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Qualitative and quantitative analysis of Carcinogenic potassium bromate in different bread samples

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ABSTRACT

Potassium Bromate is considered as a genotoxic carcinogen and an active agent which causes thyroid related problems. Potassium Bromate is used in the bread, pizza and burger food products to strengthen the dough and its elasticity. The countries like European Union, China, South Korea, Sri Lanka, Canada, Brazil, Peru and Colombia have banned the use of this toxic chemical as a flour treatment agent. But India allows the use of Potassium Bromate up to 50 ppm on flour mass basis. Our study is focussed on the determination of Potassium Bromate content in different bread samples of different brands available in Indian Market. Potassium Bromate was extracted from each sample and its concentration is determined by using UV-Visible spectroscopy. It was found that the concentration of Potassium Bromate in the samples is in between 8 to 30.75 ppm.

Keywords: Potassium Bromate; Carcinogenic; UV-Visible Spectrophotometer

INTRODUCTION

Forensics is the use of basic sciences in the investigation of crime. Collection, preservation and analysis of the evidences in the forensic science laboratory are the various functions of the forensic scientist. Any field can be forensic, if certain section has developed over time to encompass the majority of forensically related cases. "Criminalist" is another term which is commonly used in U.S.A. Forensic Science embraces all branches of physical and natural science (Nabar, 2012).

The history of term originates from Roman Times, during which a criminal charge meant presenting the case before a group of peoples in the unit. The case will be divided in favour of the individual with the best argument and delivery. The term forensics in the field Forensic Science can be considered correct, as the term forensic is effectively a synonym for legal or related to the court. (Matihil, 2012).

The word "Toxicology" arisen from the Greek word "Toxicon" which means a poisonous substance (State DFS Mannual). Traditionally, the toxicology is

defined as the science which deals with the knowledge, origin, property, fatal effect, fatal dose and analysis of poison. (DFS Mannual). The Toxicologist is a trained person to examine the role of such substances and their adverse effects, the variety of a potentialadverse effect and the diversity of the chemicals present in an environment contribute to make toxicology a very broad field of science. The professional role of toxicologist falls into four main parts such that Forensic, Industrial, Clinical and Environmental Toxicology. Forensic toxicology emerged as the combination of analytical chemistry and toxic principal effects. The forensic toxicologist primarily works in establishing the cause of death and analysing its evidences in post mortem investigation. (Parikh, 2004) Toxicology is the science which deal with the substances, their characteristics, mode of action, symptoms, fatal dose, treatment, method of their detection and autopsy findings (cdn.downtoearth.org.in). The function of forensic toxicology is the legal outcome of the toxicological findings and the technology utilized, for the obtainment and interpretation of result. Sections 284, 299, 300, 304A, 324, 326 and 328 of IPC deals with the offences relating to the uptake of poisons. A poison is a substance which when administered, inhaled or ingested as capable of acting deleteriously on the human or animal body (Parikh, 2004). In law, the real difference between medicine and poison is the reason for which it is taken. If the substance is given with the intension to save life, it is medicine but if it is given with the intension to cause bodily harm it is poison (Parikh, 2004).

About potassium bromate:

Use of chemicals, as food additives is a common practice in packaged and processed foods. Not all of them are safe. One such additive is potassium bromate ($KBrO_3$) which is used in most parts of the world to treat flour for bread and bakery products. $KBrO_3$ is used to give the product a high rise and uniform finish. It is utilised as a flour treatment agent because of the assumption that no residues of bromate are found in the final product. As the bread and bakery products are widely consumed food articles, it is important to prevent the population from using this cancer-causing chemical. The Food Safety and Standards Authority of India (FSSAI) should take cognizance of why and how this chemical is regulated in the rest of the world, and bans its use in India. In addition to this, the use of potassium iodate as a flour treatment agent should be banned. It is not allowed to be used in several countries on account of possible higher intake of iodine.

Objective:

Determination of potassium bromate qualitatively and quantitatively in different brands of bread samples with the help of ultraviolet-visible spectrophotometry.

MATERIALS & METHODS

EQUIPMENTS	REAGENTS
-20 Breads samples - Test tubes - Beakers - Spatula -UV-vis spectrophotometer - Pipette - Conical flask - Measuring cylinder	-Potassium Bromate - Distilled water -Potassium iodide -Hydrochloric acid

Samples:

Twenty different commonly used bread which were available in the local markets of Nagpur city of Maharashtra state were selected for the study. The bread's brand names are as follows:

Sr. No.	Bread Samples	Sr. No.	Bread Samples
1	Pizza Base	11	Sweet Bun
2	Sandwich bread	12	Milk bread
3	Fruity Bun	13	Fruity bread
4	Milk Pav	14	Brown bread
5	Cup Cake	15	Pizza bread
6	Doughnut	16	Pav Bhaji bread
7	Burger Bun	17	Ajit's sandwich bread
8	Haldiram's Atta bread	18	Bun pav
9	Cake base	19	Bread
10	Bun	20	Pav bhaji

Qualitative analysis of potassium bromate in bread-

1. Small sample from each bread brand was measured out into different test tubes.
2. Water was added to wet the samples
3. 0.5ml of 1% potassium iodide solution in 2M HCl was added.

Figurer 1

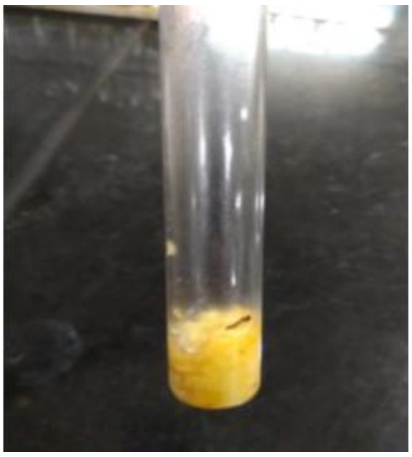

Figure 2

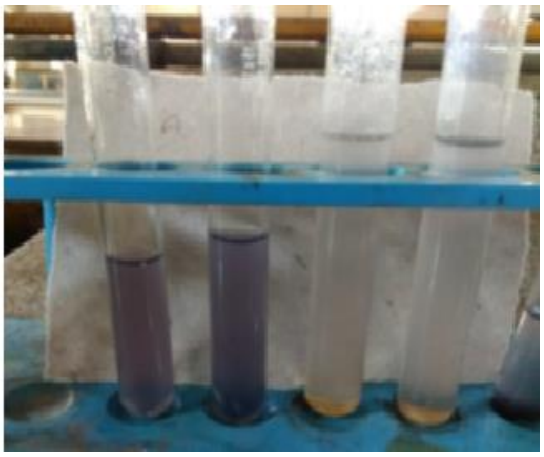

Figure 1

4. The test tubes were labelled, covered with foils and allowed to stand for a day.
5. The appearances of black spots on the samples indicate the presence of potassium bromate in the bread samples.

Quantitative analysis of potassium bromates in bread:

1. 1.0 g quantity was weighed out from the crumb part of each bread sample using an electronic weighing balance in the different test tube.
2. 10 ml of distilled water was added; the mixture was shaken and allowed to stand for 20 minutes at 28^0 C
3. 5.0 ml volume was decanted from the test tube. 5.0 ml quantity of freshly prepared 1% potassium iodide solution in 0.1N hydrochloric acid was added.
4. Colour change was observed from milky to light purple with variations in the degree of colour change.
5. The absorbance of the sample was taken at 352 nm in a colorimeter and converted to concentration using a calibration curve constructed for potassium bromate using the pure sample.
6. The pure sample for the calibration curve was prepared by weighing out 10 mg of potassium bromate using a weighing balance, and dissolved in 1000 ml of distilled water.
7. Different concentration were made from the pure sample of concentration as 2.5, 5, 7.5, 10, 12.5, 25, 30, 35 40 and 50 ml and make it full up to 50 ml by adding water.
8. A 50 ml quantity of freshly prepared 1g of potassium iodide solution in 0.1N HCl was added to each pure sample.
9. The absorbance of the sample was taken at 352 nm in a UV-Vis spectrometry.
10. And plot a graph of absorbance against concentration and got the concentration of the given samples of bread by using the calibration curve.

Table 1 : Absorbance of Potassium Bromate solution with known concentration:

Sr. No.	Concentration (ppm)	Absorbance
1	2.5	0.24
2	5	0.38
3	7.5	0.48
4	10	0.61
5	12.5	0.72
6	25	1.26
7	30	1.54
8	35	1.76
9	40	2.06
10	50	2.66

Table 2: Absorbance and concentration of different solutions of bread and pizza samples:

Sr. No.	Samples name	Absorbance	Concentration(ppm)
01	Pizza Base	0.58	9.5
02	Sandwich bread	0.52	8.5
03	Fruity Bun	0.85	15.5
04	Milk Pav	0.86	15.75
05	Cup Cake	0.64	11.25
06	Doughnut	0.60	10.25
07	Burger Bun	1.24	24
08	Haldiram's Atta bread	0.55	9.25
09	Cake base	0.76	13.75
10	Bun	1.50	29.5
11	Sweet Bun	1.44	29.5
12	Milk bread	1.34	26
13	Fruity bread	1.43	27.75
14	Brown bread	1.53	30.25
15	Pizza bread	1.26	24.25
16	Pav Bhaji bread	1.00	18.75
17	Ajit's sandwich bread	0.55	9
18	Bun pav	1.02	19.25
19	Bread	0.91	16.75
20	Pav bhaji	0.83	15

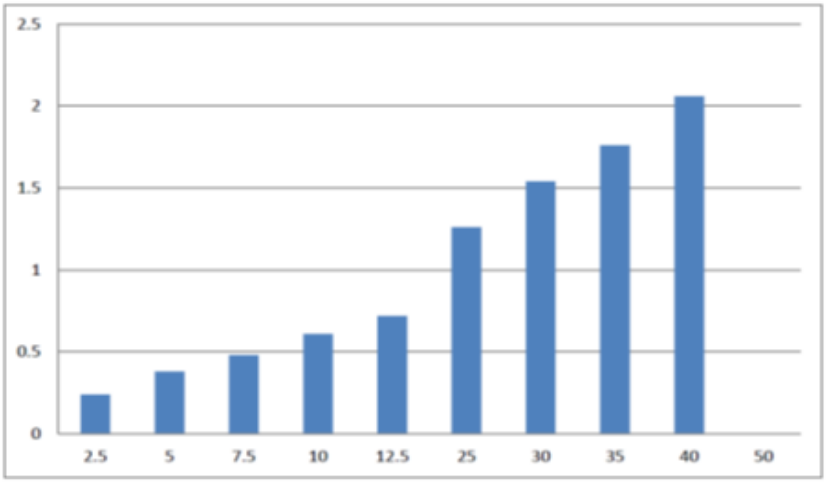

Figure 4: Graph for serial dilution

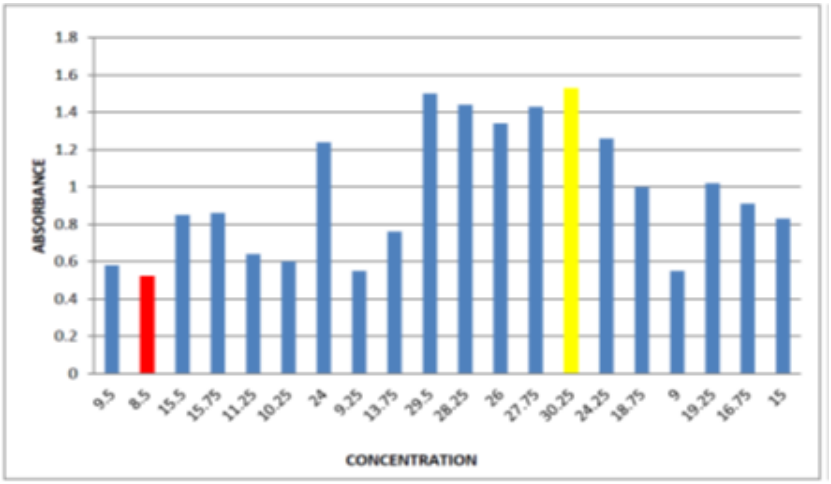

Figure 5: Graph for unknown absorbance

CONCLUSION

The study concludes that the concentration of cancer-causing potassium bromate in various bread and pizza samples is below the limit as given by FSSAI. But, regular eating of such food materials can cause the cancer and the renal failure. So, it is advisable to the manufacturer to find an alternative to potassium bromate which will not produce any toxic effects on human health.

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