

Analysis of bakery biscuits-Electroanalytical techniques

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ABSTRACT:

Different brands of biscuits were studied for the presence of phosphorus, glucose and Iron using Electro analytical technique. UV-Visible spectrophotometric analysis enabled to know the composition of certain metals. The sample solutions were prepared by ashing and using 6N HCl. In the present study, absorbance measurements were made in the range, 500nm to 850nm.

For the analysis of iron, the samples were made to react with 1, 10 phenanthroline and hydroxyl amine hydrochloride to give a red coloured complex which was measured at 510nm. The presence of phosphorus was known by the blue coloured complex formed when the samples were treated with ammonium molybdate and absorbance measurements made at 810 nm. By treating the samples with alkaline cupric tartarate and phospho molybdic acid, blue oxides of molybdenum were formed and absorbance measurements were made at 640nm for the presence of glucose.

This method demonstrated good reproducibility and was found to be simple, accurate and less time consuming.

Key Words: electroanalytical technique, spectrophotometry.

I. INTRODUCTION

A proper diet must consist of a certain amount of protein, fat, carbohydrate, water and minerals. (1). Micronutrients Ca and P are the main constituents of the bone mineral (2).P is needed for the body to make protein for the growth, maintenance and also for the repair of cells and tissues. (3). Phosphorus deficiency includes loss of appetite, anxiety, bone pain, fragile bones, fatigue, irregular breathing, and weakness (4).H cl in the stomach helps in the solubility and absorbability of the minerals from food in the diet. Ca , P, K, Mg,S ,Na are the dietary macro minerals (5) required more than 100mg per day).Trace minerals required in milligram quantities per day include Fe, I, Zn,Cr,Mn, Mo, F, Se, Si which have specific biochemical roles in maintaining the body functions.

Biscuits are ready to eat baked snacks. Biscuits are wheat based products which are nutritious containing minerals, vitamins, carbohydrates. Wheat is an important cereal contributing to one third of the total food grain production in India. Ca, P, Na, K, Mg and S make up the dietary macro minerals, those minerals required at more than 100mg per day by the adult. Each of these minerals has a specific function in the body. The body malfunctions if these minerals are not provided in the diet on a regular basis.

Iron is one of the essential constituents of the body occurring in haemoglobin and myoglobin (6).Body recycles the iron obtained from the breakdown of RBC and the daily requirement of iron is low. Iron is essential for the elementary and metabolic process and is responsible for the transport of molecular oxygen from the respiratory chain (7).

Phosphorus is the essential element abundant in the body and comprises approximately 0.8% to 1.1% of the total body weight. Phosphorus is absorbed through the intestines, transported in the bloodstream and stored in the bones and teeth. Phosphorus plays an important role in the cell metabolic activities. Phosphorus is an essential compound of RNA and DNA and is a part of the molecular structure of the phospholipids, the key component in the structure of cell membranes (8).Sugars, starch, cellulose are the carbohydrates which are easily digested and provide the necessary calories in the diet.

II. METHODOLOGY:

Different brands of biscuits were purchased from the local market at Hyderabad, air dried for about 3 hrs in hot air oven and powdered. Moisture content of the samples was removed at a temperature 60-80°C maintained in a hot air oven for 14 to 18hrs.

The moisture content was calculated,

Moisture % (G/100g) = $\frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of sample}} * 100$

Table 1: % of moisture of samples

Sample	% of the moisture
BRAND -I	1.37
BRAND -II	1
BRAND -III	1.34
BRAND -IV	1.23
BRAND -V	1.87

Ashing was done to remove the organic content from the samples and the solutions were prepared using 6N HCl.

2.1 Procedure:

UV-Visible spectrophotometry:

The instrument is adjusted to 0% transmittance without any cell and 100% transmittance with reference cell. Double distilled water is used as blank.

2.1.1 Iron

Aqueous solutions of Fe²⁺ react with 1,10 phenanthroline to form a red colored complex and Fe³⁺ forms pale blue color complex. Fe³⁺ is reduced to Fe²⁺ with hydroxyl ammine hydrochloride reducing agent. The red colored iron complex is measured at 510nm (9).

Reagents used: Acetate buffer solution, 1, 10 Phenanthroline and the reducing agent used was Hydroxyl ammine hydrochloride.

Preparation of Stock solution: 0.05gms of FAS in 10ml of conc.HCl was taken in 12 ml water and was further diluted to 500ml.

Preparation of working standards: Working standard solutions were prepared by pipetting 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 ml of the above stock solution into 25ml standard flasks. To each of these flasks 1ml of hydroxyl ammine hydrochloride and 5ml of buffer solution were added and allowed to stand for 5 min, 1ml of the reagent was added and made up to the mark with double distilled water. Samples (brand 1,2,3,4,5) were prepared similarly The absorbance of these solutions were measured at 510nm.

2.1.2 Glucose

Samples are treated with alkaline cupric tartarate solution and phospho molybdic acid to produce blue oxides of molybdenum which is a measure of the amount of glucose present.

Reagents Used: Alkaline Cupric solution, Phospho molybdic acid

Preparation of stock solution: 10mg of glucose is dissolved in 100ml of 0.1% benzoic acid.

Preparation of working standards: Working standard solutions were prepared by pipetting 0.1, 0.2, 0.3, 0.4, 0.5ml of the above stock solution into 25ml standard flasks. To each of these solutions 2ml of double distilled water and 2ml of alkaline Cu solutions were added and heated. These solutions were cooled, phosphor molybdic acid was added and made up to 25ml with double distilled water. Samples (brand 1, 2,3,4,5) were prepared similarly The absorbance of these solutions were measured at 640nm(10).

2.1.3 Phosphorus

Aqueous solutions of PO₄³⁻ react with ammonium molybdate and forms a blue colored phospho molybdate compound. The concentration of phosphate blue solution is determined at 820nm (11).

Reagents Used: Ammonium molybdate solution, ANS Reagent

Preparation of stock solution: 0.1096gms of KH₂PO₄ dissolved and volume is made up to 100ml

Preparation of working standards: Working standard solutions were prepared by pipetting 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 ml of the above stock solution into 25ml standard flasks. To each of these flasks 1ml of ammonium molybdate and 0.2ml of ANS reagent were added, made up to the mark with double distilled water and further kept in hot water for maximum development of color. Samples (brand 1,2,3,4,5) were prepared similarly. Each of these solutions were measured at an absorbance of 820nm.

III. RESULTS AND DISCUSSION:

Table-2-Absorbance measurements of the working standard solutions-Iron

S.no	Volume(ml)	Absorbance	Concentration(×10 ⁻⁶)
1	0.5	0.023	2.5
2	1.0	0.045	3.6
3	1.5	0.051	4.38
4	2.0	0.069	5.5

5	2.5	0.072	5.7
6	3.0	0.084	6.9

Table-3-Absorbance measurements of the sample solutions -Iron

S.no	Volume(ml)	Absorbance	Concentration($\times 10^{-6}$)
1	Brand -I	0.043	3.57
2	Brand -II	0.051	4.38
3	Brand -III	0.059	5.1
4	Brand -IV	0.064	5.202
5	Brand -V	0.065	5.304

Table-4 - Absorbance measurements of the working standard solutions - Glucose

S.no	Volume(ml)	Absorbance	Concentration ($\times 10^{-6}$)
1	0.1	0.135	3.1
2	0.2	0.147	4.2
3	0.3	0.162	5.5
4	0.4	0.187	6.2
5	0.5	0.230	7.9

Table-5-Absorbance measurements of the sample solutions - Glucose

S.no	Volume(ml)	Absorbance	Amount of glucose mg/100mg
1	0.1	0.226	480
2	0.2	0.147	180
3	0.3	0.150	200
4	0.4	0.203	400
5	0.5	0.158	220

Table-6-Absorbance measurements of the working standard solutions- Phosphorus

S.no	Volume(ml)	Absorbance	Concentration(10^{-3})
1	0.5	0.365	4
2	1.0	0.516	6
3	1.5	0.605	8
4	2.0	0.739	10
5	2.5	0.814	12

Table-7-Absorbance measurements of the sample solutions - Phosphorus

S.no	Volume(ml)	Absorbance	Concentration (* 10^{-3})	Amount of Phosphorus mg/100gms
1	BRAND -I	0.764	7.2	1286.9
2	BRAND -II	0.604	4.386	992
3	BRAND -III	0.552	5.1	892.8
4	BRAND -IV	0.558	5.202	881.2
5	BRAND -V	0.646	6.304	1066.4

Calibration graphs of the sample solutions for the presence of iron, glucose and phosphorus were obtained by plotting absorbance vs. concentration.

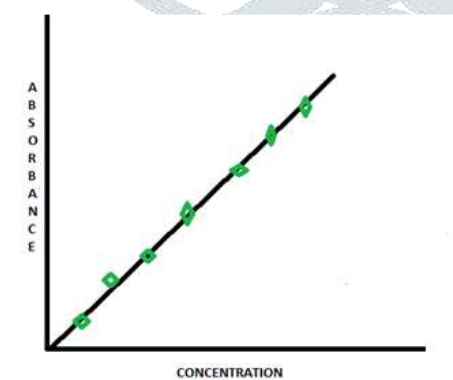


Table-8-Composition of minerals mg/100gm

S.no	TYPE	Fe	P	GLUCOSE
1	BRAND -I	79.6	1289.6	480
2	BRAND –II	98.2	992	180
3	BRAND –III	114.24	892.8	200
4	BRAND –IV	116.5	881.2	400
5	BRAND -V	118.8	1066.4	220

IV. CONCLUSION: In the present study, five brands of biscuits were compared for the presence of Fe, glucose and phosphorus and spectrophotometric analysis was found to be effective and also the method of choice, the results being reproducible (12). Brand 1 and V was found to be rich in P, brand 1 and IV were rich in glucose whilst brand i was found to have low content of iron. The obtained results demonstrated that the procedure could be successfully applied for the analysis.

V ACKNOWLEDGMENTS

The authors are thankful to the Chairman, secretary and Principal of G.Narayanamma Institute of Technology and Science for providing all the facilities to carry on the research work.

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