



DETERMINE OF POTASSIUM BROMATE CONCENTRATION IN SELECTED BOTTLES OF STERILE DRINKING WATER

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ABSTRACT

The study included determining the concentration of potassium bromate in (20) samples of bottled drinking water and various origins in the local markets in the city of Baghdad has been used ion chromatography to measure ion bromate and the results range from (0-5.6)part per billion which is within the allowable concentration, which varies depending on the allowable concentration level of bromate ions in drinking water disinfected by ozone as defined by global health organizations as well as within the allowable limits for the concentration of bromate that between(1-10).

KEYWORDS: Potassium Bromate, Drinking water, Ozone and Ion Chromatography

INTRODUCTION

To ensure the drinking water is safe that means we need a safety disinfection process, commonly chlorine used as oxidizing agent unfortunately some of the byproducts of this process are harmful such as trihalomethanes and the international agent for research on cancer (IARC) considered this substance as carcinogenic for that it was alternative methods of drinking water disinfection, one of them which replacing chlorine is ozone. Ozonation is an effective disinfection process that is used worldwide. Ozone a unstable toxic gas with powerful oxidizing properties, formed from oxygen by electrical discharges or ultraviolet light(1) It differs from normal oxygen (O₂) in having three atoms in its molecule (O₃). The ozonation suffers from a major risk namely the formation of bromate ions, bromate ions not normally found in raw or sources of water(2) but when the sources of water from underground or from surface water may be contains bromide ions and when ozone reacts with relatively non-toxic bromide amount to produce toxic bromate as byproduct and the following chemical equations show the pathway of oxidation of bromide to bromate through the intermediate formation of hypobromine(3):



This reaction depends on the pH of water and the temperature and time period for reaction and also the concentration of ozone. The International Bottled Water Association (IBWA) is authoritative source of information about all types and members brands of bottled water and the Office Environmental Health Hazard Assessment (OEHHA) has developed a public health goal (PHG) of 0.1 part per billion this is based on study by (4) in which the

authors related cancer in male rats. Bromate is an active oxidant in biological systems and has been shown to cause an increase in renal and thyroid follicular cell tumors in rats(5). The U.S. Environmental Protection Agency (U.S.EPA) the maximum contaminant level goal (MCLG) for bromate is set as zero based on carcinogenicity and the maximum contaminant level (MCL) is set to 10 part per billion based on the practical quantification limit(6) and also the list of U.S.EPA classification of bromate as probable human carcinogen(7). The proposals to reduce bromate formation using an alternate water sources without or with a low bromide concentration. Only a few methods have been reported for the determination of traces level or low concentrations of Potassium bromate(8,9). In this study, Potassium bromate was estimated by ion chromatography method as published in (12).

MATERIALS & METHOD

The materials were prepared as in (11) also as in ISO15061:2001 which is also as a part of the German standard method for water(12)

Samples and stocks preparation

- 20 different brands of bottled water that disinfected by Ozonation were collected from logical market in Baghdad.
- Standard stock solution was prepared by dissolve 1.31 gm. Of potassium bromate in one liter of deionized water .
- Calibration standards: five standard solutions were prepared by dilution of above standard stock with deionized water. The concentrations of these solutions between 1ppb and 25ppb.
- Eluent solution: a 20 mM of sodium hydroxide solution by dilute 2mL of 400 g/l of 10 M NaOH to 1 liter of deionized water.

Determine of potassium bromate concentration in selected bottles of sterile

- The concentration of Potassium Bromate were determined by using ion Chromatography system including Dionex ICS-2500. The concentration of potassium Bromate as shown in the table(1):

Table(1) potassium Bromate concentration in sample

No. of sample	Origin	Conc. Of KBrO ₃
1	Iraq/Baghdad	5.2
2	Iraq/Baghdad	5.3
3	Iraq/Basra	5.0
4	Iraq/Duhok	1.6
5	Iraq/Baghdad	1.6
6	Iraq/Touirij	3.9
7	Saudi Arabia	1.1
8	Iraq/Baghdad	2.2
9	Iraq/Babylon	3.9
10	Kuwait	1.1
11	Iraq/Baghdad	1.1
12	Iraq/Baghdad	5.3
13	Iraq/Baghdad	5.1
14	Iraq/Touirij	5.1
15	Iraq/Karbala	5.0
16	Iraq/Baghdad	4.1
17	Iraq/Touirij	5.6
18	Iraq/Basra	5.1
19	Iraq/Baghdad	3.5
20	Iraq/Babylon	3.3

RESULTS & DISCUSSION

This study determined the concentrations level of potassium Bromate in drinking water that disinfection by Ozone and the results shown the levels of bromate. Many countries have established concentration limits for certain disinfection byproducts and one of them bromate ion which set the upper limit sat at 3-10 part per billion in Europe and USA. In above table were safety and that provide the water sources not contain bromide ion because bromate is not commonly found in source of water but it may be formed as byproduct of Ozonation process

RECOMMENDATIONS

1-Add allowed limit for bromate ion concentration in the Iraqi standard for drinking water which disinfected by ozone

Water testing before the ozone sterilization process and if found bromide must amend the ozone process conditions by reducing the pH or the concentration of ozone or reaction time.

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