Ion-pair extractive spectrophotometric determination of isopropamide iodide in pharmaceutical formulations and environmental wastewater samples using Bromo phenol blue

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المستخلص

تم تطوير طريقة طيفية تمتاز بالبساطة والدقة والحساسية العالية لتقدير يوديد الايزوبروباميد في مستحضراته الصيدلانية وفي المياه الصناعية المطروحة تعتمد الطريقة على تكوين مزدوج ايوني بين يوديد الايزوبروباميد وبروموفينول الأزرق وتم استخلاص الناتج الملون بواسطة الكلوروفورم حيث أعطى أقصى امتصاص عند600 نانومتر.حيث وجد أن قانون بير يسري على الكميات التي تتراوح بين 2 - 20 مايكروغرام/مل. و معامل الامتصاص المولاري ودلالة ساندل كانتا3.17×10^4 لتر/مول.سم و15.15 نانوغرام\سم^2 على التوالي.وان الانحراف القياسي النسبي للطريقة أفضل من 1.5% .وطبقت الطريقة بنجاح لتقدير يوديد الايزوبروباميد في في المياه الصناعية المطروحة وفي مستحضراته الصيدلانية (الحبوب)

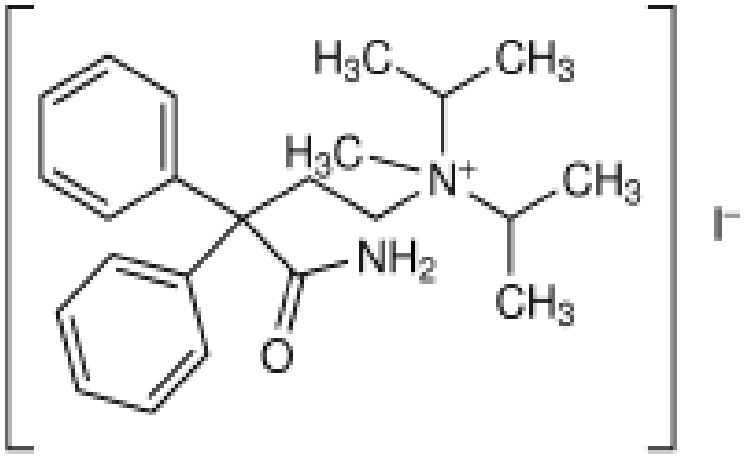
Abstract

A simple, accurate and sensitive spectrophotometric method was developed for the determination of isopropamide iodide in pharmaceutical formulations and environmental wastewater samples. The method was based on the formation of ion-pair between isopropamide iodide and bromophenol blue (BPB). The colored product was extracted into chloroform and measured spectrophotometrically at 600 nm. Beer's law was obeyed in the concentration range of 2.0-20.0 µg/mL with molar absorptivity and Sandell's sensitivity of 3.17×10^4 L /mol. cm and 15.15 ng/.cm^2 respectively. The relative standard deviation (RSD) is better than 1.5. The method was applied successfully to the determination of isopropamide iodide in environmental wastewater samples and in pharmaceutical formulations (tablets).

Keywords: Isopropamide iodide, spectrophotometry, bromophenol blue.

Introduction

Isopropamide iodide, (3-carbamoyl-3,3- diphenylpropyl) di- isopropylmethyl ammonium iodide Fig(1), is a quaternary ammonium antimuscarinic with peripheral effects similar to those of atropine. It is used as an adjunct in the treatment of peptic ulcer disease, in the relief of gastrointestinal and urinary-tract disorders associated with smooth muscle spasm [1].



Molecular formula: C23H33IN2O

Molecular weight: 480.42

Fig (1):Chemical structure of isopropamide iodide.

The literature survey reveals that several methods have been reported for determination of isopropamide iodide in pure form and in pharmaceutiacal formulations. Official method includes potantiometric titration for pure form and Uv spectrophotometric method for tablets [2] .The spectrophotometric method include second derivative and ion-pair complexation reaction [3-8] .Other methods reported for determination of isopropamide iodide like high-performance liquid chromatography [9] , and with other drugs by LC methods[10-12]. Spectrophotometry is by far the instrumental technique of choice in the laboratories of underdeveloped and developing nations for the quantification of drugs, owing mainly to its simplicity, high sensitivity and selectivity and often demanding low-cost equipment. The objective of the present work is to develop and validate a simple, sensitive and economically viable spectrophotometric method for the determination of isopropamide iodide in bulk and in their pharmaceutical formulations. The proposed method was based on the extraction of isopropamide iodide into chloroform as blue colored ion pair with bromophenol blue. The blue colored ion pair was quantitated spectrophotometrically at 600 nm. The proposed method has been validated for linearity, sensitivity, precision, accuracy, and selectivity .

Material and method

Apparatus

Spectro-scan 50 UV- visible (double beam) spectrophotometer with 1.0 cm quartz cells was used for absorption measurements.

Reagents

All chemical used were of analytical or pharmaceutical grade and distilled water was used throughout. Standard materials and pharmaceutical preparations (isopropamide iodide tablets) were provided from ALhokamaa Company for pharmaceutical industries (HPI) Mosul-Iraq.

Isopropamide iodide solution (0 .01%): This solution was prepared by dissolving 0.01 gm of isopropamide iodide in **100** ml distilled water in a volumetric flask .

Buffer solution (pH10)

This solution contains 50 ml of 0.05 M sodium bicarbonate and 10.7 ml of 0.1M sodium hydroxide ,it was then diluted to100 ml by distilled water in a volumetric flask [13] .

Bromo phenol blue (0.1%) [BDH, UK]: This solution was prepared by dissolving 0.1 gm of Bromophenol blue in **100** ml distilled water in a volumetric flask

Recommended procedure

Aliquots of standard drug solution of isopropamide iodide 0.5- 5 ml were taken and transferred into a series of 50 ml of separating funnels. To each funnel 3.0 ml of buffer solution (pH10) and 2 ml of 0.1% Bromophenol blue was added. Reaction mixture was shaken gently for 5 min. Then 10 ml of chloroform was added to each of them. The contents are shaken thoroughly for 5 min and allowed to stand, so as to separate the aqueous and chloroform layer. Colored chloroform layer was separated out in dry test tubes containing anhydrous sodium sulfate. The absorbance was measured at 600 nm against reagent blank.

Procedure for pharmaceutical preparations (tablets)

Weight and powder 10 tablets. Dissolve a quantity of the powdered tablets containing 0.01 gm of isopropamide iodide in about 50ml distilled water and mixed for **20** mints and then filtered. The filtrate was mad up to 100ml with distilled water. Treat 3ml of this solution as mentioned under recommended procedure.

Procedure for industrial waste water

To demonstrate the practical applicability of the proposed method, industrial waste water sample from ALhokamaa company for pharmaceutical industries (HPI) Mosul-Iraq were analyzed by spiked with the concentrations (5, 10, 15 $\mu g.ml^{-1}$) of isopropamide iodide and aliquot of this solution was treated as described above for recommended procedures.

Results and Discussion

The ion-pair complex is a special form of molecular complex resulting from two oppositely charged ions extractable into organic solvents from aqueous phase at suitable pH. In the recent years ion pair extraction spectrophometry has received substantial significance for the quantification of many pharmaceutical compounds [14-17]. A new method has been developed for the spectrophotometric determination of isopropamide iodide. The method was based on the ion transfer complex formed by BPB, an acidic dye, and isopropamide iodide that have basic nitrogen as electron donor to yield ion-pair salts which form color compound extractable from the aqueous solution to chloroform organic phase. The absorbance spectra and proposed reaction mechanism are shown in Figure 2 and Scheme 1.

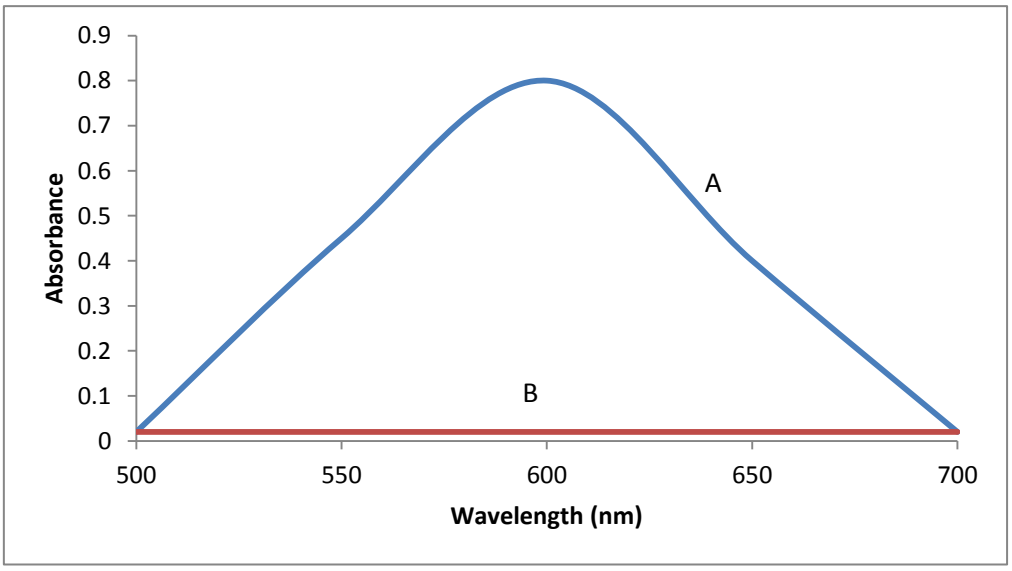
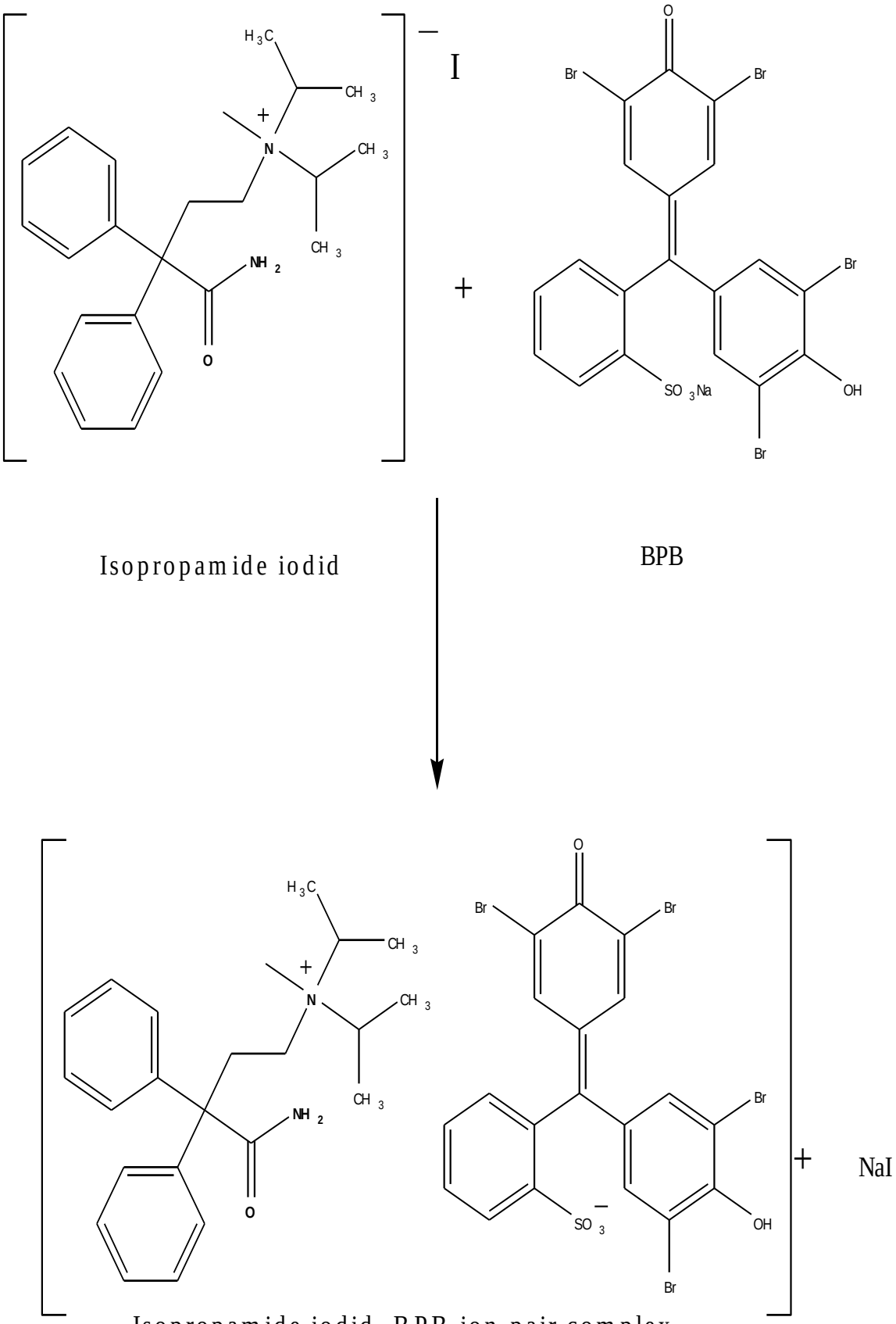


Fig [2]: Absorption spectra of A: 12µg/ml isopropamide iodide against blank. B:blank against chloroform



Scheme (1): Proposed reaction mechanism

The reaction variables were optimized by varying each variable while keeping others constant for obtaining maximum absorbance. The reaction was found to be quantitative in alkaline medium (pH 10) .It was found that 3 ml of pH10 solution give high sensitivity and this amount has been used for subsequent experiments. The effect of the amount of BPB on the absorbance was investigated. A maximum and constant absorbance was found with 1 to 5 ml of 0.1% BPB solution and 2.0 ml has been used for subsequent experiments. The effect of extracting solvent different organic solvents (chloroform, benzene, toluene, cyclohexane, and carbon tetrachloride have been tried in order to investigate their ability to extract the isopropamide iodide -BPB ion pair complex. Among the various organic solvents tried, chloroform was found to be the most appropriate solvent. Hence it was chosen for extraction of the isopropamide iodide -BPB ion pair complex from the aqueous phase. The color reaction occurred at room temperature immediately and remained stable for at least 6 h. and a reaction time of 5 min were selected for reproducible results. Under the experimental conditions described, Beer's law is obeyed over the concentration range 2-20 µg /ml Fig [2].Calibration curve was prepared from absorbance values so obtained

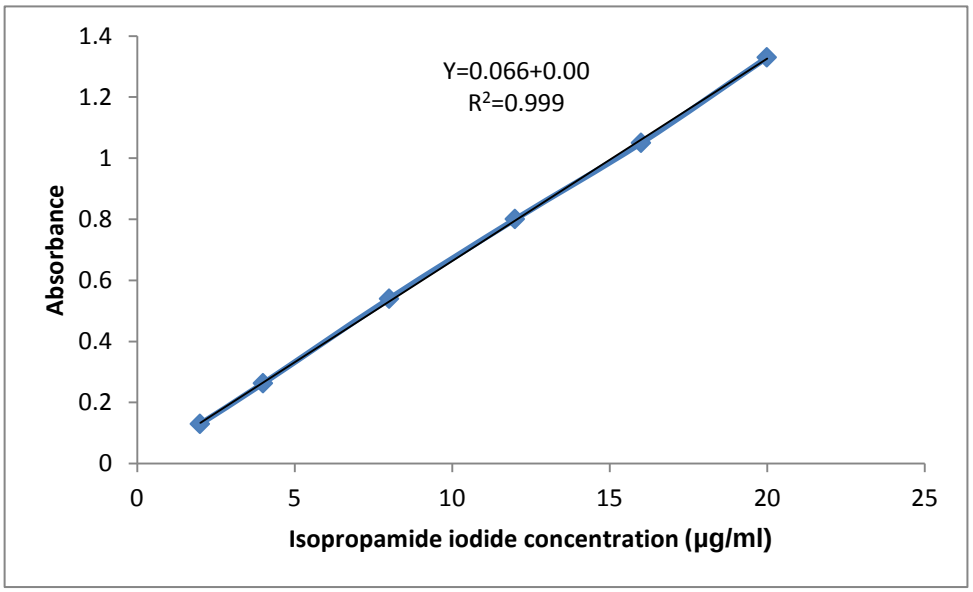


Fig. (2): Calibration graph of isopropamide iodide.

Accuracy and precision

The accuracy and precision of the method was established by analyzing the pure drug solution at three different concentrations ,each determination being repeated six times. The relative error(%) and relative standard deviation values are summarized in Table[1].From Table[1] the values of standard deviation were satisfactory and the recovery studies were close to 100%,.The RSD% value is less than 1.5 indicative of accuracy of the method.

Table[I]: Accuracy and precision of the proposed method.

isopropamide iodide taken µg/ml	Er (%)[a]	RSD(%)
5	1.01	1.3
10	1.12	1.3
15	1.20	1.4

a: Mean of six determinations

Analytical application

The proposed method was satisfactorily applied to the determination of isopropamide iodide in its pharmaceutical preparations tablets and wastewater samples ,the results of the assay of the pharmaceutical preparations revels that there is close agreement between the results obtained by the proposed method and the label claim Table [2],and the results of water samples Table [3] show that the recovery values obtained were closed to 100%.

Table [2]: Determination of isopropamide iodide in pharmaceutical formulations

Pharmaceutical formulations(HPI)	Label amount(mg)	Found by proposed method * (mg)	Recovery%
Salabid tablets	5 mg/tab	4.96	99.8

***mean value of ten determinations**

Table[3]: Determination of isopropamide iodide in wastewater samples

Wastewater samples	**Added µg/ml**	**Found* µg/ml**	**Recovery% (n=10)**
Industrial wastewater	5	5.02	100.4
	10	9.98	99.8
	15	15.08	100.5

*** mean value of ten determinations**

Conclusion

The developed method is found to be high sensitive ,accurate ,simple ,precise and economical ,and can be used for routine quality control analysis of isopropamide iodide in pure form ,bulk, pharmaceutical formulations and environmental wastewater samples.

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