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Ultraviolet Estimation Of Guaiphenesin In Pharmaceutical Preparations And Environmental Wastewater Samples.

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ABSTRACT

A simple, accurate, precise, rapid, economical and sensitive ultraviolet method has been developed for the estimation of guaiphenesin in pharmaceutical preparations and environmental wastewater samples, which shows maximum absorbance at 275 nm in 20:80 ethanol-water. Beer's law was obeyed in the range of 0.5-6µg/ ml, with molar absorptivity of 2.457 $\times 10^4$ $L.mol^{-1}.cm^{-1}$, relative standard deviation of the method was less than 1.7%, and accuracy (average recovery %) was 100 ± 1.0. No interference was observed from common excipients and additives often accompany with guaiphenesin in pharmaceutical preparations .The method was successfully applied to the determination of guaiphenesin in some pharmaceutical formulations (syrups) and industrial wastewater samples. The proposed method was validated by sensitivity and precision which proves suitability for the routine analysis of guaiphenesin in true samples.

Keywords: Guaiphenesin, Ultraviolet, Estimation, Pharmaceutical Preparations, Environmental Samples

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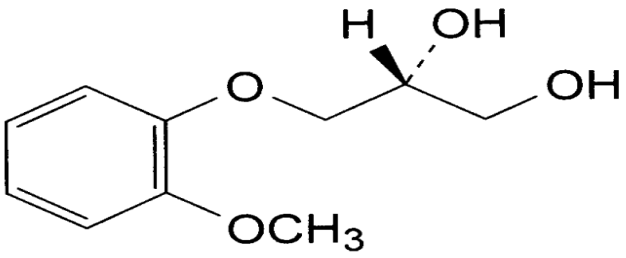
INTRODUCTION

Guaiphenesin is chemically known as 1, 2- propanediol3-(2-methoxyphenoxy) Figure1. [1] is an expectorant and widely used for the treatment of coughing [2]. Guaiphenesin may help control symptoms but does not treat the cause of symptoms or speed recovery. Guaiphenesin is in a types of medications called expectorants. It works by thinning the mucus and cleaning the airways .The usual does is 100 -200 mg every 2 - 4 hours[3-5]



and enantiomer

Molecular formula: $C_{10}H_{14}O_4$ =198.2

Figure 1: Chemical structure of guaiphenesin

Analytical procedures for the determination of guaiphenesin include titrimetry [1], various spectrophotometric [6-13], HPLC [14-20], micellar electro kinetic chromatography [21, 22]Voltametric assay[23], Capillary gas chromatography [24,25] and ion pair HPLC [26].UV- Visible methods can be used for estimation of drugs and for purposes of control throughout the entire manufacturing process of drugs, as well as quality control of the finished product .It has the advantages of being simple, sensitive, rapid, accurate and reproducible [27-29]. The present paper reports the development of a new UV method for determination of guaiphenesin in different type of syrups and industrial waste water samples.

EXPERIMENTAL

Apparatus

Shimadzu UV- 1700 pharm aspect (double beam) spectrophotometer with 1.0 cm quartz cells was used for absorption measurement.

Reagents

All chemical used were of analytical or pharmaceutical grade and guaiphenesin standard material and pharmaceutical preparations (syrups) was provided from AL-hokamaa company for pharmaceutical industries (HPI) Mosul-Iraq.

Ethanol: Water (20:80)(v/v)was used as a solvent .

Guaiphenesin standard solution 10ppm

This solution was prepared by dissolving 10 mg of guaiphenesin in 1000 ml of 20:80 ethanol: distilled water in calibrated flask.

Determination of absorption maxima

The standard solution of guaiphenesin (3µg/ml) was scanned in the range of 250-350 nm which shows maxima located at 275 nm Figure2. Therefore, 275 nm wavelength was selected for the construction of calibration curve.

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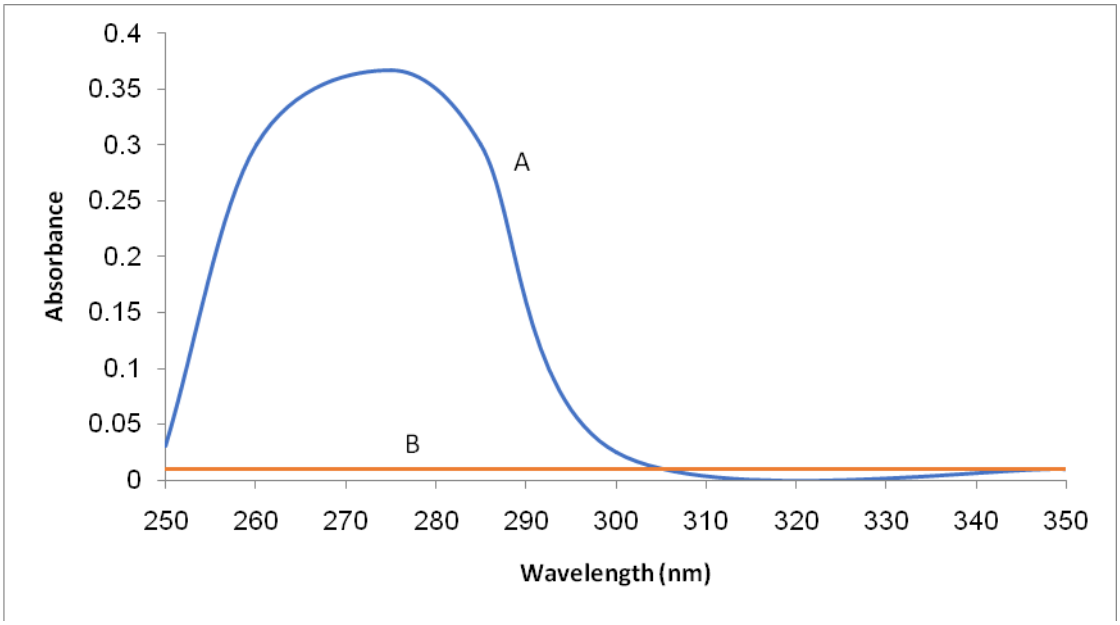

Figure 2: Absorption spectra of (A) 3µg/ml guaiphenesin against blank (20:80) ethanol: water), (B) blank against distilled water

Recommended procedure:

From the absorption maxima ,calibration curve was prepared in the concentration range of 0.5-6 µg/ml .The absorbance was measured at 275 nm against ethanol-water 20:80 as a blank .The concentration of the sample solution can be determined by using the calibration curve

Procedures for pharmaceutical preparations (syrups):

Three different type of guaiphenesin syrup provided from AL-Hokamaa Company for pharmaceutical industries (HPI) Mosul-Iraq. Formulations (Exidil 30mg/5ml, Pulmocodain 100mg/5ml and Tussilet 50mg/5ml) were selected for analysis. The content of 5 bottles of each type was mixed well in 1L dried beaker. Aliquots equivalent to 5 mg of guaiphenesin were transferred into 1L volumetric flasks and diluted with 20:80 ethanol-water to the volume to get 10µg/ml solution and aliquot of this solution was treated as described above for recommended procedure and the concentration was calculated by using the calibration curve of this method

Procedure for real water samples

To demonstrate the practical applicability of the proposed method, real water samples were analyzed by this method. Industrial waste water from AL-hokamaa company for pharmaceutical industries (HPI) Mosul-Iraq, were fortified with the concentrations in the range of 0.5,3,6 µg/ml of guaiphenesin. The fortified water samples were analyzed as described above for recommended procedure and the concentration was calculated by using the calibration curve of this method.

RESULTS AND DISCUSSION

UV- Visible estimation is still considered to be simple, low cost, convenient and widely used method for the determination of pharmaceuticals [27-29]. This method used for the estimation of guaiphenesin in pharmaceutical preparations and environmental wastewater samples was found to be sensitive ,simple ,accurate ,and reproducible .Beer s law was obeyed in the concentration range of 0.5-6 µg/ml Figure 3 with correlation coefficient of 0.9995 ,intercept of 0.0029 and slope of 0.124 .The conditional molar absorptivity was found to be 2.457×10^4 l/mol.cm

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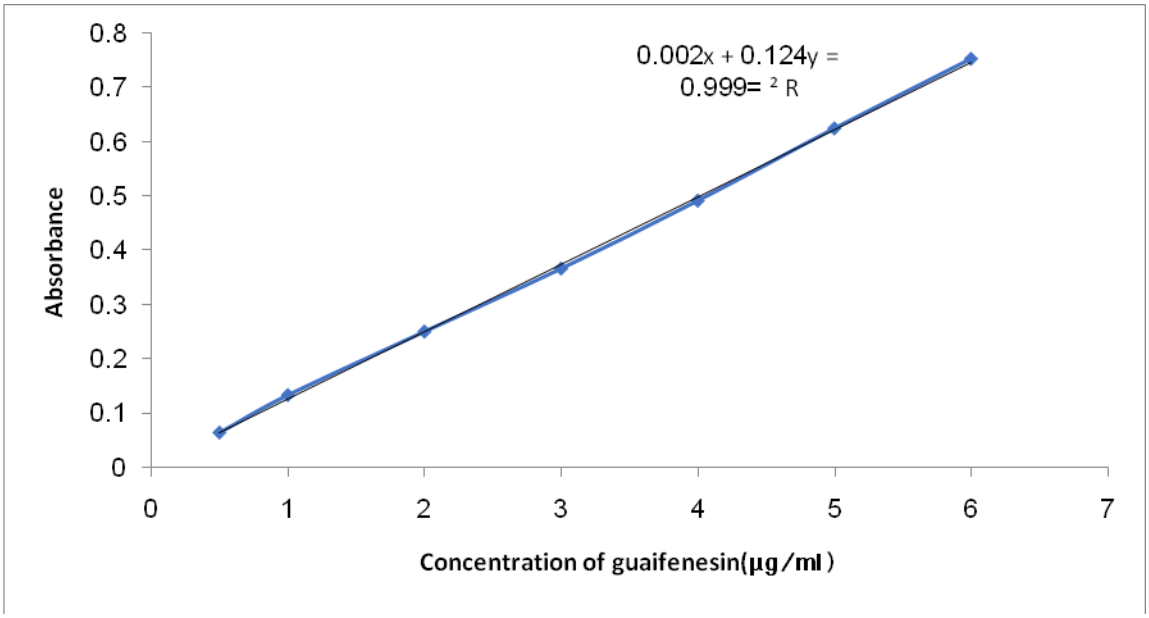

Figure 3: Calibration curve for guaiphenesin

The accuracy and precision of the method, a pure drug solution was analyzed 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 than1.7 indicative of accuracy of the method.

Table I: Accuracy and precision of the proposed method

Guaiphenesin taken(µg/ml)(	Er (%)[a]	RSD (%)
0.5	1.1	1.3
3	1.2	1.6
6	1.2	1.5

a: Mean of six determinations

The proposed method was compared with other reported UV spectrophotometric methods and found to be superior, (Table 2).

Table 2: Comparison of the existing UV photometric methods with the proposed method for guaiphenesin

Parameters	Method 1	Method 2	Method 3	. Method 4
Ref	7	8	11	Proposed
λMax(nm)	272	274	273	275
Solvents	Methanol	H_2O	Methanol	Ethanol:H_2O 20 : 80
Linear range µg/ml	30-150	10 -50	5-40	0.5-6
ε(l/mol.cm)	$8.72x10^3$	$2.378x10^3$	$2.973x10^3$	$2.457x10^4$
RSD%	Less than 2	----	0.74	Less than 1.7
Application	Tablets	Tablets	Tablets	Syrups and industrial wastewater

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Analytical application

The proposed method was satisfactorily applied to the determination of guaiphenesin in its pharmaceutical preparations syrups and wastewater samples, the results of the estimation of pharmaceutical preparations revels that there is good agreement between the label claim amount and the results obtained by the proposed method. The results were also statistically compared by variance ratio F-test and student t-test with those obtained by UV- Photometric official method (29) at 95% confidence level .The calculated F- and t-values did not exceed the theoretical values indicating that no significant differences between the precision of the proposed and literature method as cited in Table 3,and the results of water samples Table 4 show that the recovery values obtained were closed to 100%.

Table 3: Estimation of guaiphenesin formulations

Pharmaceutical formulations	Proposed method found*	official JP XVII method	Label amount	t value	F value
Exidil syrup (HPI)	6.04mg/ml	6.1mg/ml	6 mg/ml	1.8	2.1
Pulmocodin syrup(HPI)	19.92 mg/ml	20 mg/ml	20 mg/ml	0.8	1.4
Tussilet syrup(HPI)	10.06 mg/ml	10.1mg/ml	10 mg/ml	1.4	2.05

*Mean value of ten estimations

T values (n=10, at 95% confidence level tabulated value 2.262).

F values (n1-1 and n2-1 =9, at 95% confidence tabulated value 3.18).

Table 4: Estimation of guaiphenesin in industrial wastewater samples

Wastewater samples	Added µg/ml	Found* µg/ml	Recovery %(n=10)
Industrial wastewater	2	2.02	101
	4	3.97	99.25
	6	6.05	100.833

*Mean value of ten estimations

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 guaiphenesin in pure form, bulk, pharmaceutical formulations and environmental wastewater samples

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