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RESEARCH ARTICLE

MEASUREMENT OF BROMATE RESIDUES IN SOME POPULAR BAKED PRODUCTS PRODUCED IN SUDAN BY X-RAY FLUORESCENCE (XRF)

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ABSTRACT

Potassium bromate is an additive widely employed by bread makers to improve bread quality. On account of its deleterious effect and carcinogenicity in humans, certain levels of potassium bromate are not allowed in baked products. Use of potassium bromate in bread and baked products are banned in many countries including Sudan. Wavelength-dispersive x-ray fluorescence (WDXRF) was applied to determine bromide (Br⁻) as an indication of pre-baking bromate addition in baked products. The limit of detection is 0.123 ppm and limit of quantification is 0.41 ppm and sensitivity at 0.040 ppm. Results show the presence of detectable residue levels of potassium bromate in some of analyzed samples.

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INTRODUCTION

Potassium bromate (KBrO₃) is one of the food additives that have been used in limited ways and amounts by the baking industry for almost a century with no known health concern. It has been used in baking since 1914 when a patent was issued by the United States Patent Office (ABA, AIB, 2008). Available information indicated that potassium bromate is produced in Argentina, Brazil, China, Germany, India, Israel, Italy, Japan and Spain (Chemical Information Services, 1995).

Bromate salts have been used as a food ingredient, being added to beer and cheese; it is also used as a neutralizing agent for permanent wave hair styling products (Dupuis, 1997; IPCS, 2006). Potassium bromate was approved in the United States by the Food and Drug Administration (FDA), for use in bromated flour at 50 ppm. Potassium bromate (KBrO₃) is used in baked goods and flour under provisions of 21 CFR Parts 136 and 137. (Mack, 1988; Dupuis, 1997; WHO, 2004, 2006). The amount of Potassium bromate used in baking may subsequently prove to be of little or no concern; however the baking industry still needs to take the necessary steps to reduce any potential of bromate residues in finished products to safe levels. According to World Health Organization (WHO, 2005), there is a

potential risk to human from exposure to bromate via drinking water. Although bromate is not typically found in drinking water; however, the bromate ion can be formed a by-product from the ozonation disinfection process. Potassium bromate (KBrO₃) classified by the International Agency for Research on Cancer (IARC) as category 2B carcinogen. Long-term toxicological studies (IARC, 1986) based on drinking water for rats have established Potassium bromate as a renal carcinogen. Quantitative risk analysis indicated that residues in the finished bread above 20 ppb in baked goods would lead to a potentially significant level of risk (IARC, 1986).

MATERIALS AND METHODS

Chemicals

- Potassium bromide (assay 99%) CDH, India.
- Cellulose Techno pharmchem, Bahadurgarh, India.

Instruments

- X- Ray Fluorescence (XRF) Model CANBERRA Series 35 Plus designed and manufactured in USA.
- Electrical grinter MX-J120P Panasonic, Pakistan.

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Sampling

Twenty four samples of coffee cake, one sample of croissant and nine samples of dry bread (gragosh) were collected from different outlets and bakeries in Khartoum State. Representative samples were bought from northern, southern, western, eastern and central of Khartoum State. All samples were obtained from products that are widely consumed in Khartoum State especially by children.

Preparation of samples

The sample preparation of cake and dry bread for bromide (Br⁻) determination by XRF. Firstly, the cake samples were dried at room temperature for 7 days and ground to a fine powder with electrical grinder, the dry bread were ground to a fine powder with electrical grinder directly. Then all samples were pressed into pellet form using a 15 ton pressing machine. The diameter of each pellet was about 2.5 cm and the mass about 1 g. the pellets were presented XRF spectrometer system, each of them was measured for 2000 sec.

Preparation of solutions

Potassium bromide stock standard (1000 mg/l). The stock standard was diluted to appropriate concentration with distilled water for the five calibration standards were 0.1, 0.2, 0.5, 0.75, and 1 ml; was added to 4 g of cellulose which generated the standard samples of 25, 50, 100, 150, and 200 ppm, respectively, After that, the wet standard was dried at 60°C for 24 h. Then, the standard was mixed for 15 min with 1 g of wax.

RESULTS AND DISCUSSION

The results were treated by Statistical Package of Social Science (SPSS) methods version 15 was used to compare the concentration of bromide residue in cake samples and dry bread samples by X-Ray fluorescence method using Independent – Samples T- Test are shown in table (3) at:

- H₀: μ₁ = μ₂
There is no statistical difference
- H₁: μ₁ ≠ μ₂
There is statistical difference
- Where:
H₀ = Null hypothesis
H₁ = alternative hypothesis

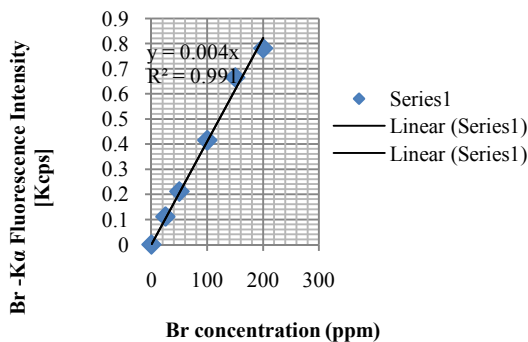


Figure 1 Calibration Curve for Potassium Bromide

Table 1 Concentration of bromide (Br⁻) in cake samples

Sample	Concentration of Br ⁻ (ppm)*	Concentration of Br ⁻ (g/100g) %
1	7.80	0.078
2	4.39	0.044
3	125.37	1.254
4	6.59	0.066
5	3.00	0.030
6	12.00	0.120
7	3.66	0.037
8	10.49	0.105
9	3.00	0.030
10	4.00	0.040
11	13.17	0.131
12	5.37	0.054
13	4.63	0.046
14	4.15	0.042
15**	9.27	0.093
16	10.49	0.105
17	5.00	0.050
18	5.12	0.051
19	5.12	0.051
20	9.27	0.093
21	22.68	0.227
22	8.00	0.080
23	6.00	0.060
24	3.17	0.032
25	3.17	0.032
Mean	11.7964	

* (ppm: parts per million by weight); ** Sample (15) is croissant sample.

Table 2 Concentration of bromide (Br⁻) in dry bread samples

Sample	Concentration of Br ⁻ (ppm)*	Concentration of Br ⁻ (g/100g) %
1	11.46	0.115
2	4.39	0.044
3	5.60	0.056
4	4.00	0.040
5	5.60	0.056
6	8.53	0.085
7	6.09	0.061
8	90.98	0.909
9	4.15	0.045
Mean	15.6444	

* (ppm: parts per million by weight).

DISCUSSION

The measurements of (Br⁻) concentration in the cake and dry bread (gargosh) samples are shown in tables (1) and (2). The Mean level of bromide level was found to be 11.7964 ppm, 15.6444 ppm in cake and dry bread samples respectively. The calibration of bromide in baked product (cake, dry bread) figure (1) has a low detection limit and high sensitivity. Some values showed that the level of bromide in cake and dry bread is lower than permissible values, others samples exhibited higher bromide level that indicate of pre-baking bromate addition in cakes and dry bread. This result agree with previous reports (Gamalat, A. Osman. 2010) on bromation of bread products, The previous studies of determine bromate residue in bread showed the good performance of XRF in measuring bromide (Br⁻) in bread. (Perez, R.D and Leon, A.E 2010) found level of bromide in bread samples determined range from 6.00 – 102.00 ppm in Argentinean bread.

Table 3

t	df	Mean	Sig (P. Value)	
-0.393	32	Sample 1 11.7964	Sample 2 15.6444	0.439*

* P.Value > 0.05; t = t-test, df = degree of freedom, sig = significant, sample 1= cake samples, sample 2 = dry bread (gargosh).

Table 3 Comparison of the concentration bromate residue in cake samples and dry bread (gargosh) samples by X-Ray fluorescence method according to tables (1) and (2) using Independent – Samples T -Test (SPSS Method).

The treated results showed the significant (P .Value) (0.439) more than significant level (0.05) that mean there is **no** statistical difference between concentration.

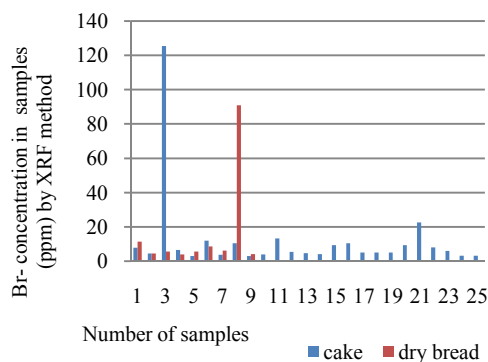


Figure 2 Histogram of bromide (Br⁻) residue in cake and dry bread (gargosh) samples

CONCLUSION

The X- ray fluorescence (XRF) analysis indicated that some producers of cakes and dry bread still use potassium bromate in their products as illegal process.

References

American Bakers Association (ABA) and American Institute of Baking International (AIB). (2008). Commercial Baking Industry Guide for the Safe use of Potassium Bromate. Washington, USA.

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Chemical Information Services (1995). Directory of World Chemical Producers 1995/96 standard edition, Dallas, USA, pp. 587

Dupuis, B. (1997). The chemistry and toxicology of potassium bromate. *Cereal Foods World* 42(3):171 – 183.

International Agency for Research on Cancer (IARC) (1986). Potassium bromate. In: IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans, Lyon, France, World Health Organization, vol 40. pp 207– 220.

International Program on Chemical Safety (IPCS) (2006). Potassium Bromate. WHO Food Additive Series 24, Geneva, Switzerland, World Health Organization, International Program on Chemical Safety.

Mack, R. (1988). Round up the usual suspects. Potassium bromate poisoning. *N C Med J* 49(5):243–245.

Gamat, A. Osman (2010). A simple method for potassium bromate determination in bread, M.Sc thesis. in chemistry, Khartoum, sudan.

Perez, R.D and Leon, A.E (2010). Bromate determination by X-Ray Fluorescence (XRF) to identify pre-baking potassium bromate addition in bread, *International Journal of Food Properties*, 13:167–175.

WHO (2004). Disinfectants and disinfectant by-products. In: Guidelines for Drinking Water Quality. Health criteria and other supporting information, 2nd edition. World Health Organization, Geneva, Switzerland. Vol 2. pp. 822-828.

WHO (2005). Bromate in drinking water. Background document for the development of WHO guidelines for drinking water quality. World Health Organization, Geneva, Switzerland (WHO/SDE/WSH/05.08/78).

WHO (2006). Bromate. In: Guidelines for drinking-water quality. Recommendations, First Addendum to Third Edition. World Health Organization, Geneva, Switzerland. Vol 1. pp. 315 - 316.

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