

# Microelemental Analysis Rice Grains using Energy Dispersive X-Ray Spectroscopic Technique

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## ABSTRACT

A non invasive Energy dispersive X-ray Fluorescence (EDXRF) technique was applied for determination of trace elements presents in some varieties of rice (*Oryza sativa*) main staple food of western Maharashtra region from different field region was demonstrated. The research work presented here includes trace element analysis of some varieties of rice. Al, Ca, Cu, Fe, K, Mg, Mn, Na, P, Ti, Si and Zn were determined without any form of any chemical pre-treatment. It has been apparent in recent updates that a newer set of problems is emerging due to the trace elements relating to the use of food grains and eatables and causing the health hazards to human life. The effect of chemical fertilizers, pesticides and herbicides on the elemental concentration of rice in particular in this work was also investigated by this technique. The EDXRF analysis gives out a ready reference for elemental concentration in cereal rice and is of immense importance in everyday life.

**Keywords:** Microelements, cereal rice, EDXRF, chemical fertilizers, pesticides etc.

## 1. INTRODUCTION

Rice (*Oryza sativa*) is one of the most important cereal crop. Nearly half of the world's population depends on this cereal for their daily diet. India has world's largest area with 39.6 million hectares. There has been increasing interest in chemical speciation of element in recent years which can be attributed to the great alteration in the chemical and the biological properties of the elements depending on their oxidation state, the type of the chemical bonds etc. applicability of Energy Dispersive X-Ray Fluorescence (EDXRF) technique for trace elements in rice grains from different fields of the region was demonstrated. To investigate any possible contamination in the grinding procedure or loss of some elements due to the drying process samples were analyzed by total reflection X-ray fluorescence technique. Some microelements are known to be essential for growth of human physique such as C, H, O, N, S, Ca, P, K, Na, Cl, Mn, Ti, Mg, Cu, Fe, Ni, Si and Zn totaling to twenty six elements [1-4]. There are other elements which occur in animal body but are not essential. They acquired in the body as environmental contamination [5] due to excess use of chemical fertilizers and pesticides on food crops. These fertilizers and pesticides produce an increase in toxic elemental concentration at micro level in Rice plant parts and hence in grains due to absorption of these chemicals.

The work being presented here includes micro elemental analysis of grains of some rice varieties. Concentration of metals like K, Ca, Mn, Mg, Fe, Al, Ti, P, Na, Zn, Cu, and Si are studied using (EDXRF) techniques

## 2. EXPERIMENTAL

All samples were collected from different fields of Eastern Vidarbha zone of Maharashtra around 5.20g of rice were collected from different fields and stored in polyethene bags. These grains were dried for 24hr in an oven at 35°C in a glass beaker without any washing. Then the samples were powdered in an agate mortar with a particle size 20-100µm. Pallet of 2.54 cm diameter were prepared using hydraulic press at a pressure of 10 tones/cm. A minimum of 3 pallets of each sample were made to reduce the error in the analysis. Boric acid powder was used as plasticizer.

The energy dispersive X-ray fluorescence spectrometer consists of a tungsten X-ray tube and a molybdenum secondary target. The X-ray generator was operated at 20KV and 50mA. A characteristic radiation was detected using argon flow scintillation counter over the range of 0-110°C with 6µm polypropylene window. The data was analyzed using Uni Quant -2 package and evaluate using the fundamental parameter method as well described in the literature [6-7].

## 3. RESULTS AND DISCUSSION

Several of the publications reviewed this year attempt to define the typical concentrations of a particular element or a group of elements. However, the composition of element present in the rice and of formulas is difficult to characterize. Many research groups have tried to extract the exact composition with the amount of element present at microlevel viz. concentrations of Cs and Se in mushrooms, [8] and of 12 elements in rice [9] were determined with essentially no sample preparation using XRF. The influence of stages of lactation on trace elements and minerals in human milk of Nigerian women were investigated using PIXE [10], Menegario et al. [11] developed a method to determine concentrations of Ba, Cd, Cu, Pb and Zn in human saliva by ID-ICP-MS using a DIN. A study by Akanle et al. [12] on maternal breast milk in Nigeria showed that breast milk for preterm infants had higher concentrations of Cl, Cu, Fe, K, Mg, Mn, Na and Zn and lower concentrations of Br and P than milk from term mothers. Concentrations of Al, Ca, I and Rb were not significantly different. Measurements were by INAA and PIXE.

The EDXRF analysis shows that various microelements are existing in different micro level in all reported varieties of rice. In particular the percentage of NKP in comparison to other microelements is due to excessive use of synthetic fertilizer [9, 13] elements such as iron, zinc, manganese and copper are detected in lower concentration which lead to the fact that these elements from insoluble inorganic legends by reacting with other solvents existing in soil.

To establish reproducibility of the instrument technique six pellets of each sample were analyzed. The results of the analysis in  $\mu\text{g}^{-1}$ (dry weight) of 35 samples were collected from different fields of the region under study.

Most of the rice varieties are grown in the warm and humid weather unfortunately tropical condition also favours the proliferation of insects on rice plants. Chemicals pesticides and insecticides are mixed in field water or spread on the plants during cultivation which get distributed throughout the tissue .The elements viz Mg, Al, Ti, and Ni are residues of pesticides and insecticides absorbed by the plant parts like rice grains in various micro percents which after consumption may be a hazard to human physique.

## REFERENCES

- [1] H.J.M. Bowen, trace elements in biochemistry, Academic press, New York (1996)
- [2] V.Valkovic, trace elements analysis, tayrov and Francis, London (1979)
- [3] Analysis of Biological Material for trace element using X-ray spectroscopy, CRC Press, Boca Raton, FL(1980).
- [4] P. Bratter and P. Schramel, trace element analysis and biology , Walter de Gruyter, Berlin (1980)
- [5] Madan Lal and R.K.Choudhary, Indian J. of Physics **65B** , 30 (1991)
- [6] J.Bohman and V.Isakson, X-ray spectrom ,**20**,305 (1989)
- [7] A. Rindby , X-ray spectrom -**18**,113 (1989)
- [8] L. Racz, A. Bumbalova, M. Harangozo, J. Tolgyessy and O. Tomecek, J. Radioanal. Nucl. Chem., 2000, 245(3), 611.
- [9] V. Rewatkar, A. A. Saoji and K. G. Rewatkar, Asian J. Chem.,2001, 13(1), 206.
- [10] O. A. Akanle, F. A. Balogun, J. A. Owa and N. M. Spyrou, J. Radioanal. Nucl. Chem., 2001, 249(1), 71.
- [11] A. Menegario, A. P. Packer and M. F. Gine, Analyst, 2001, 126(8), 1363.
- [12] O. A. Akanle, F. A. Balogun, J. A. Owa and N. M. Spyrou, J. Radioanal. Nucl. Chem., 2000, 244(1), 231.
- [13] S.V. Rao and Krishna Rao Andra Agr. J. **9**.255 (1961).