

# A Review on Evaluation of Bromide Ion Concentration In water Samples From Himatnagar, Sabarkantha District, Gujarat

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## ABSTRACT

Developed projects of State Standards of Himatnagar, Gujarat referring to evaluation of bromide ions in waters of different types. The method of determination of bromide ions is based on reflection spectra of bromination of phenol red. The method make it possible to determine bromide ions within the interval 0.03–0.5mg/dm<sup>3</sup>. A special attention is given to the study of interfering impact of water components and methods to remove it.

**Keywords:** Gas extraction, bromide ions, chemiluminescence, Maximum allowable concentration(MAC), Carcinogenic nitrosamines, ion chromatography

## I. INTRODUCTION

Bromide ion in drinking water is necessary to be controlled due to formation of carcinogenic bromates at oxidizing disinfection by chlorine and ozone. Maximum allowable concentration (MAC) for bromate constitutes 10 µg/dm<sup>3</sup> [1]. Therefore, the development of standard high sensitive techniques required for detecting bromide ions in water.

### Evaluation of Bromide ion concentration

For determination of bromide ions in waters kinetic, electrochemical and photometric methods are described as well as ion and gas chromatography [2]. Ion chromatography is a standard method for evaluation of bromide ion concentration [3].

Recently a method [4] has been developed based on decolouration of the dye methylene blue by bromine generated at oxidizing of bromide by bromate in an acid medium. The detection limit of bromide (DL) with the use of diffusion of bromine molecules through a gas permeable membrane into the solution of methylene blue constitutes 0.4 mg/dm<sup>3</sup>. Bromine activity in the chemiluminescent reaction with

luminol was used in method [5], where bromine formed during oxidation of bromide by chromic acid, by the stream of the carrier gas is transferred to a cavity placed into a luminometer containing an alkaline solution of luminol. DL of bromide-ions by luminescence in the reaction luminol-bromine constitutes 1.5 µg/dm<sup>3</sup>.

Proposed method is visualization of bromide ion as a tracer in waters and soil profiles [7] by means of reaction of Bromine with Ag<sub>4</sub>[Fe(CN)<sub>6</sub>] with the formation of Prussian Blue K<sub>4</sub>[Fe(CN)<sub>6</sub>] potassium ferricyanide and sparingly soluble compound AgBr. DL of bromide ions in the aqueous solution—11 mg/dm<sup>3</sup>. Also developed are test systems for bromides in waters based on measuring the length of dark zone of strip of the indicator paper, whose one end was in contact with the liquid being studied [8]. DL of bromide with the use of paper impregnated by Ag<sub>2</sub>CrO<sub>4</sub> silver chromate constitutes 0.15 mg/dm<sup>3</sup>. Described method for evaluation of bromide ions in waters in the interval of concentrations 0.92–6.5 mg/dm<sup>3</sup> by the method of solid phase spectrophotometry [9], which lies in bromination of pararozanilin immobilized on cation-exchanger

KRS8P and measuring optical density of the sorbent layer 0.5 mm thick on photoelectrocolorimeter. In the literature the description of the methods for evaluation of bromides based on reflection spectrophotometry is not found except [10, 11]. Paper [10] is based on bromination of fluorescein and preconcentration on membrane filters of colored product—ion associate of eosin with cationic surfactant. DL of bromides is about  $11 \mu\text{g}/\text{dm}^3$ , but reproducibility of the method is poor. Paper [11] is based on bromination of Fuchsin Basic and isolation of sparingly soluble coloured product on nitrocellulose membrane filters. DL does not differ from one achieved in [10], however evaluation of bromide is increased by 120 fold excess of chloride ions, which limits usage of the method. Inclusion into new standards of water quality is more selective method based on bromination of dye Phenol Red, where instead of measuring optical density of solutions the spectra of diffuse reflection of colored concentrates are recorded. The method of evaluating mass concentration of bromide ions is used for water intended for human consumption including bottled water and water of add on purification. It is based on oxidation of bromide ions to bromine, by subsequent bromination of reagent Phenol Red (PR), on isolation of blue colored product—Bromophenol Blue (BPB) on the filter paper through filtration and recording of the spectra of diffusion reflection of obtained dark spots.

## II. EXPERIMENTAL

Solutions of reagents were prepared in distilled water, The initial solution ( $1 \text{ g}/\text{dm}^3\text{Br}^-$ ) was prepared from KBr “specially pure”,  $5.7 \times 10^{-5} \text{ M}$ , solution of PR—from the preparation of Phenol Red watersoluble, “pure for analysis”, acetate buffer solution with pH 5 from  $10^{-5} \text{ M}$  of anhydrous sodium acetate and glacial acetic acid, “chemically pure” in the presence of  $12.4 \times 10^{-3} \text{ M}$  of ammonium acetate, “chemically pure”, solution of chloramine T—from the initial  $0.1 \text{ M}$  solution. Before the use solutions of Phenol Red and acetate buffer were merged in the ratio 1 : 1.

In filtration of the solutions filter paper Filtrak was used and also a Teflon collapsible Buchner funnel for  $150 \text{ cm}^3$  with effective filtration area of  $1.2 \text{ cm}^2$ . Spectra of light absorbing solutions as well as the spectra of diffusion reflection of dark spots were recorded by means of a spectrophotometer with an attachment for recording spectra of diffusion reflection. Water samples for analysis were taken. All special recommendations were fulfilled related to the types of waters being evaluated. Water samples were stored in glass ware. The tests were carried out on the day samples and they were not conserved.

Gradient of solutions of bromide ( $80 \text{ cm}^3$  each) with the mass concentrations of bromide ions 0, 0.025, 0.05, 0.10, 0.2 and  $0.4 \text{ mg}/\text{dm}^3$  were transferred to conical flasks  $250 \text{ cm}^3$ , each flask was added with  $5.0 \text{ cm}^3$  of mixed reagent (solution  $5.6 \times 10^{-5} \text{ M}$  of Phenol Red and acetate buffer solution with pH 5 with theratio 1 : 1), was stirred, then  $5.0 \text{ cm}^3$  of solution  $2.5 \times 10^{-3} \text{ mol}/\text{dm}^3$  of chloramine T was added, solution was diluted with distilled water to  $100 \text{ cm}^3$ , was held out for 10 min and filtered through a paper filter “blue ribbon”. The filter then was taken out of the filter holder, dried out and the spectrum of diffuse reflection was noted.

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