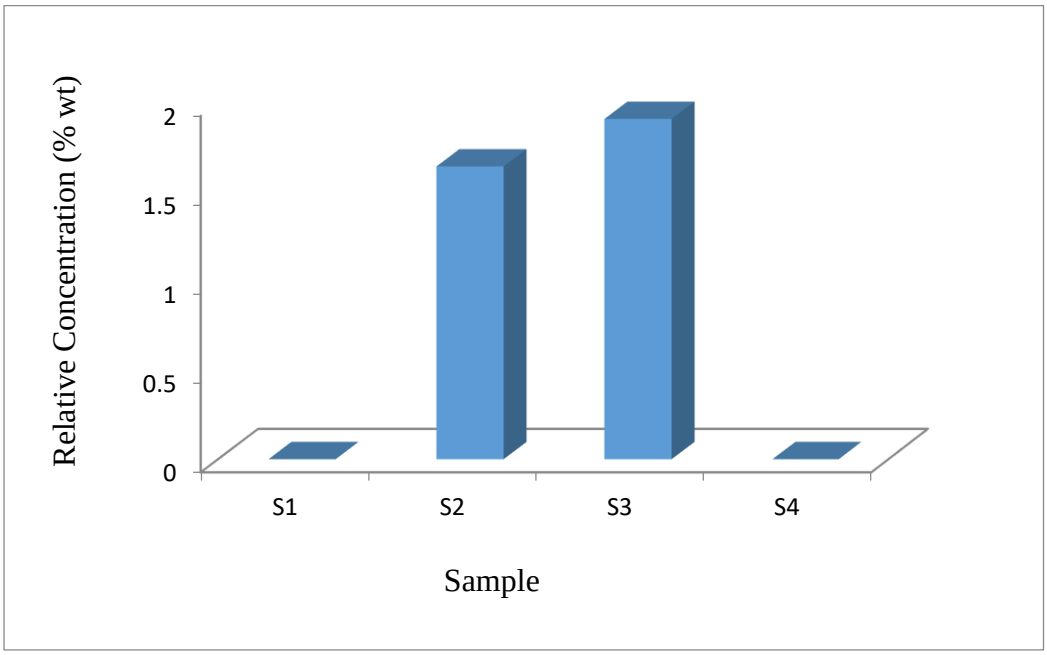

Figure (7) Comparison of relative concentration of (Fe) of the black and yellow corn samples

Results and Discussion

Discussion

In this research, the EDX-720 energy dispersion X-ray fluorescence (EDXRF) system was used to analyze the two kind of corn (black, yellow). The technique used in this research was fundamental parameter method. From Table 5, black corn and yellow corn were observed the following. In rainy season, the sample of black corn has the highest concentration of potassium (k) and the lowest concentration of Phosphorus (P). The sample of yellow corn has the highest concentration of Potassium (K) and the lowest concentration of Iron (Fe). In cold season, the sample of black corn has the highest concentration of Potassium (k) and the lowest concentration of Iron (Fe). The sample of yellow corn has the highest concentration of potassium (K) and the lowest concentration of Phosphorus (P). The sample S_3 has the highest relative concentration of Potassium (K) and the sample S_2 has the lowest relative concentration of Potassium (K) in Figure (4). The sample S_4 has the highest relative concentration of Chlorine (Cl) and the sample S_1 has the lowest relative concentration of Chlorine (Cl) in Figure (5). The sample S_2 has the highest relative concentration of Phosphorus (P) and the sample S3 has the lowest relative concentration of Phosphorus (P) in Figure (6). The sample S3 has the highest relative concentration of Iron (Fe) and the sample S1 and S4 have no relative concentration of Iron (Fe) in Figure (7).

Conclusion

One of the advantages of EDXRF analysis is that it can be used to detect and measure many elements simultaneously. Energy dispersive X-ray fluorescence technology provides one of the simplest, most accurate and most economic analytical methods for the determination of the chemical composition of many types of materials. It is non-destructive and reliable which requires no, or very little, sample preparation and is suitable for solid, liquid and powder sample. The black corn has the highest concentration of Potassium (k). The yellow corn has the highest concentration of Potassium (k). The energy dispersive X-ray fluorescence technique can be used to analyze heavy metals such as Potassium (K), Chlorine (Cl), Phosphorus (P) and Iron (Fe) elements. Heavy metal can be poison venom both people and animal but every nourishment and foods any contained. So it can be used to check the unknown fruits or used as a quality control technique for Myanmar traditional foods. Therefore, this data is very useful for the production and improving the traditional foods to become the international standard.

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