Research Paper

Optimization and Validation of Spectrophotometric and Potentiometric Methods for Determination of Lansoprazole and Omeprazole in Pure and Capsules

M. Y. NASSAR*, M. F. EL-SHAHAT[1], S. M. KHALIL[2] AND E. A. EL-MOETY[3]

Chemistry Department, Faculty of Science, Benha University, Benha 13815, [1]Chemistry Department, Faculty of Science, Ain Shams University, Cairo, [2]National Organization for Drug Control and Research (NODCAR), Giza, [3]National Cancer Institute, Cairo, Egypt

Two fairly sensitive, simple and accurate methods have been developed and validated for the assay of omeprazole and lansoprazole in pure and dosage forms. The proposed spectrophotometric method was based on the oxidation of the title drugs with acidic potassium iodate solution resulted in liberation of iodine, which was then extracted and measured at λ 520 nm under the optimized experimental conditions. The method was proved to be accurate and precise and the linearity was found to be in the concentration range of 5-200 and 15-200 µg/ml, for omeprazole and lansoprazole, respectively, with apparent molar absorptivities of 2.42×10^{-4} and 2.01×10^{-4} $lmol^{-1}cm^{-1}$, and with the corresponding Sandell sensitivity value of 0.0281 and 0.0473 $mgcm^{-2}$ for the afore mentioned drugs, respectively. Moreover, the kinetics of these reactions was investigated. On the other hand, the potentiometric method was based on the direct titration of the drugs with acidic N-bromosuccinimide solution with determination of the end point potentiometrically using a platinum indicator electrode under the optimum conditions. The concentration ranges were found to be 25-100 and 15-100 µg/ml with standard deviation of 0.007-0.042 and 0.005-0.034, and with relative standard deviation of 0.79-2.4 and 1.4-2.9 for omeprazole and lansoprazole, respectively. Additionally, the proposed methods could successfully be applied for the determination of the cited drugs in pharmaceutical dosage forms. The relative standard deviations for the results did not exceed 1%, confirming the high precision of the method and reproducibility of the results

Key words: Omeprazole, lansoprazole, potassium iodate, N-bromosuccinimide, spectophotometry, potentiometry and kinetics

Omeprazole (Prilosec), 5-methoxy-2-[[(4-methoxy-3,5-dimethyl-2-pyridinyl)methyl]sulphinyl]-1H-benzimidazole[1] (fig. 1a), is the first-in-class of the proton pump inhibitors (PPIs) that is widely used for the prophylaxis and treatment of both gastroduodenal ulcers and symptomatic gastro-esophageal reflux[2]. Consequently, this drug can increase the bioavailability of oral digoxin by suppressing acid production in the stomach and raising gastric permeability to digoxin[3,4]. Also, it is highly effective in the treatment of Zollinger-Ellison syndrome[5]. Its empirical formula is $C_{17}H_{19}N_3O_3S$, with a molecular weight of 345.42.

On the other hand, lansoprazole is effective in the treatment of various peptic diseases, including gastric and duodenal ulcer, reflux esophagitis and Zollinger-Ellison syndrome[1]. The PPIs are unstable at a low pH, and therefore, the oral dosage forms are supplied as enteric-coated granules encapsulated in a gelatin shell. The PPIs are also considered to be weak base pro-drugs that easily penetrate cell membranes and concentrate in acidic compartments, where they are converted into sulphonamide forms, representing the active inhibitors[6]. Additionally, PPIs are chemo sensitizing cytotoxic drugs, and active against various human tumor cells[7-9]. The active ingredient in Prevacid delayed-release capsules and Prevacid delayed-release orally disintegrating tablets is lansoprazole, a substituted

***Address for correspondence**
E-mail: m_y_nassar@yahoo.com

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benzimidazole, 2-[3-methyl-4-(2,2,2-trifluoroethoxy)-2-pyridyl]methyl]sulfinylbenzimidazole. Its empirical formula is $C_{16}H_{14}F_3N_3O_2S$ with a molecular weight of 369.37 (fig. 1b).

Several analytical methods have been developed for quantitative estimation of omeprazole and lansoprazole[1,9]. However, some of these methods have low limits of detection and quantitation, and others exhibit several shortcomings. For example, spectrophotometry[10-21], electrochemical methods[22], high-performance liquid chromatography (HPLC)[23-28], liquidchromatography-electrospray ionization tandem mass spectrometry (LC/ESI-MS/MS)[29] and electrophoresis[30,31] have been used for determination of omeprazole. While for lansoprazole, spectrophotometry[32], HPLC[33-35], high performance thin layer chromatography (HPTLC)[36,37], capillary electrophoresis[38], and electro analytical methods[39] have been developed for its quantitative determination.

Organic sulfide compounds can readily be oxidized to sulfoxide forms (R_2SO) and/or to sulfone forms (R_2SO_2), or even can be brominated using N-bromosuccinimide (NBS)[40-49]. Consequently, these are the ideas, which our techniques are based on for the determination of omeprazole and lansoprazole. In the present work, two simple, sensitive and accurate methods are described for the determination of omeprazole and lansoprazole. One is spectrophotometric assay based on oxidation of the drugs by potassium iodate in an acidic medium where an equivalent amount of iodine is liberated. The iodine is subsequently quantitatively extracted into cyclohexane and measured spectrophotometrically at 520 nm. The other method is based on the direct titration of the drug with NBS in an acidic medium and then detection the end point of the oxidation process potentiometrically using Pt electrode. Different factors affecting the two proposed methods have been investigated and their reaction mechanisms have been proposed, as well. It is noteworthy that both validation methods are original and had not previously been used for the determination of both drugs in pharmaceutical dosage forms.

MATERIALS AND METHODS

All the absorption spectral measurements were made using double beam Shimadzu UV/Vis spectrophotometer (model 1700, Japan) equipped with 10 mm matched quartz cells. The potentiometric determination was done by using a pH meter (Jenway) with platinum electrode and magnetic stirrer, which was calibrated before and after each series of measurements.

All solvents and reagents were of analytical reagent grade. Omeprazole and lansoprazole reference standards and bulk powders were kindly supplied from El Arabeya Company for Pharmaceutical and Chemical Industries, Egypt. Their purities were found to be 99.77% and 99.78%, respectively, according to the manufacturers' method. The commercial formulations used included Omepak capsules labeled to contain (20 mg/capsule, Sedico Company, Egypt) and Losec capsules labeled to contain (30 mg/capsule, AstraZeneca, Egypt).

Standard solutions:

For the spectrophotometric method (method I) a standard stock solution of the analyte containing 1 µg/ml was prepared from a stock solution (1 mg/ml) by making the required dilution. The stock solution (1 mg/ml) was prepared by dissolving 100 mg of pure drug in 20 ml methanol and further diluted to 100 ml in a calibrated flask with the same solvent. The

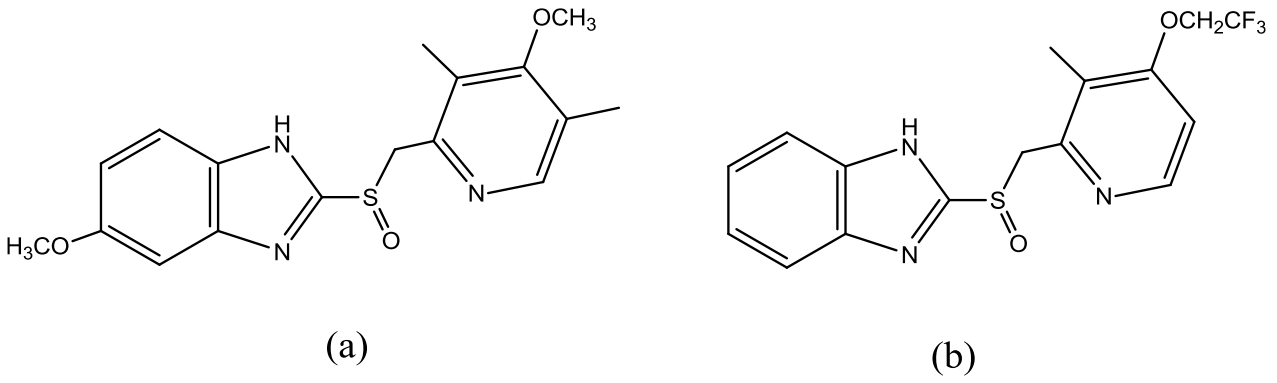

Fig. 1: Chemical structures of (a) omeprazole and (b) lansoprazole

standard solution was kept in a refrigerator and found to be stable for at least one month if stored in a cool (<25°) and dark place. For the potentiometric method (method II) a standard stock solution of the analyte of concentration 1×10^{-3} M was prepared by dissolving an accurately weight of 34 or 36 mg for omeprazole or lansoprazole, respectively in 20 ml methanol and then further diluted in 100 ml calibrated flask to the mark.

Solutions of potassium iodate KIO_3 (1% w/v) in water, and 30% (v/v) H_2SO_4 were prepared for method I. However, for working up using method II, a solution of NBS (1×10^{-3} M) was prepared by dissolving 17.8 mg of NBS in 20 ml water then completed to the mark in a 100 ml calibrated flask, and finally the obtained solution was standardized before use.

Spectrophotometric procedure (method I):

Different portions of omeprazole or lansoprazole (containing amounts in the range 0.0500-2.00 or 0.150-2.00 mg, respectively) were transferred into 50 ml stoppered conical flasks. Then to each drug solution, 2 ml of potassium iodate solution was added followed by 10 ml cyclohexane and 2 or 2.5 ml sulphuric acid solution for omeprazole or lansoprazole, respectively. The obtained solution was mixed well upon shaking. The reaction mixture was then quantitatively transferred into separating funnel. The liberated iodine was extracted using cyclohexane. The extraction of the liberated iodine was repeated with cyclohexane (2×5 ml), the extracts were combined and then diluted to the mark if necessary with cyclohexane in 50 ml measuring flask. The absorbance was finally recorded at 520 nm against reagent blank.

Potentiometric procedure (method II):

Different volumes, 20-120 µg/ml of 1×10^{-3} M omeprazole or 10-140 µg/ml of 1×10^{-3} M lansoprazole, were transferred into 50 ml beakers. Subsequently, 3 ml of sulphuric acid solution was added to each solution and diluted with distilled water to 50 ml. Using Pt electrode as an indicator electrode, each drug solution was potentiometrically titrated with 1×10^{-3} M NBS solution by drop wise addition and constant stirring. The potential difference (E) was plotted against the added volume of the NBS titrant, (v).

Application to capsules:

The contents of twenty capsules were removed and finely powdered using an agate mortar. The combined contents were mixed and weighed accurately. A portion of the powder equivalent to 100 mg of omeprazole or lanzoprazole was accurately weighed and exactly 30 ml of methanol was added, sonicated for about 10 min, left for some time in a fridge, and then filtered into a 100 ml volumetric flask to remove any insoluble matter. The solution was then completed to the mark with the same solvent. The nominal contents of the capsules were determined either from the calibration graph or using the corresponding regression equation.

RESULTS AND DISCUSSION

This work was conducted to establish two simple and accurate methods for the determination of omeprazole and lanzoprazole in pure and pharmaceutical dosage forms. Method I was based on the oxidation-reduction reaction between the drug and an excess of iodate ions in an acidic medium[43,44,52] resulting in liberation of iodine, which was then spectrophotometrically determined by measuring the absorbance at 520 nm, (fig. 2). This oxidation reaction was a 2-electron oxidation reaction, in which one molecule of iodate oxidized one molecule of the drug resulting in the formation of a sulfone from the sulfoxide group. If the two drugs were labelled as R_2SO then it was obvious from fig. 2 that the drugs would be oxidized with IO_3^- to give sulfone derivatives (R_2SO_2) and iodide ions (Eqn. 1; fig. 2), which in turn the latter would react with the excess acidified oxidant (IO_3^-) to generate iodine according to the Dushman reaction, Eqn. 2[43]. However, this redox reaction was a stoichiometric one so that the absorbance of the released iodine was found to be linearity dependent on the concentration of the drugs, which served as the basis of the assay. The factors such as reaction time, volume of sulphuric acid

$$5\ IO_3^- + 5R_2SO + 20\ H^+ \longrightarrow 5I^- + 5\ R_2SO_2 + 10\ H_2O \quad (1)$$

$$IO_3^- + 5I^- + 6\ H^+ \longrightarrow 3I_2 + 3\ H_2O \quad (2)$$

$$6\ IO_3^- + 5R_2SO + 26\ H^+ \longrightarrow 5\ R_2SO_2 + 3I_2 + 13\ H_2O$$

Fig. 2: Proposed mechanism of oxidation of the drugs (R_2SO) with iodate ion

solution, volume of potassium iodate solution, quantity of the used drugs, which could influence the oxidation of the drugs of interest, were carefully studied. In order to study the effect of time, samples were assayed and the absorbance was determined after varying the time intervals at the room temperature (25±1°) and the obtained data were depicted in fig. 3. The data exhibited that 30 min were enough to complete the oxidation reaction and given the best results for omeprazole drug and 25 min are enough for the similar reaction for lansoprazole drug.

The optimum volume of 30% v/v sulphuric acid solution used for production of maximum colour intensity was 2 and 2.5 ml, for omeprazole and lansoprazole, respectively; however, larger volumes caused the colour to decrease. The influence of potassium iodate concentration on the oxidation of the drugs was studied and it was found that 2 ml of 1% w/v KIO_3 were enough for complete oxidation of the omeprazole and lansoprazole drugs; however, higher concentration of potassium iodate had no effect on the absorbance and so the absorbance was nearly constant.

The stoichiometry of the reaction between the two drugs and potassium iodate was investigated by the continuous variation and molar ratio method[49] under the selected optimum conditions. The experimental results showed that the molar ratio of drug:iodate is 1:1 for the title drugs, as shown in figs. 4 and 5.

Under the optimum reaction conditions previously described, the calibration curves for both drugs were constructed. The regression equations for the results were derived using the least squares method. A linear regression analysis using absorbance data versus concentration of the drug was carried out. The slope and intercept data obtained from linear regression analysis of the calibration graph were used to calculate the concentration of an unknown sample, using the Eqn., absorbance = intercept+[(slope)×(concentration)].

Consequently, unknown concentration of the drug of interest may be directly obtained using this Eqn. It is noteworthy that, in all cases, Beer's law plots, as shown in fig. 6, were linear with very small intercepts and good correlation coefficients in the concentration range 5-200 and 15-200 µg/ml for omeprazole and lansoprazole, respectively. The apparent molar absorptivity[49] was found to be 2.42×10^{-4} and 2.01×10^{-4} $mol^{-1}cm^{-1}$, whereas Sandell sensitivity[50] was found to be 0.0281 and 0.0473 μgcm^{-2} for omeprazole and lansoprazole respectively, as presented in Table 1.

The reaction between omeprazole or lansoprazole and an acidic KIO_3 solution increases gradually reaching its maximum after 25 and 30 min for omeprazole and lansoprazole, respectively. It was useful to elaborate a kinetically-based method for the determination of omeprazole and lansoprazole, hence, the reaction was investigated under various conditions. The reaction rate and maximum absorbance increased

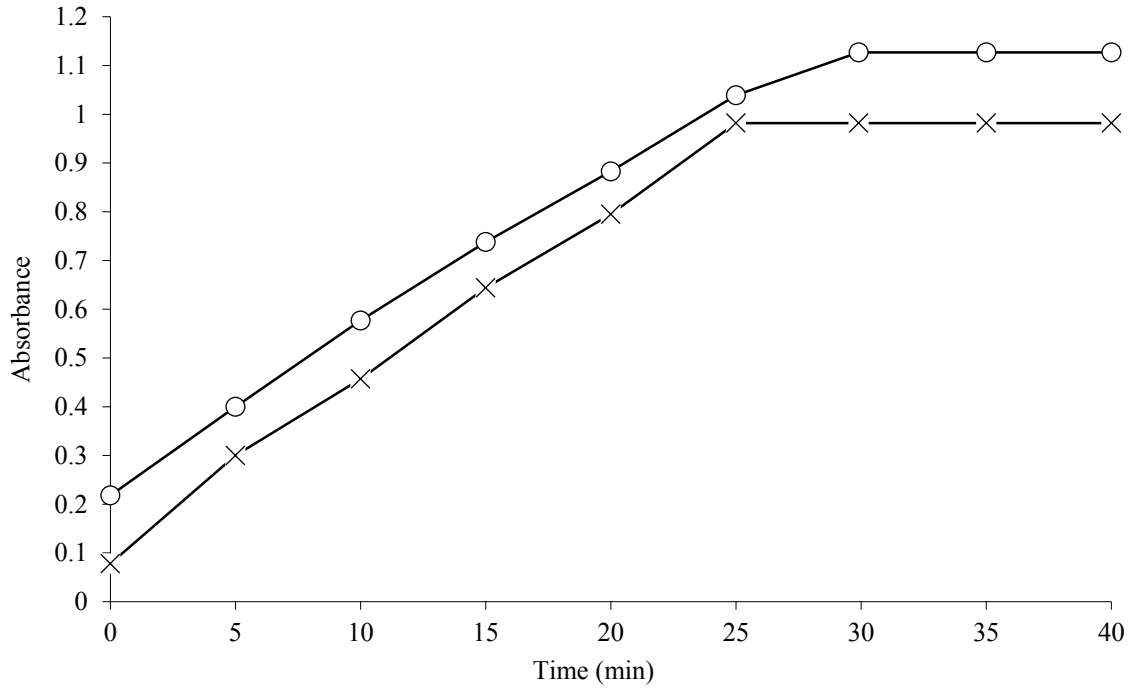

Fig. 3: Effect of time on oxidation reaction
Omeprazole (-o-) and lansoprazole (-×-) using 2 ml of 1% w/v KIO_3 and 2 or 2.5 ml 30% v/v H_2SO_4, respectively, at λ_{max}=520 nm

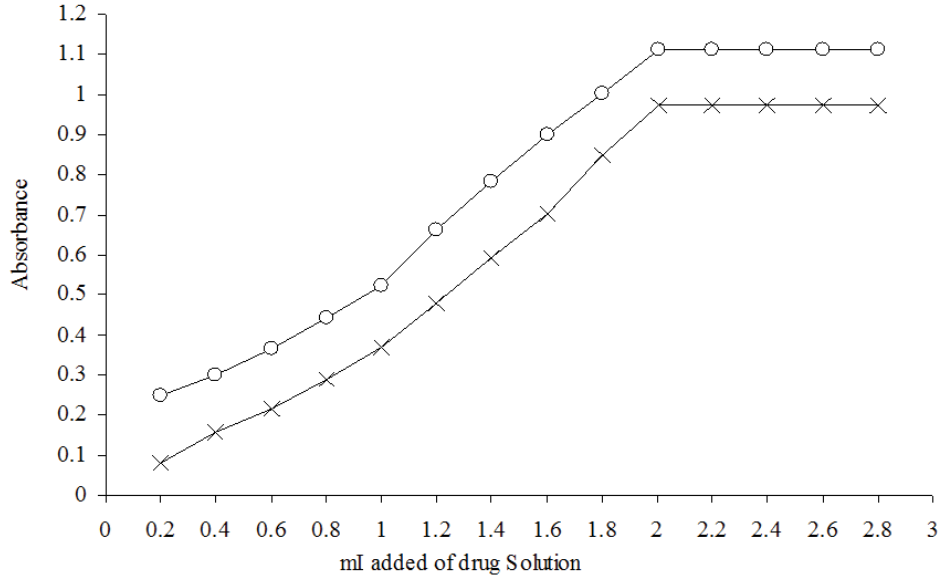

Fig. 4: Molar ratio of KIO_3 solution (2×10^{-4} M) to 2 ml of 2×10^{-4} M Omeprazole (-o-) and lansoprazole (-×-)

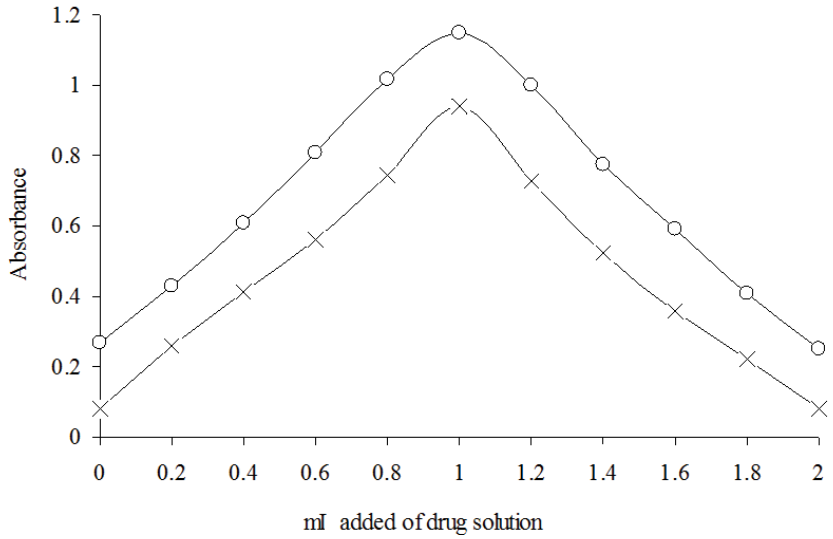

Fig. 5: Jobs method of continuous reaction graph for the reaction of KIO_4 reagent with omeprazole and lansoprazole
Continuous reaction graph for the reaction of KIO_4 reagent with omeprazole (-o-) and lansoprazole (-×-). Total molar concentration equals $2x10^{-4}$ M and optimum λ_{max}=520 nm

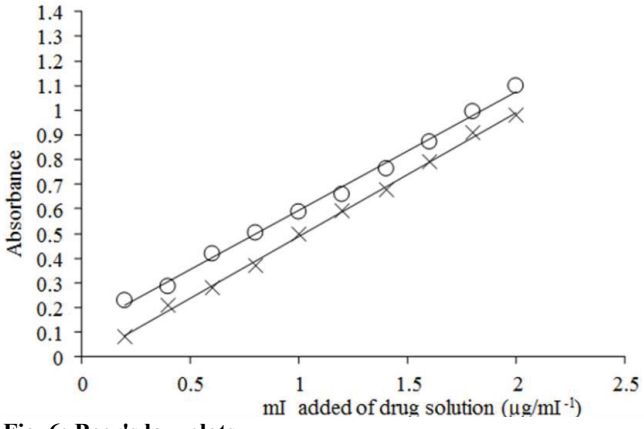

Fig. 6: Beer's law plots
Beer's law in determination of omeprazole (-o-) and lansoprazole (-×-)

with increase KIO_3 concentration and it is noteworthy that 2 ml of 1×10^{-3} M KIO_3 was adequate for the maximum. The rate of reaction was followed at room temperature with various concentration of the drug in the range 0.2×10^{-4}-1×10^{-4} M for omeprazole and lansoprazole, while KIO_3 and H_2SO_4 concentration was kept constant, and it was found that the rate of reaction was concentration-dependent. The reaction rate was found to obey the following Eqn. 1, Rate = K' $[drug]^n$, where, K' is the pseudo-order rate constant and n is the order of the reaction. The rate of the reaction may be studied by the variable time method and measured as $\Delta A/\Delta t$, where, A is the absorbance and t is the time in second[50,51]. By taking logarithms

TABLE 1: QUANTITATIVE PARAMETERS FOR THE DETERMINATION OF OMEPRAZOLE AND LANSOPRAZOLE WITH KIO_3 USING METHOD I

Parameters	Omeprazole	Lansoprazole
λ_{max} (nm)	520	520
Beer's law limits (µg/ml)	5 - 200	15 - 200
Molar absorptivity (1 $mo^{-1}cm^{-1}$)	$2.42x10^{-4}$	$2.01x10^{-4}$
Sandell sensitivity (μgcm^{-1})	0.0281	0.0473
Slope	0.184	0.234
Intercept	0.002	0.006
Correlation coefficient	0.9999	0.9998
Standard error (r)	0.075	0.053
Relative standard deviation (RSD)	0.069	0.198
F. test	2.22	2.43
T. test	1.67	2.42

of rates and concentration of drug, Eqn. 1 will be in the following form Eqn. 2, log(rate) = log[ΔA/Δt] = log K'+nlog[drug]. Regression of log(rate) vs. log[omeprazole] or log[lansoprazole] by the least squares method gave the regression Eqns. 3 and 4, Log [ΔA/Δt] = 1.021+0.98 log[omeprazole] (r=0.9890) and Log [ΔA/Δt] = 1.21+0.96 log[lansoprazole] (r=0.9910).

The quantitative estimation of omeprazole and lansoprazole under the previously optimized experimental conditions would result in a pseudo-first order with respect to their concentrations, where KIO_3 concentration is kept constant. However, the rates will be directly proportional to omeprazole and lansoprazole concentration in a pseudo-first order rate equation as follows: rate = K' [drug], where K' is the pseudo-first order rate constant equation was the basis for several experimental, which were carried out to obtain omeprazole and lansoprazole concentration. Various analytical methods such as initial-rate, rate-constant, fixed-absorbance and fixed-time[50,51] have been tried and the most suitable analytical method was selected taking into account the sensitivity, applicability, the correlation coefficient (r), the slope of the calibration graphs, and the intercept.

In initial rate method, graphs of the rate (at the beginning of the reaction) versus drug concentration was not easy to obtain, because the first step of the reaction was too fast to follow, so tangents of the curves were not easy to draw and hence this method was therefore abandoned. In rate-constant method, values of log[absorbance] versus time for drug concentrations in the range 0.2×10^{-4}-1×10^{-4} M for the two drugs were groped and plotted in and all the plots appeared to be rectilinear. Pseudo-first order rate constant (K') corresponding to different drug concentration [C] were calculated from the slopes (log[A] vs. t) multiplied by – 2.303. Plus, regression of [C] versus K' produced the following Eqns, K' = 0.0003+12.24[C] (r = 0.989) for omeprazole and K' = 0.0002+39.28[C] (r = 0.899) for lansoprazole.

It is obvious that the values of r show poor linearity, which may be due to inconsistency of K' values. In fixed absorbance method, rates of the reactions were calculated for different drug concentrations in the range of 0.2×10^{-3}-1.0×10^{-3} M at λ=520 nm. A pre-selected value of the absorbance; 0.6 for omeprazole and 0.3 for lansoprazole, was fixed and the time was detected in seconds. The reciprocal of time (1/t) was plotted against the initial concentration of the drug and hence the following equations of the calibration graphs were obtained by linear regression: 1/t = 0.0015+2.00002 (r = 0.997) for omeprazole and 1/t = 0.0013+3.00006 (r = 0.998) for lansoprazole. However, it is worthy to mention that the ranges of concentration, which give the most acceptable calibration plots using the above equations are limited, which can be considered a disadvantage.

In the fixed-time method**,** the rates of reactions of interest were calculated for different concentrations of omeprazole and lansoprazole drugs. At a pre-selected fixed and determined time, the absorbance was recorded. Calibration plots of absorbance against initial concentrations of omeprazole and lansoprazole drugs, shown in fig. 7A and B, were obtained at fixed times of 5, 10, 15, 20, 25, 30 and 35 min for omeprazole and lansoprazole and their calibration equations are presented in Table 2. It is obvious that the slopes of the calibration graphs increase with time and the most suitable values of the correlation coefficient (r)[50,51] and the intercepts are obtained at a fixed-time of 30 and 25 min for omeprazole and lansoprazole, respectively, which are therefore chosen as the most suitable time intervals for measurements for the respective drug.

The above developed method was successfully applied to omeprazole and lansoprazole in bulk powder and dosage pharmaceutical. Five replicate measurements were performed at five different concentrations and the relative standard deviation (RSD) were found to be 0.12 and 0.19 for omeprazole and lansoprazole, respectively in bulk powder and dosage pharmaceutical as shown in Tables 3 and 4. The performance of the proposed method was assessed by calculation of the *t*-value (for accuracy) and *F*-test (for precision). The

results showed that the calculated values (Table 4) did not exceed the theoretical ones. Hence, there is no a remarkable difference between the proposed and the reference method, indicating that the proposed method is an accurate and precise as the reference one[26] and the certified values of the samples. Moreover, the results indicate a good agreement with the official method and the proposed method can be recommended for

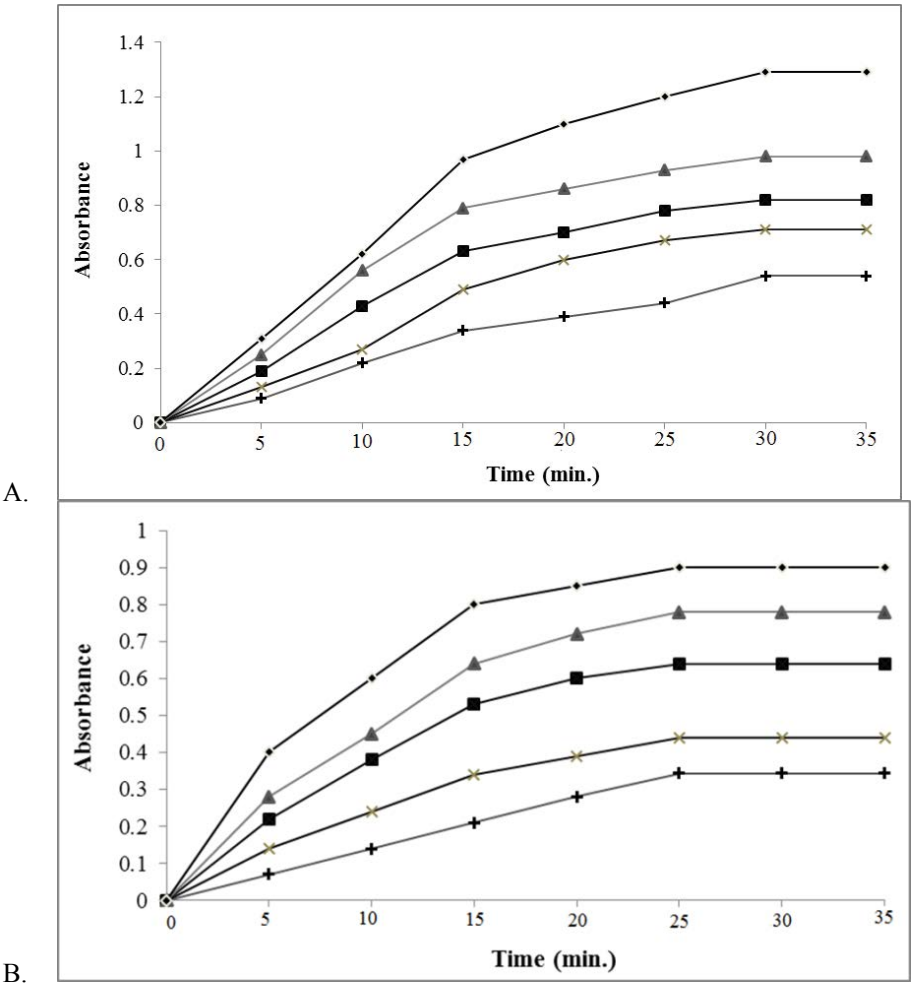

Fig. 7: Absorbance versus time graphs

Absorbance versus time graphs for the reaction of (A) omeprazole and KIO_3 (B) lansoprazole at λ_{max}=520 nm, temperature of 25°. Molar omeprazole concentration, 0.2×10^{-3} (–I–); 0.4×10^{-3} (–×–); 0.6×10^{-3} (–■–); 0.8×10^{-3} (–▲–) and 1.0×10^{-3} (–●–)

TABLE 2: CALIBRATION EQUATIONS AT DIFFERENT FIXED TIMES FOR OMEPRAZOLE AND LANSOPRAZOLE

Drug	Time (min)	Regression equation	Correlation coefficient
Omeprazole	5	$A = 0.002+2.5x10^{4}C$	0.9933
	10	$A = 0.003+3.0x10^{4}C$	0.9934
	15	$A = 0.003+5.0x10^{4}C$	0.9935
	20	$A = 0.004+4.0x10^{4}C$	0.9992
	25	$A = 0.004+5.\ 2x10^{4}C$	0.9996
	30	$A = 0.005+6.6x10^{4}C$	0.9998
Lansoprazole	5	$A = 0.004+7.0x10^{4}C$	0.9994
	10	$A = 0.006+6.2x10^{4}C$	0.9997
	15	$A = 0.009+8.4x10^{4}C$	0.9996
	20	$A = 0.007+6.2x10^{4}C$	0.9997
	25	$A = 0.008+6.2x10^{4}C$	0.9999
	30	$A = 0.007+5.5x10^{4}C$	0.9998

Calibration equation at different fixed time for omeprazole and lansoprazole over the range (0.2×10^{-4}-1.2×10^{-4}) ml at constant KIO_3 concentration (1×10^{-4} M) and room temperature

routine analysis in the majority of drug quality control laboratories. Plus, another favourable characteristic of the method is that the absorbance of the colored products formed is stable for at least 24 h.

Method II is a potentiometric procedure in which NBS[52] is found to react quantitatively with omeprazole and lansoprazole in sulphuric acid medium. Omeprazole and lansoprazole are directly potentiometrically titrated in H_2SO_4 medium with 1×10^{-3} M NBS as titrant using Pt electrode. The titration curves of omeprazole and lansoprazole are shown in fig. 8 and they exhibit well-defined s shaped titration curves. However, it is worthy to mention that in this technique, omeprazole and lansoprazole drugs (R_2SO) undergo oxidation to give probably sulfone derivatives (R_2SO_2) and this may be represented by fig. 9. In this case, NBS as an oxidant in an acidic media maybe behave like chloramine-T in oxidation of drug sulphide or sulfoxide compounds to sulfone forms (R_2SO_2)[48]. Moreover, as a confirmation to our proposed mechanism, it was also reported that NBS is able also to oxidize the sulphide form drugs into sulfone forms[53]. The stoichiometry of the reaction between the two drugs under investigation and NBS was studied. The experimental data revealed that the molar ratio of drug:NBS is 1:1 for both drugs.

The proposed method was successfully applied for determination of omeprazole and lansoprazole in bulk powder and dosage pharmaceutical potentiometrically. Omeprazole and lansoprazole can quantitatively be determined in the concentration range of 25-100 and 15-100 µg/ml for omeprazole and lansoprazole, respectively. The standard deviation values are found to be in the range 0.007-0.042 and 0.005-0.034 and the RSD values are found to be in the range 0.79-2.4 and 1.4-2.5 for omeprazole and lansoprazole, respectively, as presented in Table 5.

The amounts of lansoprazole and omeprazole assayed by the proposed method can be calculated using the Eqns., 1 ml of 1×10^{-3} M NBS=36 mg of omeprazole and 1 ml of 1×10^{-3} M NBS=34 mg of lansoprazole. In order to investigate the validity and the applicability of the proposed methods and the reproducibility of the obtained results in bulk powder (i.e., pure drugs), five replicate experiments at different concentrations of the drugs under investigation were carried out and the obtained results are presented in Table 5. From the obtained standard deviation and RSD values for each drug, it can be concluded that the proposed method is valid, applicable and highly reproducible. Plus, the validity and applicability of the proposed methods were also proved for application of the proposed method for determination of the drugs under investigation, omeprazole and lansoprazole, in capsules. The obtained results are given in Table 6. The fact that the

TABLE 3: DETERMINATION OF OMEPRAZOLE AND LANSOPRAZOLE IN BULK POWDER USING AN ACIDIC KIO_3 SOLUTION, METHOD I

	Taken (µg/ml)	Found (µg/ml)	Recovery %	SD	RSD
Omeprazole	20	20.09	100.45	0.089	0.24
	40	39.82	99.55	0.075	0.04
	60	60.08	100.10	0.049	0.14
	80	79.99	99.98	0.043	0.05
	140	139.92	99.93	0.093	0.05
	180	180.03	100.01	0.650	0.09
	200	200.02	100.01	0.540	0.16
Lansoprazole	20	20.01	100.01	0.056	0.16
	60	59.92	99.86	0.046	0.14
	80	80.04	100.05	0.093	0.19
	140	139.98	99.92	0.023	0.22
	180	180.06	100.03	0.056	0.15
	200	199.11	99.55	0.029	0.19
	220	219.93	99.968	0.078	0.18

TABLE 4: DETERMINATION OF OMEPRAZOLE AND LANSOPRAZOLE IN PHARMACEUTICAL DOSAGE FORM USING AN ACIDIC KIO_3 SOLUTION, METHOD I

Drug	Recovery (%)±SD		T. test	fF. test
	Proposed method	Official method		
Omeprazole (10 mg/tab)	101±0.15	99.39	1.67	2.22
Lansoprazole (30 mg/tab)	100.63	100.10	2.42	2.43

mv values before the end point in the titration curves of pure of omeprazole and lansoprazole and their corresponding products are almost identical provide evidence that the other excipients that might be present in the product do not affect the titration curves. The results obtained for omeprazole and lansoprazole in their corresponding products show that the recoveries are in good agreement with the official method and RSD values are <2.5%. Thus, the reproducibility and accuracy is very satisfactory for the drug products as well as the drug substances. These results indicate that the content of each drug in the product can be safely determined using this method without interference from other substances in the preparations.

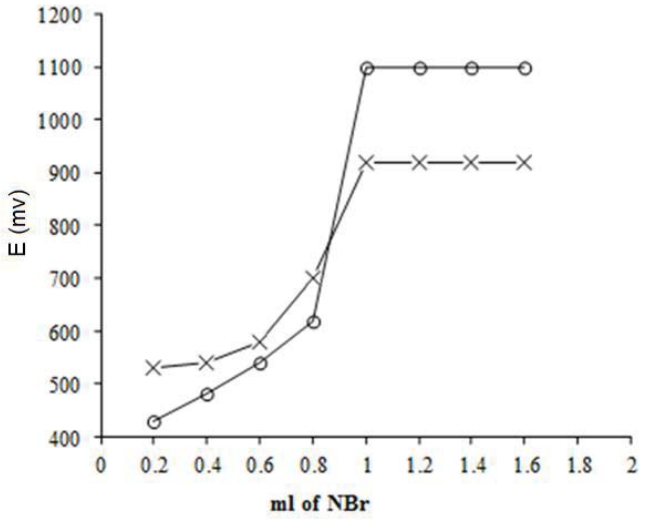

Fig. 8: Titration curves for potentiometric titration, method II
Titration curves for potentiometric titration (1 ml, 1×10^{-3} M) of omeprazole (-o-) and lansoprazole (-×-) with 1×10^{-3} M NBS reagent, method II

In conclusion, the proposed spectrophotometric and potentiometric method could be utilized for routine analysis of pharmaceuticals since they offer simple methodology coupled with short analytical time, good reproducibility and accuracy. On comparing the results obtained by the proposed spectrophotometric method using KIO_3 and potentiometric method using NBS titrant, it is obvious that the iodate method is sensitive to high concentration while the NBS method is sensitive to low concentrations as given before. The kinetically-based method proposed in this work for the quantitative analysis of omeprazole and lansoprazole is direct method and more sensitive than the previously methods.

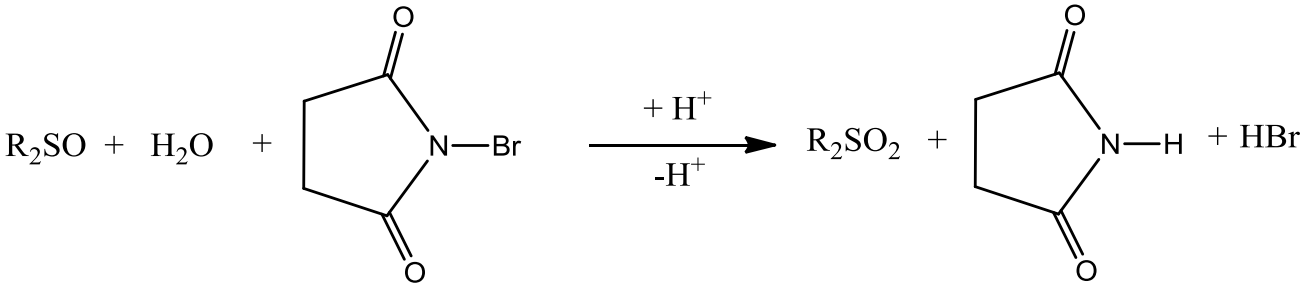

Fig. 9: Proposed mechanism for the reaction of omeprazole and lansoprazole (R_2SO) with NBS reagent

TABLE 5: DETERMINATION OF OMEPRAZOLE AND LANSOPRAZOLE IN BULK POWDER USING 1×10^{-3} M NBS REAGENT, METHOD II

Drug	Taken (ml)	Found (ml)	Recovery %	SD	RSD
Omeprazole	0.2	0.201	100.5	0.007	2.40
	0.4	0.399	99.7	0.010	1.50
	0.6	0.598	99.6	0.022	0.79
	1.0	1.032	100.3	0.042	1.60
Lansoprazole	0.3	0.290	96.66	0.007	1.40
	0.5	0.480	96.00	0.020	2.30
	0.7	0.709	101.20	0.034	2.50
	1.0	99.83	99.83	0.005	1.79

TABLE 6: DETERMINATION OF OMEPRAZOLE AND LANSOPRAZOLE IN PHARMACEUTICAL DOSAGE FORM USING 1×10^{-3} M NBS REAGENT, METHOD II

Drug	Recovery (%) ± SD		T. test	F. test
	NBS method	Official method		
Omeprazole (cap/ 20 mg/tab) 10 mg cap.	102	99.97	2.2	2.46
Lansoprazole (cap/ 30 mg/tab) 30 mg cap.	100.53	100.20	1.82	2.81

Conflict of interest:

All authors declare no conflict of interests.

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