



## Potassium Bromate Concentration Measurement in Local Bread Types from Various Bakeries in Zawia, Libya

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### قياس تركيز برومات البوتاسيوم في أنواع الخبز المحلي من مخابز مختلفة في الزاوية، ليبيا

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#### Abstract:

Bread is widely consumed in Libya, primarily for breakfast, dinner, and school meals, by people from all socioeconomic backgrounds. In the banking sector globally, potassium bromates to their blends. This research aims to determine the degree of compliance with the prohibition fourteen years later and to evaluate the safety of bread by measuring residual potassium bromate with a fast and accurate technique (spectrophotometric technique), from various bakeries in Zawia, Libya, twenty-nine distinct bread samples were chosen randomly. The reducing-oxidant reaction of bromate and promethazine in an acidic media is the basis for this technique. At 515 nm, the reddish-pink product that was formed had the highest absorption. According to the results, every bread sample that was examined contained potassium bromide. In the bread samples, the amount of bromated varied between 9 and 60 mg per kg. The French bread sample showed the lowest level, while the Fino bread sample showed the highest level. This investigation shows that all four varieties of bread samples have potassium bromate levels above WHO guidelines.

**Keywords:** Bread, Potassium Bromate, Spectrophotometer, promethazine. Zawia City.

#### الملخص:

يتم استهلاك الخبز على نطاق واسع في ليبيا، لتناول الإفطار والعشاء والوجبات المدرسية من قبل جميع الفئات الاجتماعية. وعلى مستوى العالم تدخل برومات البوتاسيوم في خلطاتها. يهدف هذا البحث الى تحديد درجة الالتزام بالكمية المسموح بها وتقييم سلامتها عن طريق قياس بقايا برومات البوتاسيوم بتقنية سريعة ودقيقة (باستخدام تقنية القياس الطيفي)، تم اختيار تسعة وعشرين عينة خبز مختلفة بشكل عشوائي من مخابز مختلفة في الزاوية، ليبيا، حيث، تم فحص العينات للتأكد من وجود بروميد البوتاسيوم. إن تفاعل الأكسدة والاختزال للبروميت والبروميثازين في وسط حمضي هو أساس هذه التقنية. عند 515 نانومتر، كان المنتج الوردي المحمر الذي تم تشكيله يتمتع بأعلى امتصاص. وبحسب النتائج فإن كل عينة خبز تم فحصها تحتوي على بروميد البوتاسيوم. وفي عينات الخبز تراوحت كمية البرومات بين 9 و60 ملغم لكل كيلوغرام. وأظهرت عينة الخبز الفرنسي أدنى مستوى، في حين أظهرت عينة خبز فينو أعلى مستوى. يوضح هذا التحقيق أن جميع أصناف الخبز الأربعة تحتوي على مستويات برومات البوتاسيوم أعلى من إرشادات منظمة الصحة العالمية.

**الكلمات المفتاحية:** خبز، برومات البوتاسيوم، المطياف الضوئي، البروميثازين، مدينة الزاوية.

#### Introduction

Food additives are non-nutritive substances that added to food, in tiny amounts, to enhance its texture, flavor, color, appearance, or ability to store. These additives, which can be divided into four major groups, are crucial to flour or dough in contemporary factory baking in order to increase baking quality or color are Enzymes, oxidizing, reducing, and bleaching agents [1]. Potassium bromate (KBrO<sub>3</sub>) is a colourless, odourless and tasteless white crystal/powder [E number E924] [2]. It was first suggested in 1916 as a way to improve the texture and volume of bread. It is an oxidizing agent that promotes the formation of gluten. They could also have bleaching properties. It has an impact on amino acids that contain sulphur, which eventually aids in the formation of disulfide bridges between gluten molecules [3]. In order to hold on to the carbon dioxide gas that the yeast produces, will cause the dough to become viscoelastic. The overall result is an increase in loaf volume and texture, as well as a rise in the bread when baking [4]. The International Agency for Research on Cancer has

categorized potassium bromate as a category 2B carcinogen. Oral administration has been used in multiple investigations involving rats and one research involving mice and hamsters. It caused thyroid follicular tumors in rats of both sexes, renal tubular tumors in rats, and peritoneal mesotheliomas in rats. [5]. The European Union, Argentina, Brazil, Canada, Nigeria, South Korea, Peru, and a few other nations have outlawed its usage in food items [6]. The U.S. Environmental Protection Agency (U.S. EPA has identified potassium bromate as causing cancer, according to that also The Office of Environmental Health Hazard Assessment (OEHHA) has found that this chemical appears to be “formally identified” as causing cancer [7].

In Libya, bread and its derivatives are used daily by all segments of society. In 2005, Libya outlawed the use of potassium bromate. Libyan bread is not containing potassium bromate, according to the official Food and Drugs agency. It claimed to have detected no potassium bromate in any of the most recent samples from bakeries that it evaluated [8]. Recently, a few studies carried in various Libyan cities examined local bread samples. A study showed that 100% of the tested samples contained high levels of residual potassium bromate, another study showed that all samples were completely free of potassium bromate. This study's major goal is to determine whether potassium bromate is still employed in Zawiya bakeries by detecting the amount of potassium bromate residue in each sample using spectrophotometric analysis.

### Material and methods

**Reagents equipment:** Hydrochloric acid (Merck, 5N), potassium bromates (Scharlau,99.8%), and promethazine hydrochloride (PTZ) was offered griaiously by Rhounepoulenc RORER, all other reagents were of analytical grade water was always distilled. The laboratory spectrophotometer, electronic balance, magnetic stirrer hot plate, and regular glass ware the equipment used.

### Collection of Samples

Twenty-nine bread samples were collected from forty-four different bakeries.in many locations in Zawiya city from June to September 2021. The bread-type products were French bread (long bread), Fino bread (Banena bread), plain Kaiser Bread (Burger bread), and Ciabatta bread (Almohawer bread), shown in figure (1).

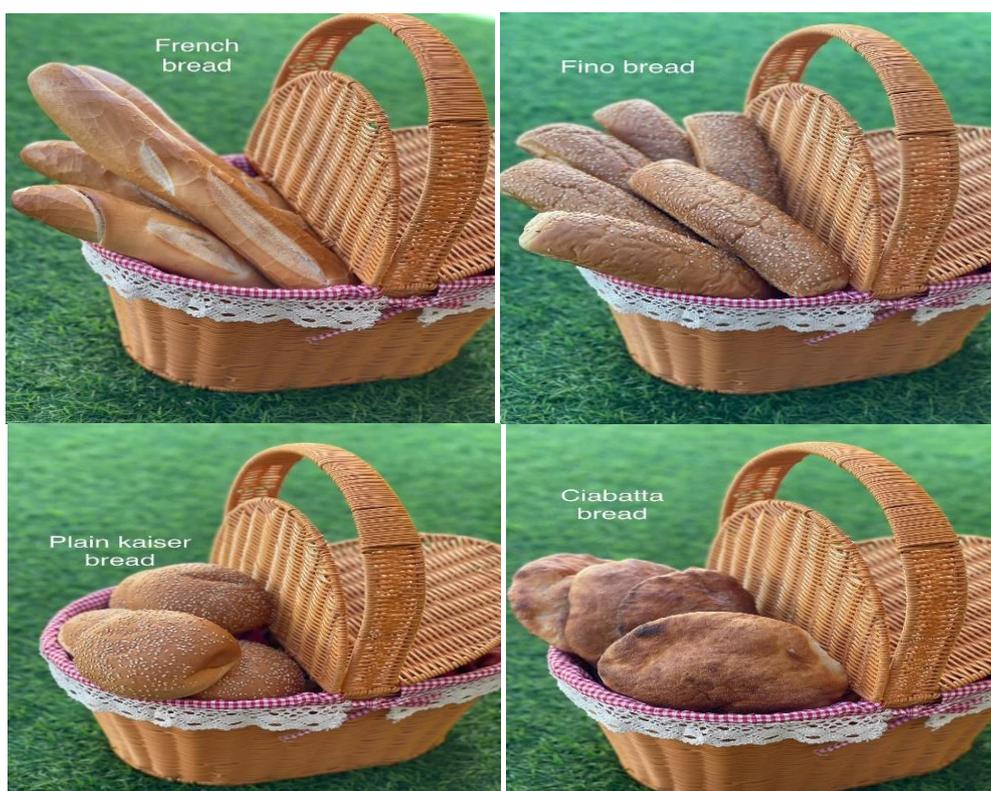


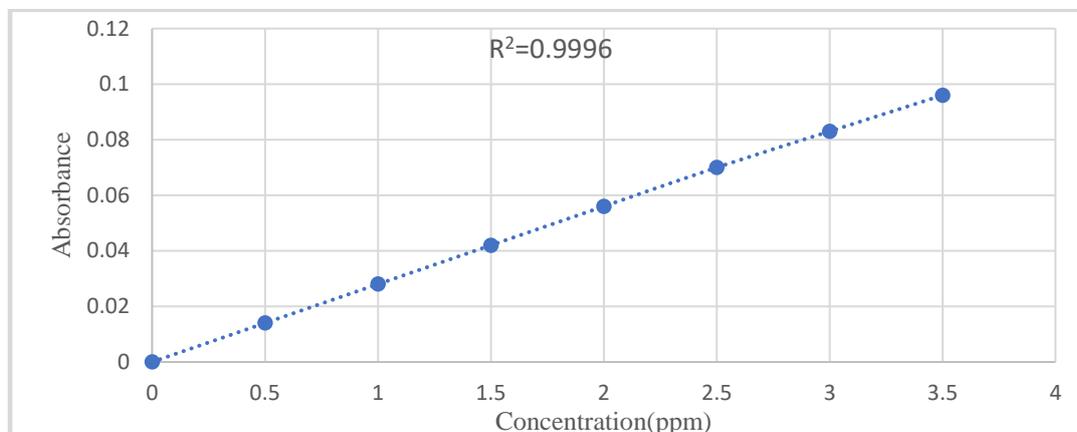
Figure 1: Types of bread.

### Sample preparation

After being sliced, the bread loaves were dried for one hour at 75 °C. With mortar, pestle and sealed containers. The crust was hand-pounded to a fine consistency. 1g of the powder was dissolved in 10.0 ml of distilled water with a magnetic stirrer, the mixture was kept at 38°C for 45 min and filtered through a wthman no 41, into 20.0ml measuring flasks, A 2.0 ml of sample was transferred into 15.0ml volumetric tube and mixed with 2ml of [ PTZ10<sup>-2</sup>M], [ 0.4mL of HCL12M] was added and the final mixture was Shaked well for 1min. The resultant colored solution was detected at 515nm using spectrophotometrically.Each sample required Three runs[9].

### Standard Preparation

A stock solution of 1000ppm potassium bromate ( $\text{KBrO}_3$ ) was prepared by dissolving (1.25g) of  $\text{KBrO}_3$  into 1L of distilling water, and 2.0 ml of [PTZ $10^{-2}\text{M}$ ] was added. Mixtures were diluted with distilled water to obtain final concentration of bromate in the range of (0.5-3.5 ppm), 0.4 ml of [HCL $12\text{M}$ ] was added. The mixture was shaken well for 1 min and the absorbances were measured at 515nm against a blank reagent, resulting in the calibration curve and calculated as shown in figure (2) with determination coefficients.



**Figure 2:** Calibration curve for potassium bromate.

### Results and discussion

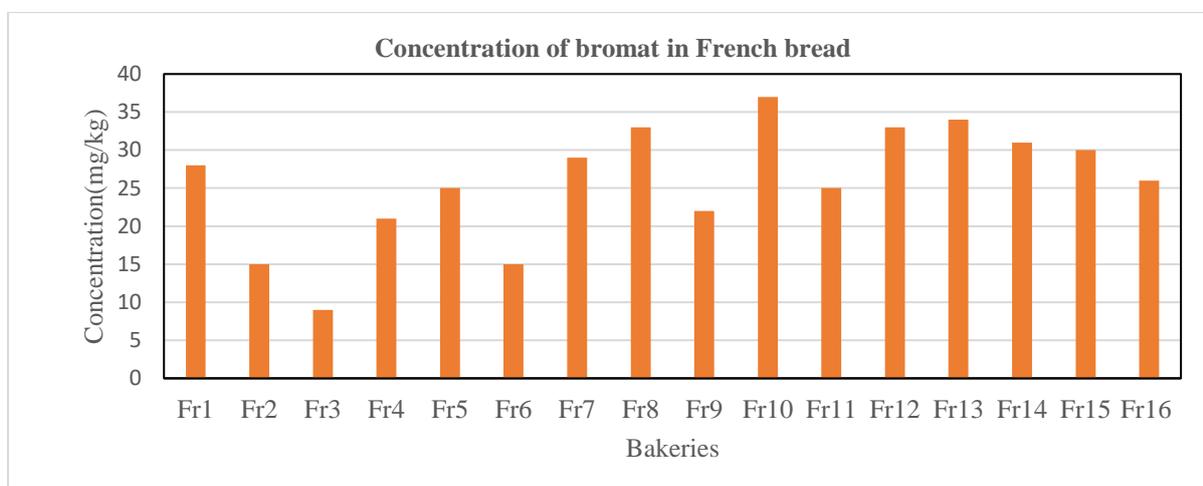
The amounts of potassium bromated found in the examined bread samples are shown in Table (1). The values are shown are the average of three separate determinations. The Fr1 sample had the greatest potassium-bromated concentration (60mg/Kg). In contrast, the Fr3 sample had the lowest levels (9 mg/Kg). the FDA's residual potassium bromated value threshold of (0.02 mg/Kg) exceeded by these quantities.

**Table 1;** potassium bromate concentration in types of bread collected from bakeries in Zawiya city (mean  $\pm$  sd)

Baked product	Sample code	potassium bromated concentration mg/Kg
French bread (Fr)	Fr1	28 $\pm$ 0.816
	Fr 2	15 $\pm$ 1.632
	Fr3	9 $\pm$ 1.633
	Fr4	21 $\pm$ 1.732
	Fr5	25 $\pm$ 1.244
	Fr 6	15 $\pm$ 1.194
	Fr7	29 $\pm$ 1.447
	Fr 8	33 $\pm$ 1.669
	Fr9	22 $\pm$ 1.693
	Fr10	37 $\pm$ 1.245
	Fr11	25 $\pm$ 1.343
	Fr12	33 $\pm$ 1.696
	Fr13	34 $\pm$ 1.237
	Fr14	31 $\pm$ 1.694
	Fr 15	30 $\pm$ 1.247
	Fr16	36 $\pm$ 0.618
	Mean $\pm$ sd (Min- Max)	26.43 $\pm$ 1.254 (9 - 37)
Plain kaiser bread (P)	P1	30 $\pm$ 1.414
	P2	42 $\pm$ 1.662
	P3	34 $\pm$ 0.471
	P4	35 $\pm$ 1.635
	P5	34 $\pm$ 1.414
	P6	35 $\pm$ 0.500

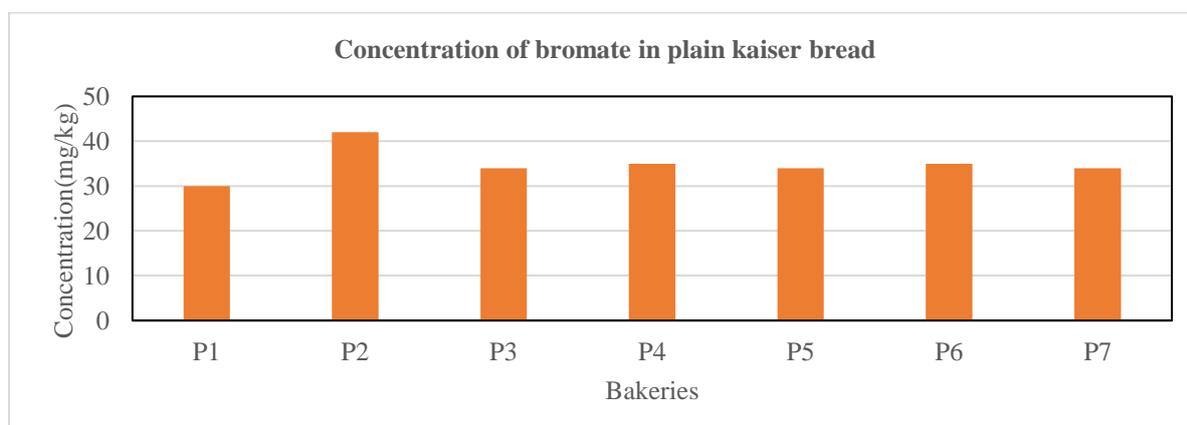
	P7	34±1.00
	Mean ±sd (Min - Max)	34.85±1.128 (30-42)
<b>Ciabatta bread</b> (C)	C1	43±0.500
	C2	34±1.00
	C3	31±0.500
	C4	34±1.00
	Mean ±sd (Min -Max)	35.50±0.75 (31- 43)
<b>Fino bread</b> (Fi)	Fi1	60±1.00
	Fi2	34±1.00
	Mean ±sd (Min - Max)	47±1.00 (34 -60)

In figure3, the average bromate content of 16 French bread samples is contrasted. sample Fr10 had the maximum bromate level(37mg/Kg), while sample Fr3 had the lowest amount (9mg/Kg).



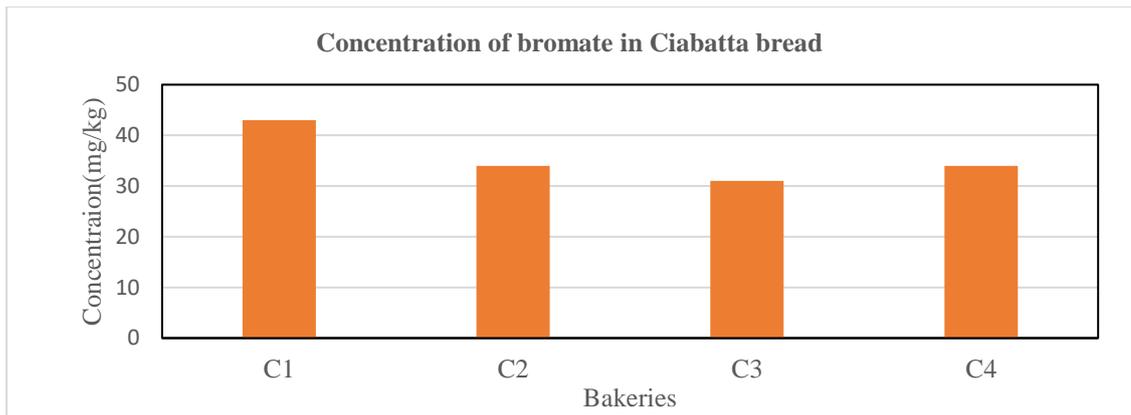
**Figure 3:** Concentration of bromate in French bread samples.

A comparison of the mean Bromate content across seven samples of regular Kaiser bread is shown in Figure 4. Sample P2 had the highest bromated level (42mg/Kg), while sample P1 had the lowest level (30mg/Kg).



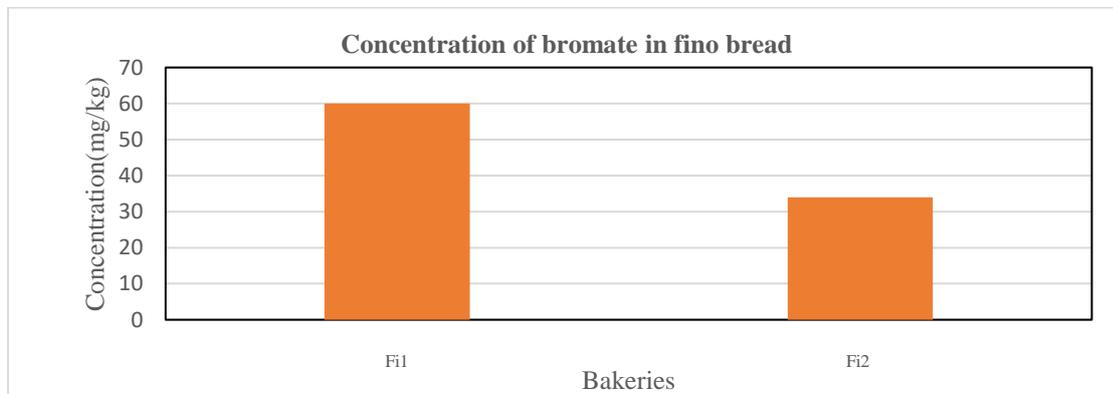
**Figure4:** Concentration of bromate in plain Kaiser bread samples.

A comparison of the mean Bromate content across four ciabatta bread samples is show in Figure 5. Sample C1 had the highest bromated level (43mg/Kg), whereas sample C3 had the lowest level (31mg/Kg).



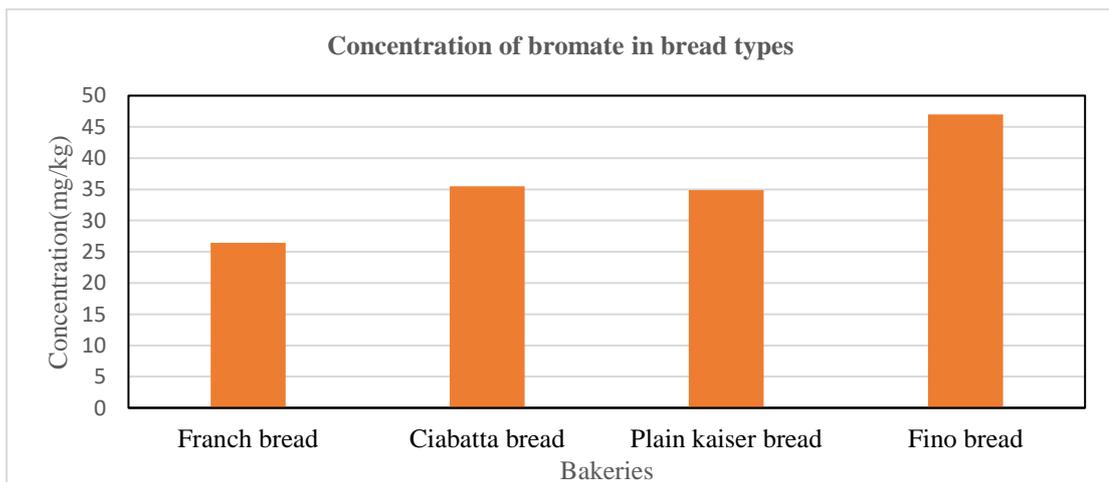
**Figure 5:** Concentration of bromate in Ciabatta bread samples.

A comparison of the mean Bromate level in two samples of fino bread is shown in Figure 6. Sample Fi1 had the highest bromated level (60mg/Kg), while sample Fi2 had the lowest level (34mg/Kg).



**Figure 6:** Concentration of bromate in Fino bread samples.

By comparing the average values of potassium bromate concentration in different types of bread, we noticed that the highest average concentration was found in Fino bread (47mg/Kg) and the lowest value was found in Franch bread (26.43mg/Kg) as in figure 7.



**Figure 7:** The mean concentration of bromate in four types of bread samples.

**Conclusion**

The results of our investigation (9-60mg/kg) closely matched Tunisia (5.95- 49.31 µg/g) [10] Nigeria (6.33-41.336 µg/g) [11]and Iraq (11.09-67.45 µg/g) [12] The levels of potassium bromate found in bread samples gathered from Zawiya bakeries could be attributed to a combination of factors such as low baking temperatures, prolonged baking times, and high flour potassium bromate content. The health implications of excessive potassium bromate ingestion are quite harmful. [13].

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