Research Article

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DETERMINATION OF POTASSIUM BROMATE IN BREAD SAMPLES FROM FIVE BAKERIES IN ADDIS ABABA, ETHIOPIA.

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Abstract

Bread samples were collected from five bakeries (Africa, Grand, Hikma, Roba, and Shewa) of wide coverage in Addis Ababa; Ethiopia. The samples were analyzed by UV-Vis spectrophotometer for potassium bromate ($KBrO_3$). The content of potassium bromate in different breads range from 5.615 -9.974mg/kg (mean 8.100mg/kg). The level of $KBrO_3$ was found to be 281 to 499 times more than the permissible limit set by FDA, which is highly toxic for consumers. A significant differences were found in the potassium bromate levels of bread samples from different bakeries ($P<0.05$).

Keywords: UV-Vis Spectrophotometer, Potassium bromate.

Introduction

Bread is an essential cereal product in human nutrition providing as much as 50-90% of total caloric and protein intakes[1]. Daily consumption of bread in Addis Ababa rated to 37.4 g per capita[2].

Bread is made from wheat through a number of processes including milling, mixing, fermenting, molding and baking[3]. Bakeries use potassium bromate, strong oxidizing agent, for bread improving effects such as preserve flavor or improve the taste and appearance[4]. When potassium bromate is added to freshly milled flour, it will increase the shelf life of the flour[5]. But, beyond all the benefits, potassium bromate is toxic above certain level i.e. 0.02ppm. It affects the nutritional quality of bread by degrading essential vitamins and fatty acids. Moreover, it possesses high carcinogenic potential in humans and causes non-cancerous health problems like abdominal problem, kidney failure, hearing loss, bronchial and ocular problems[4]. The International Agency for Research on Cancer (IARC) classified $KBrO_3$ as a 2B (a possible human) carcinogen[6]. Even if, some countries limit its use and some others ban, Ethiopia neither set a limit nor ban potassium bromate. Therefore, this research work is expected to provide the basis to take action towards it. The overall aim of the project was to determine the levels of potassium bromated in bread, which are very important with regard to human health as well as the food quality control perspective.

Materials and Methods

Study area and sample Collection: Addis Ababa city is metropolitan of Ethiopia and has high

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intensive population. Bread samples were collected randomly from open markets of five bakeries: Shewa, Roba, Hikma, Africa, and Grand, which have a wide coverage in Addis Ababa. The bread samples were collected in four consecutive weeks between November and December, 2010. Ten bread samples were taken randomly per batch per day once in a week. Bread samples from the same bakery were mixed together to obtain representative samples.

Sample preparation for analysis

Potassium bromate in the bread samples was qualitatively and quantitatively analyzed using reported methods[4], 2010. A 1.0 g quantity was weighed out from each bread sample using an analytical weighing balance. This was transferred into a test tube. Ten milliliter (10 ml) of distilled water was added; the mixture was shaken and allowed to stand for 20 min at 28 ± 10°C. Heating was done using a water bath and the temperature of the mixture was controlled using a thermometer. After cooling, a 5.0 ml volume was decanted from the test tube. A 5.0 ml quantity of freshly prepared 0.5% potassium iodide solution in 0.1N hydrochloric acid was added. Any color change was noted. The presence of potassium bromate was indicated by a change in color from light yellow to purple. The absorbance of the samples was taken at 620nm using a UV-Vis spectrophotometer. Analysis was done on three replicates for each of the samples.

Estimation of the level of potassium bromate

The mean absorbance produced by the standards (corrected for the standard blank) was plotted versus the concentration of the anlyte in the sample to produce a calibration curve. The concentration of potassium bromate in each bread sample was calculated using the equation of the calibration curve based on its absorbance.

Statistical analysis

Analysis of variance was performed to compare whether there is a significant difference in the content of potassium bromate among the studied bread samples from different bakeries (Shewa, Roba, Grand, Africa and Hikma). Mean values obtained for the potassium bromate were compared by One-Way ANOVA using SPSS 17, assuming that there were significant differences among them when the statistical comparison gives a value of $p < 0.05$. The post-hoc analysis was done through the least significance difference (LSD).

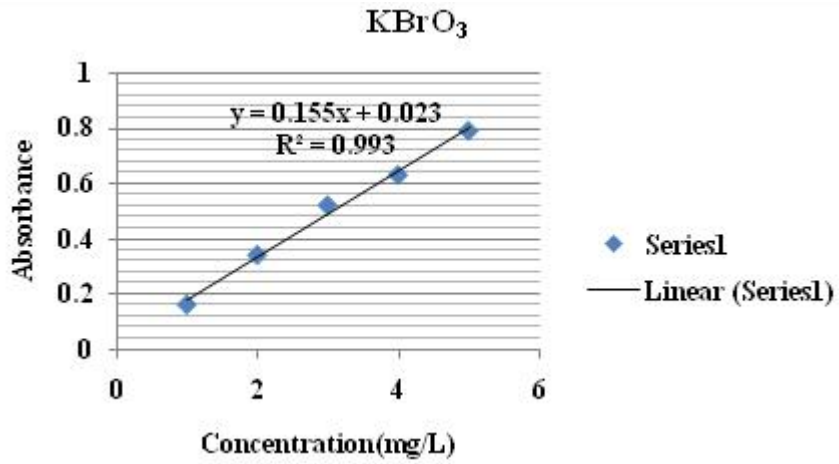

Fig 01: Calibration curve for potassium bromate

Result and Discussion

The concentration of $KBrO_3$ standards used in spiking for constructing calibration curve includes 1, 2, 3, 4, and 5mg/L. The calibration curve based on concentration versus absorbance is drawn using excel. The slope, intercept and correlation coefficients of the calibration curve for potassium bromate are 0.155, 0.023, and 0.997, respectively. The method detection limit of potassium bromate was found to be 0.101.

Table 01: Content of $KBrO_3$ in bread from the selected bakeries, n=3 (µ±SD)

Bread samples	Amount found(mg/kg)	Number of folds with respect to limits by	
		FDA	WHO
Africa	9.974 ± 0.087	499	399
Grand	8.732 ± 0.039	437	349
Hikma	7.194 ± 0.017	360	288
Roba	8.983 ± 0.013	449	359
Shewa	5.615 ± 0.070	281	225
Permissible level(mg/kg)		**0.02**	**0.025**

Potassium bromate was found in all samples and it has been found at a concentration much above the limit set by World Health Organization, and Food and Drug Administration. The level of potassium bromate in the studied samples against the number of folds more than international limits is presented in table -1. The average contents of $KBrO_3$ in samples collected from Shewa, Hikma, Grand, Roba and Africa bakeries were 5.615±0.070, 7.194±0.017, 8.732±0.039, 8.983±0.013, and 9.974±0.087, respectively. The content of potassium bromate (5.615-9.974mg/kg) is comparative with values from the studies done in Nigeria (1-16ppm) and (1.16-10.44mg/kg)[4, 7]. It was much higher than the finding in Nigeria (1.08-3.78mg/kg)[8]. Presence of potassium bromate was tested in flour samples taken from each bakery. All indicated no change in color from light yellow to purple that confirms the presence of potassium bromate. This indicates that either the level of potassium bromate is below the detection level or there is no potassium bromate in the flour. The absence of color formation indicates that great attention needs to be given to the bread making processes at the bakery rather than at the flour industries.

Analysis for significance of differences between means (ANOVA)

The mean content of potassium bromate of bread from the five bakeries was statistically different ($p<0.05$). The $KBrO_3$ content of each sample of bread was significantly different from the other bread sample ($p<0.05$) in the post hoc LSD analysis. It was observed that there was a very diverse contamination profile of potassium bromate among bakeries.

Conclusion and recommendation

In this study, potassium bromate was found much above its permissible limit. All bread samples had an extraordinarily high content of $KBrO_3$, which is very hazardous to health. It is recommended that regulatory authorities take control of the content of potassium bromate in all bakery breads and/or to ban the product not to be incorporated in the bread making process.

References

1. Khaniki G, Yunesian M and Nazmara S. Trace metal contaminants in Iranian flat breads. Journal of Agriculture & Social Sciences, 1: 2005, 301-303.
2. Central Statistical Agency of Ethiopia (CSAE). Household income, consumption and expenditure survey. Http://www.csa.gov.et accessed on (2004) 05-03-2011.
3. Cubaddaa F, Raggia A and Marconib E. Effects of processing on five selected metals in the durum wheat food chain. Microchemical Journal, 79: 2005, 97–102.
4. Emeje MO, Ofoefule SI, Nnaji AC, Ofoefule AU and Brown SA. Assessment of bread safety in Nigeria: Quantitative determination of potassium bromate and lead. African Journal of Food Science, 4: 2010, 394 – 397.
5. Van Staden JF, Mulaudzi LV and Stefan RI. Spectrophotometric determination of bromate by sequential injection analysis. Talanta, 64: 2004, 1196–1202.
6. Moore MM and Chen T. Mutagenicity of bromate: Implications for cancer risk assessment. Toxicology, 221: 2006, 190–196.
7. Okolie NP and Osarenren EJ. Toxic bromate residues in Nigerian bread. Bulletin of environmental contamination and toxicology, 70: 2003, 443–446.
8. Ekop AS, Obot IB and Ikpatt EN, Anti-nutritional factors and potassium bromate content in bread and flour samples in Uyo metropolis, Niger. E-Journal of chemistry, 5: 2008, 736-741.