CHAPTER 2

SURVEY OF LITERATURE
Section (i): Survey of literature of selected drugs

(a) Ramipril

Various methods are reported in literature for the determination of ramipril in pharmaceutical formulations which include Spectrophotometric method\textsuperscript{1-9}, UV spectrophotometry, Spectrofluorometry, and HPLC\textsuperscript{10}, Spectrophotometric and Spectrofluorimetric method\textsuperscript{11}, Spectrophotometric and Atomic Absorption Spectrometric determination\textsuperscript{12}, RP–HPLC method\textsuperscript{13-14}, Liquid chromatography Mass Spectrometry method\textsuperscript{15}, Radio Immunoassay\textsuperscript{16} Potentiometry\textsuperscript{17-18}, Gas Chromatography\textsuperscript{19-20}, HPLC method\textsuperscript{21-26}, and HPTLC Method\textsuperscript{27}.

S. Bankey et al\textsuperscript{1}, proposed a simple, fast and precise multicomponent mode analysis method for simultaneous determination of Ramipril (RMP), Hydrochlorothiazide (HCT) and Telmisartan (TEL) in tablet formulation. The wavelengths selected for these drugs were 218nm, 271nm and 296nm, respectively, using methanol as solvent. The concentrations of these drugs were evaluated in laboratory mixture and marketed formulation. Accuracy was determined by recovery studies from tablet dosage forms and it ranged from 99.09–99.52%. Precision of the method was found out as repeatability and day-to-day analysis to analyze variations. The method shows the values within the acceptable limit.

Priyanka R et al\textsuperscript{2}, proposed a new, simple, rapid and novel spectrophotometric method developed for simultaneous estimation of ramipril and amlodipine. Here, simultaneous equation method is used. It involves measurement of absorbance at two wavelengths, 210 nm and 238 nm–max of ramipril and amlodipine, respectively. Beer’s law obeyed in concentration range of 15–35 $μg/ mL$ and 5–25 $μg/ mL$ for ramipril and amlodipine, respectively. The proposed method is recommended for
routine analysis, since it is rapid, simple, accurate and also sensitive and specific by no heating and no organic solvent extraction. This paper describes the development and validation of UV spectroscopic method for simultaneous estimation of ramipril and amlodipine in combined solid dosage form.

Nafisur Rahman et al\(^3\), propose and present a simple and sensitive kinetic spectrophotometric method for the determination of ramipril in commercial dosage forms. The method is based on the reaction of the drug with 1-chloro-2,4-dinitrobenzene (CDNB) in dimethyl sulfoxide (DMSO) at 100 ± 1°C. The reaction is followed spectrophotometrically by measuring the rate of change of the absorbance at 420 nm. Fixed-time (\(\Delta A\)) and equilibrium methods are adopted for constructing the calibration curves.

Both the calibration curves were found to be linear over the concentration ranges 20 - 220\(\mu\)g/mL. The regression analysis of calibration data yielded the linear equations: \(\Delta A = 6.3 \times 10^{-4} + 1.54 \times 10^{-3} C\) and \(A = 3.62 \times 10^{-4} + 6.35 \times 10^{-3} C\) for fixed time (\(\Delta A\)) and equilibrium methods, respectively. The limits of detection (LOD) for fixed time and equilibrium methods are 1.47 and 1.05 \(\mu\)g/mL, respectively. The method has been successfully applied to the determination of ramipril in commercial dosage forms. Statistical comparison of the results shows that there is no significant difference between the proposed methods and reported spectrophotometric method.

B. Popat et al\(^4\), have developed, two simple accurate, sensitive and specific methods for the simultaneous determination of Ramipril and Telmisartan in binary mixture. The method is based on UV–spectrophotometric determination of two drugs. Method–A is by using multi component system. It involves absorbance measurement
Beer's law is obeyed in the concentration range of 5–40 µg mL for Ramipril and 2–20 µg mL for Telmisartan. Method-B is graphical absorbance system which is based on measurement of absorbance of Ramipril and Telmisartan at 222.0 nm (iso-absorptive point of Ramipril and Telmisartan) and 291.0 nm ($\lambda_{\text{max}}$ of Telmisartan). Both these methods have been successively applied to pharmaceutical formulation and were validated according to ICH guidelines.

A.A. Al-Majed et al, proposed a simple and sensitive spectrophotometric method for the determination of ramipril in its dosage forms. The method is based on the reaction of the drug with potassium permanganate in alkaline medium whereby a bluish green colour peaking at 610 nm is produced. The absorbance–concentration plot is rectilinear over the range 0.1 – 7.5 µg/mL ($r = 0.9992$) with minimum detectability of 0.05 µg/mL ($1.2 \times 10^{-7}$ M). The molar absorptivity was $2.42 \times 10^4$ L·mol$^{-1}$·cm$^{-1}$. The different experimental parameters affecting the development and stability of the colour were carefully studied and optimized. The proposed method was further applied to the determination of ramipril in its dosage forms, whether alone or in combination with hydrochlorothiazide. The results obtained were in good agreement with those obtained by a reference HPLC method. A proposal of the reaction pathway was postulated.

N. Rahman et al, proposed a kinetic spectrophotometric method for determination of ramipril in pure form and pharmaceutical formulations. The method was based on the reaction of carboxylic acid group of the drug with a mixture of potassium iodate ($\text{KIO}_3$) and potassium iodide ($\text{KI}$) in aqueous medium at room temperature.
The reaction is followed spectrophotometrically by measuring the increase in absorbance at 352 nm as a function of time. The initial-rate and fixed-time methods were adopted for constructing the calibration curves. Both the calibration curves were linear in the concentration range of 10.0–70.0 μg/mL. The detection limits were 0.02 μg/mL and 0.15–μg/mL for initial rate and fixed time methods, respectively. The proposed methods are validated statistically and through recovery studies. The point and interval hypothesis tests have been performed confirming that there is no significant difference between the proposed methods and the reference method. The experimental true bias of all samples is less than ± 2%. The methods have been successfully applied to the determination of ramipril in tablets and capsules.

E.R.K. Nevin⁷, developed two two-component mixtures using both Vierordt's method and ratio–spectra zero–crossing derivative spectrophotometric methods. Such mixtures are hydrochlorothiazide–spironolactone and hydrochlorothiazide–ramipril. These selected applications illustrate the relative ease and simplicity offered by ratio – spectra zero – crossing derivative spectrophotometry for the assay of two component mixtures with spectral interferences from matrix formulations.

M.S. Attia⁸ proposed a new, simple, sensitive and selective spectrofluorimetric method for the determination of Ramipril. The Ramipril can remarkably quench the luminescence intensity of the Sm³⁺ ion in Sm³⁺oxycycline complex at λ_max = 375 nm in sol–gel matrix. At the same time, the intensity of the emission band of the Ramipril in DMSO at 454 nm is increased due to the energy transfer from the Sm³⁺–doxycycline complex to Ramipril in the excited state. The quenching of luminescence intensity of Sm³⁺–doxycycline complex doped in the sol–gel matrix and the enhancement of the emission band of Ramipril at 454 nm are
directly proportion to the concentration of Ramipril with a dynamic ranges of $3.4 \times 10^{-9} - 1.0 \times 10^{-7}$ mol L and $2.4 \times 10^{-9} - 1.0 \times 10^{-7}$ mol L and detection limits of $6.0 \times 10^{-10}$ and $5.2 \times 10^{-10}$ mol L, respectively.

K. Suresh Kumar et al\textsuperscript{9}, proposed a new, simple, specific, sensitive, rapid and economical procedure for simultaneous estimation of metoprolol tartrate and ramipril in a combined dosage form. The method is based on the ultraviolet absorbance maxima of the above two drugs at 209.5 nm and 222 nm, respectively. Both the drugs obeyed Beer's law in the concentration range of 40–120 and 4–20 µg/mL, respectively. The proposed methods were successfully applied for the simultaneous determination of both the drugs in commercial capsule preparations. The results of the analysis have been validated statistically and by recovery studies.

A. Fawzy et al\textsuperscript{10}, have developed two–component mixtures of felodipine (FLD) and ramipril (RMP) were assayed by derivative UV spectrophotometry, spectrofluorometry, and high performance liquid chromatography (HPLC). The spectrophotometric methods included a zero–crossing first–order and second–order derivative procedure and a derivative compensation technique for the determination of binary mixtures with overlapping spectra. The spectrofluorometric method was based on first– and second–order derivatives of the emission spectra (zero–crossing point). Results from these methods were compared with those obtained by an exclusively developed isocratic reversed phase HPLC method. A reversed–phase Adsorbosil DS analytical column, with methanol–acetonitrile–water (50:30:20, v/v) mobile phase at a flow rate of 1.5 ml/min, was used with a UV detector. The temperature was set at 25±0.2°C. Results obtained by the spectrophotometric and spectrofluorometric
methods were comparable to those obtained by the HPLC method, as far as analysis of variance (ANOVA) of the test results concerned.

It is concluded that the developed methods are equally accurate, sensitive, and precise; with direct and simple application to pharmaceutical formulations of felodipine and ramipril combination, without interference from common pharmaceutical adjuvants.

E. Hisham and Abdellatef [11], describe three sensitive spectrophotometric and spectrofluorimetric methods for determination of ramipril in its pure form and pharmaceutical tablets. The first method is based on the oxidation of the drug with 1-chlorobenzotriazole reagent (CBT) in strong alkaline medium followed by measuring the absorbance at 350 nm. The method obeys Beer's law over concentration range 15–50 µg mL⁻¹. For the second and third, both are non-extractive methods based on the formation of ternary complex between copper (II), eosin and ramipril in the presence of methylcellulose as surfactant. Spectrophotometrically, under the optimum condition, the ternary complex showed an absorption maximum at 543 nm. The method obeys Beer's law over concentration range of 20–80 µg mL. A fluorescence quenching method for the determination of ramipril by forming this ternary complex was also investigated for the purpose of enhancing the sensitivity of the determination. The methods are simple, sensitive, and accurate. The results obtained are reproducible with a coefficient of variation less than 2%.

The proposed methods have been successfully applied to the assay of ramipril in tablets. The results compare favorably with reference methods.
E. Hisham and Abdellatef et al\textsuperscript{12} have developed two sensitive, spectrophotometric and atomic absorption spectrometric procedures for the determination of ramipril and perindopril. Both methods are based on the formation of a ternary complex, extractable with chloroform, between copper (II), eosin and the two cited drugs. Spectrophotometrically under the optimum condition, the ternary complexes showed an absorption maximum at 535 nm, with apparent molar absorptivities of $6.55 \times 10^3$ L mol$^{-1}$cm$^{-1}$ and Sandell’s sensitivities of $5.80 \times 10^{-2}$ and $1.04 \times 10^{-1}$ µg cm$^{-2}$ for perindopril and ramipril, respectively. The solution of ternary complex obeyed Beer’s law in concentration ranges 10–60 and 20–100 µg/mL for perindopril and ramipril, respectively. The proposed method was applied to the determination of the two cited drugs in pharmaceutical tablets. The atomic absorption spectrometric method, directly through the quantitative determination of copper content of the organic extract of the complex, was also investigated for the purpose of enhancing the sensitivity of the determination. The spectrophotometric and atomic absorption spectrometric procedures hold their accuracy and precision well when applied to the determination of ramipril and perindopril dosage forms.

(b) Tenofovir disoproxil fumarate

Literature survey revealed a few analytical methods which include spectrophotometric method\textsuperscript{28–32}, HPLC method\textsuperscript{33} RP–HPLC method\textsuperscript{34–35} and Liquid chromatography tandem mass spectrometric method\textsuperscript{36–38} TDF is not official in IP, BP and USP.

A. Shirkhedkartul et al\textsuperscript{28}, have developed two new, simple and cost effective UV–spectrophotometric and first order derivative methods for estimation of tenofovir
disoproxil fumarate in bulk and tablets. Tenofovir disoproxil fumarate was estimated at 260 nm in 0.1N HCl. In first order derivative, it showed amplitude at 273 nm. In both the methods linearity was found to be in the range of 5–40 µg/mL; for UV-spectrophotometric method (Y=0.02586 X+0.0083; r²=0.9999) and for first order derivative spectrophotometric method (Y=0.00132 X+0.00035; r²=0.9995), respectively. These methods were tested and validated for various parameters according to USP guidelines. The quantitation limits were found to be 1.546 and 1.986 µg/mL, for both the methods. The proposed methods were successfully applied for the determination of tenofovir disoproxil fumarate in pharmaceutical formulations. The results demonstrated that the procedure is accurate, precise and reproducible (relative standard deviation <2%), while being simple, cheap and less time consuming and can be suitably applied for the estimation of tenofovir disoproxil fumarate in different dosage forms.

G. Gnanarajan et al⁹, have developed spectrophotometric method for estimation of Tenofovir disoproxil fumarate in bulk and tablet dosage form. Tenofovir disoproxil fumarate is estimated to be 261 nm in triple distilled water. The Beer’s Law is obeyed in the concentration range of 5–90 µg/mL of the drug. The slope and intercept values are 0.0109 and 0.1075, respectively. Results of analysis of this method have been validated statistically and by recovery studies. The method is applied to the marketed tablet formulation. A result of the analysis of tablet formulation, given as a percentage of label claim ± standard deviation is 98.15 ± 0.76. The precision and accuracy has been examined by performing recovery studies and found to be 100.06 ± 1.24. The developed method is simple, sensitive, and reproducible, and can be used for the routine analysis of Tenofovir disoproxil fumarate in bulk and tablet dosage form.
A. SA et al\textsuperscript{30}, have developed two new, simple and cost effective UV-spectrophotometric and first order derivative methods for estimation of tenofovir disoproxil fumarate in bulk and tablets. Tenofovir disoproxil fumarate was estimated at 260 nm in 0.1N HCl.

In first order derivative, it showed amplitude at 273 nm. In both the methods linearity was found to be in the range of 5–40 μg/mL; for UV–spectrophotometric method ($Y=0.02586x+0.0083; r^2=0.9999$) and for first order derivative spectrophotometric method ($Y=0.00132x+0.00035; r^2=0.9995$), respectively. These methods were tested and validated for various parameters according to USP guidelines. The quantitation limits were found to be 1.546 and 1.986 μg/mL, for both the methods. The proposed methods were successfully applied for the determination of tenofovir disoproxil fumarate in pharmaceutical formulations. The results demonstrated that the procedure is accurate, precise and reproducible (relative standard deviation <2%), while being simple, cheap and less time consuming and can be suitably applied for the estimation of tenofovir disoproxil fumarate in different dosage forms.

A. Swapnil et al\textsuperscript{31}, have proposed two methods for the simultaneous determination of Emtricitabine and Tenofovir by spectroscopy. These two simple, accurate and precise methods include Area Under the Curve (AUC) method and Dual Wavelength Method. From a solvent effect studies and the spectral behaviours of Emtricitabine and Tenofovir, methanol was selected as solvent. Emtricitabine shows maximum absorbance at 281 nm and Tenofovir shows maximum absorbance at 259 nm.
In the AUC method, the wavelength ranges between 242–248 nm and 269–275 nm were selected with reference to the absorbance curves plotted between the wavelengths of 200–400 nm. In the second method, i.e., the dual method, two wavelengths were selected for each drug in a way so that the difference in absorbance is zero for another drug. Emtricitabine shows equal absorbance at 230.696 nm and 250 nm, where the differences in absorbance were measured for the determination of Tenofovir. Similarly, differences in absorbances at 250 nm and 268.670 nm were measured for determination of Emtricitabine. These methods allow rapid analysis of two drug combination. The results of analysis were validated statistically and by recovery studies. This tablet containing both drugs was assayed using the methods developed and show good accuracy and precision.

Patel Suhel et al\textsuperscript{32}, have developed two simple, accurate, economical and reproducible spectrophotometric methods for simultaneous estimation of two-component drug mixture of Tenofovir disoproxil fumarate and Emtricitabine in bulk and combined tablet dosage form. The first method employs formation and solving of simultaneous equations using 259 nm and 286 nm as two analytical wavelengths. The second method is absorption ratio method, which uses 286 nm and 247.6 nm as two analytical wavelengths.

Both methods were statistically validated according to International Conference on harmonization and recovery studies confirmed the accuracy of the proposed method.
(c) Esomeprazole Magnesium

Currently, esomeprazole magnesium and its pharmaceutical dosage forms are not found in any pharmacopoeia and different analytical methods are reported for its determination. These include spectrophotometric method\textsuperscript{39-41}, HPLC method\textsuperscript{42-44}.

Rahman Nafisur et al\textsuperscript{39}, have developed two simple, sensitive and economical spectrophotometric methods for the determination of esomeprazole magnesium in commercial dosage forms. Method A is based on the reaction of esomeprazole magnesium with 5-sulfosalicylic acid in methanol to form a yellow product, which absorbs maximum wavelength at 365 nm. Method B utilizes the reaction of esomeprazole magnesium with N-bromo succinimide in acetone chloroform medium to form α-bromo derivative of the drug peaking at 380 nm. Under the optimized experimental conditions, Beer's law is obeyed in the concentration ranges of 2–48 and 10–100 μg/mL with molar absorptivity of $2.11 \times 10^4$ and $4.57 \times 10^4$ L mol cm$^{-1}$ for methods A and B, respectively. The limits of detection for methods A and B are 0.35 and 0.46 μg/mL, respectively. No interference was observed from excipients commonly present in tablet formulations. Methods A and B are successfully applied to the commercial tablets for the estimation of esomeprazole magnesium with good accuracy and precision. The results compare favorably with the reference spectrophotometric method indicating no significant difference between the methods compared.

Vidya Gawande et al\textsuperscript{40}, proposed a simple and sensitive spectrophotometric method had been developed for the quantitative estimation of esomeprazole magnesium in bulk and its tablets. Esomeprazole magnesium showed maximum absorbance at about 279 nm and obeys beer's law in the concentration range of 4–40
µg/mL. The results of assay and recovery studies were found to be satisfactory. The method was validated in terms of different parameters. The method was found to be simple, precise and accurate and can be applied for the routine estimation of Esomeprazole Magnesium in solid dosage form.

Putta Rajesh Kumar et al\textsuperscript{41}, Esomeprazole magnesium trihydrate is a proton pump inhibitor used against peptic ulcer disease to suppress excess acid secretion in the stomach. Physico chemical characterization studies showed that Esomeprazole magnesium trihydrate has showed a melting point of 177.330 C. The solubility of drug esomeprazole followed the order methanol > ethanol > acetone > buffer pH 9.0 > distilled water. The analytical method developed for the estimation of esomeprazole magnesium trihydrate in bulk fluids showed maximum absorbance $\lambda_{\text{max}}$ of 203.5 nm in methanol between 200 nm and 400 nm. Linearity studies indicated that estimation of esomeprazole magnesium trihydrate between 2.00 µg /mL to 10.00 µg /mL was found to be linear with regression equation of $y = 0.1546X -0.00414$; ($r^2 = 0.999$). The method developed was validated for inter and intra day variation, limit of quantitation studies. The SD values of Inter day and Intra day variation studies indicated that the variation is minimum. Limit of Quantitation of esomeprazole was found to be of 1.00 µg/mL. The above analytical parameters indicated that the developed UV Spectrophotometric method of esomeprazole was simple, accurate and reproducible.

(d) Lamotrigine

Literature survey reveals that spectrophotometric method\textsuperscript{45-49}, and HPLC method\textsuperscript{50-58}, for the determination of lamotrigine.
N. Alizadeh et al\textsuperscript{45}, have developed rapid and sensitive spectrophotometric methods for the determination of lamotrigine in pharmaceutical dosage forms and urine samples, based on the formation of the charge–transfer complexes between lamotrigine as an n–donor and the acceptor, bromo cresol purple, and chloro phenol red. These complexes are studied spectrophotometrically in chloroform solution in order to obtain some information about their stoichiometry and stability of complexation. The analytical parameters and their effects on the extraction of drug from urine samples were investigated. The reactions were extremely rapid at room temperature, and the absorbance values remained unchanged after 24 h for all reactions. Beer’s law was obeyed in the concentration ranges 0.15–19.8, 0.15–19.8 and 0.05–34.1 μg · ml\textsuperscript{-1} for chloro phenol red, bromo cresol purple and bromo cresol green, respectively. The proposed methods were applied successfully for the determination of lamotrigine in pharmaceutical formulations, and human urine samples in the presence of other antiepileptic drugs such as carbamazepine, oxcarbazepine and phenobarbital, with good accuracy and precision.

N. Rajendra Prasad et al\textsuperscript{46}, proposed three reliable, rapid, highly sensitive and selective methods for the determination of lamotrigine in pure drug and in tablets. The first method (method A) is based on the formation of chloroform extractable ion–pair complex between lamotrigine and bromophenol blue at pH 1.44±0.01 with a wavelength of maximum absorption at 420 nm. In the second (method B) and third (method C) methods, the drug–dye ion pair is dissolved in either ethanolic H\textsubscript{2}SO\textsubscript{4} and resulting acid form of the dye is measured at 420 nm or ethanolic KOH and the resulting base form of the dye is measured at 600 nm. All variables affecting the drug–dye complex formation and its extraction into CHCl\textsubscript{3} have been investigated and conditions optimized. Beer’s law was obeyed over a concentration range of 2.5–25 μg
mL, 50–400 μg mL and 10–80 μg mL, for method A, method B and method C, respectively.

The calculated molar absorptivity values are $7.26 \times 10^3$, $5.4 \times 10^5$ and $2.6 \times 10^6$ L mol$^{-1}$ cm$^{-1}$, respectively, for methods A, B and C; and the corresponding Sandell sensitivities are 0.0353, 0.0005 and 0.0001 μg cm$^{-2}$. The limits of detection and limits of quantification have also been reported. The stoichiometry of the formed ion-pair complex was found to be 1:1 for method A, and the stability constant is also calculated. The accuracy and precision of the methods were evaluated on intra-day and inter-day basis; and the relative error (RE) and the relative standard deviation (RSD) were ≤ 2.0% and ≤ 1.4%, respectively. The proposed methods were successfully applied for the determination of lamotrigine in bulk powder and in tablets.

Youssef Nadia Fayek and Taha Elham Anwer have developed three reliable, rapid and selective methods for the determination of lamotrigine in the presence of its impurity, 2, 3–dichlorobenzoic acid. The first method is spectrophotometric method using $p$–chloranilic acid forming a colored product with $\lambda_{max}$ 519±2 nm. All variables affecting the reaction have been investigated and the conditions were optimized. Beer's law was obeyed over a concentration range of 10–200 μg/mL with mean accuracy 100.13±0.44%. The molar ratio of the formed ion–association complex is found to be 1:1 as deduced by Job's method. The conditional stability constant ($K_d$), standard free energy (AG), molar absorptivity ($\epsilon$), and sensitivity index were evaluated.
The second method is based on TLC separation of the cited drug (Rf= 0.75 ±0.01) from its impurity (Pf=0.23±0.01) followed by densitometric measurement of the intact drug spots at 275 nm. The separation was carried on silica gel plates using ethyl acetate: methanol: ammonia 35% (17:2:1 v/v/v) as a mobile phase. The linearity range was 0.5–10 μg/spot with mean accuracy 99.99±1.33%. The third method is accurate and sensitive stability–indicating HPLC method based on separation of lamotrigine from its impurity on a reversed phase C18 column, using a mobile phase of acetonitrile: methanol: 0.01 M potassium orthophosphate (pH 6.7±0.1) (30: 20: 50 v/v/v) at ambient temperature 25±5 °C and UV detection at 275 nm in an overall analysis time of about 6 minutes, based on peak area. The injection repeatability, intraday and interday repeatability were calculated. The procedure provided a linear response over the concentration range 1–12 μg/mL with mean accuracy of 99.50±1.30%.

The proposed methods were successfully applied for the determination of lamotrigine in bulk powder, in dosage form and in presence of its impurity. The results obtained were analyzed by ANOVA to assess that there was no significant difference between each of the three methods and the reported one. The validation was performed according to USP guidelines.

(e) Dapsone

Various techniques adopted for the estimation of Dapsone are Spectrophotometric method59-70, Colorimetric method71, Iskender et al59, have developed a method for the determination of dapsone in tablets by spectrophotometrically using 1, 2–Naphthoquinone–4–sulfonic acid sodium salt. The method was based on the chromophore formation after reaction with sodium 1, 2–
naphthoquinone-4-sulfonate (NQ). The reaction proceeded quantitatively at pH 2 and 60° within 30 minutes when the molar ratio of the reagent to dapsone was 10. After completion of the reaction, the derivative formed; dapsone–NQ, was extracted from the aqueous solution with chloroform/butyl alcohol (3:1). dapsone–NQ, showed maximum absorbance at 440 nm.

Zarapker et al\textsuperscript{60}, proposed a simple spectrophotometric method for the estimation of dapsone from pharmaceutical preparation. The method based on coupling of the diazotized dapsone with 8–anilino–1–naphthalene sulfonic acid, resorcinol or β–naphthol in alkali medium and measurement of absorbance at 550, 440 or 490 nm respectively.

Shoukrallah et al\textsuperscript{61} determined dapsone by spectrophotometric method using 9–chloroacridine as a chromomeric reagent. The method was based on condensation reaction of 9–chloro acridine and the amino groups of dapsone. The reaction variables were investigated and optimized. The resultant coloured product was measured at 443 nm.

El–Dolfiny et al\textsuperscript{62}, have developed two methods for the micro determination of dapsone in bulk and dosage forms by spectrophotometric method. In the first method, sodium 1, 2–naphthoquinone–4–sulfonate was used as a reagent for the colorimetric determination of the drug. The second method used coupling of the diazotized primary aromatic amino groups in dapsone with barbituric acid.

Rao B.C et al\textsuperscript{63}, proposed a simple and sensitive spectrophotometric method for the estimation of dapsone. The method was based on schiff's base formation with
4-dimethyl amino cinnamaldehyde in the presence of methanolic sulfuric acid. The red coloured chromogen had absorption maxima at 540 nm.

Rami Reddy et al\textsuperscript{64} proposed a new spectrophotometric method for the estimation of dapsone. The method was based on the bromination of dapsone with brominating mixture. The excess brominating mixture was reacted with potassium iodide to produce yellow colour. The absorbance of yellow colour solution is measured at 350 nm.

Rami Reddy et al\textsuperscript{65} developed a simple spectrophotometric method for estimation of dapsone form pharmaceutical preparations. The method is based on the diazotization of dapsone followed by the addition of ammonia solution. The yellow colour developed was measured at 445 nm.

Toral, M.I et al\textsuperscript{66} proposed a simple and fast spectrophotometric method for the simultaneous determination of dapsone and pyrimethamine by first-order digital derivative spectrophotometry. Acetonitrile was used as a solvent to extract the drugs from the pharmaceutical formulations, and the samples were subsequently evaluated directly by digital derivative spectrophotometry.

The simultaneous determination of both drugs was performed by the zero-crossing method at 249.4 and 231.4 nm for dapsone and pyrimethamine, respectively. The best signal-to-noise ratio was obtained when the first derivative of the spectrum was used. The excipients of commercial pharmaceutical formulations did not interfere in the analysis. Chemical and spectral variables were optimized for determination of both analytes. A good level of repeatability, 0.6 and 1.7% for dapsone and
pyrimethamine, respectively, was observed. The proposed method was applied for the simultaneous determination of both drugs in pharmaceutical formulations.

Nagaraja, P et al\textsuperscript{67} proposed a rapid, simple and sensitive spectrophotometric method for the determination of some sulfa drugs. The method is based on the formation of orange yellow colored azo product by the diazotization of sulfonamides, viz., dapsone (DAP), sulfathiazole (SFT), sulfadiazine (SFD), sulfacetamide (SFA), sulfamethoxazole (SF\textsubscript{M}x), sulfamerazine (SF\textsubscript{M}r), sulfaguanidine (SG\textsubscript{F}) and sulfadimidine (SF\textsubscript{D}d) followed by a coupling reaction with 3-aminophenol in aqueous medium. Absorbance of the resulting orange yellow product is measured at 460 nm and is stable for 6 days at 27°C. Beer's law is obeyed in the concentration range of 0.05–8.0 µg/mL at the wavelength of maximum absorption.

The method is successfully employed for the determination of sulfonamides in various pharmaceutical preparations and common excipients used as additives in pharmaceuticals do not interfere in the proposed method.

Wang H, et al\textsuperscript{68} developed Spectrophotometric method for determination of dapsone. The dapsone reacts with sodium 1, 2-naphthoquinone-4-sulfonic in pH 6.98 buffer solution to form a salmon pink compound, and its maximum absorption wavelength is at 525 nm, $\varepsilon_{525}=3.68 \times 10^{4}$ L mol$^{-1}$ cm$^{-1}$. The absorbance of dapsone from 0.40 –10µg/mL obeys Beer's law.

The linear regression equation of the calibration graph is $y = 0.0234 \pm 0.01288$, with a linear regression correlation coefficient of 0.9998, the detection limit is 0.24 µg/mL and recovery is from 99.2 to 102.4%. Effects of pH, surfactant, organic
solvents, foreign ions, and standing time on the determination of dapsone have been examined. This method is simple and can be used for the determination of dapsone in injection solution of dapsone. The results obtained by this method agreed with those by the reference method.

Revanasiddappa, H.D and Manju, B, have determined metoclopramide, dapsone, p-aminobenzoic acid, and cisapride in both pure and dosage forms by spectrophotometric method. The method is based on the diazo-coupling reaction of metoclopramide, dapsone, p-aminobenzoic acid, and cisapride with a new coupling agent, acetyl acetone, in an alkaline medium.

The optimum reaction conditions and other analytical parameters are evaluated. The influence of the substrates commonly employed as excipients with these chemotherapeutic agents has been studied.

Omran, A.A, proposed a rapid, sensitive and selective spectrophotometric method for the quantitative determination of dapsone (DAP) and metoclopramide hydrochloride (MCP) in both pure and dosage forms. Individual and simultaneous methods are based on the diazo coupling reaction of these drugs with benzoylacetone (BAC) in alkaline medium.

The resulting azo dyes exhibit maximum absorption at 437 and 411 nm with a molar absorptivity of $4.14 \times 10^4$ and $2.97 \times 10^4$ L mol$^{-1}$ cm$^{-1}$ for DAP and MCP, respectively. Simultaneous determination of DAP and MCP was developed utilizing first-order digital derivative spectrophotometry. All variables have been optimized.
No interferences were observed from drug excipients and the validity of the methods was tested against reference methods.

Shetty et al\textsuperscript{71}, have developed a specific colorimetric assay for dapsone in biological fluids. The original bratton and Marshall method for sulfanilamide assay was modified for differential assay of dapsone (DDS) even in the presence of other diazotizable compounds.

The property of the dapsone diazo derivative to precipitate into coupling with N– (1–naphthyl) ethylene diamine was used to differentiate this sulfone from that of other diazotizable compounds.

(f) Amiloride

Various spectrophotometric methods\textsuperscript{72–77}, capillary zone electrophoresis method\textsuperscript{78} and HPLC methods\textsuperscript{79–86}, are reported in the literature for the estimation of amiloride tablets formulations.

Martín, E. et al\textsuperscript{72}, have developed three methods for the simultaneous determination of amiloride (AMI) and hydrochlorothiazide (HCT): zero-crossing, derivative quotient spectra with normalized divisor and multiple linear regression (MULTIC) methods. The first two methods use the derivative spectrophotometry, and the last one uses the absorbance measurement. The three methods were used to determine both compounds in synthetic mixtures and pharmaceutical preparations with errors less than 5% and 15%, respectively.
Mohamed Ael-M and Salem H et al\textsuperscript{73}, proposed a simple multivariate calibration method for analysis of two types of hypotensive mixture. The mixtures are composed of chlorthalidone with atenolol or chlorthalidone with both amiloride hydrochloride and atenolol.

The components of the mixtures result in substantial spectral overlap—between 87.5 and 91.0\%. Resolution of the mixtures under investigation has been accomplished mainly by using CLS and PCR methods. The components in each mixture have been simultaneously determined in three commercial dosage forms with high accuracy and without interference from commonly encountered excipients and additives. Good recoveries were obtained with both synthetic mixtures and commercial tablets. The results obtained were compared with those from pharmacopeial methods and found to be in good agreement. The results obtained from CLS and PCR were also compared with those obtained from a first derivative spectrophotometric method.

Ferraro, M.C et al\textsuperscript{74}, have developed multivariate spectrophotometric calibration for the simultaneous analysis of synthetic samples and commercial tablet preparations containing hydrochlorothiazide (HCT) and amiloride hydrochloride (AMH) is reported. Partial least squares (PLS–1) analysis of electronic absorption spectral data allowed the rapid and accurate resolution of mixtures in which the analyte ratios were approximately 10:1, without the need of a previous separation step and without interference from other sample constituents. The method, validated by the analysis of synthetic mixtures of both drugs, where accuracy over the linear working range as well as inter– and intra–assay precision were determined, was used in the concentration ranges of 21.7–30.4 mg/mL for HCT and 1.8–3.0 mg/mL for AMH.
The proposed method was successfully applied to the evaluation of the stability of the stock solutions of the analytes in MeOH–H₂O and to the elaboration of drug dissolution profiles of commercial tablets, results being concordant with those furnished by the USP technique. The method was also employed for the determination of drug content in two different pharmaceutical formulations, providing results that were in excellent agreement with those obtained by HPLC.

Dinç, E and Ustündağ, O et al. described four chemometric techniques, classical least squares (CLS) and inverse least squares (ILS) and principal component regression (PCR) and partial least squares regression (PLSR) were applied to the absorption and derivative spectrophotometric determinations of amiloride and hydrochlorothiazide in a pharmaceutical preparation. Four chemometric calibrations for both zero-order and first derivative spectra were constructed by measuring the absorbance and their dA/dλ values at 34 points in the wavelength range 205–395 nm for a training set containing 2–10 µg/mL amiloride and 4–28 µg/mL hydrochlorothiazide corresponding to 25 point mixture design. The building chemometric calibrations were confirmed by using the synthetic mixtures containing two drugs.

The results obtained by the proposed techniques based on the use of the measurements at the absorption spectra and at the first derivative spectra were statistically compared with each other.

Ferraro, M.C et al. proposed a numerical method, based on the use of spectrophotometric data coupled to PLS–1 multivariate calibration, for the simultaneous determination of furosemide and amiloride hydrochloride in synthetic
samples and commercial tablets. The method was applied in the concentration ranges of 8.0–13.0 mg L for furosemide and 1.0–1.6 mg L for amiloride hydrochloride. Its accuracy and precision were determined, and it was validated by the analysis of synthetic mixtures of both drugs. The method was successfully applied to the quantitation of furosemide and amiloride hydrochloride in three different pharmaceutical formulations, providing results in agreement with those obtained by HPLC. It allowed the rapid, accurate and precise simultaneous estimation of the concentration of both analytes of interest in spite of their important spectral overlap, high concentration relationship and the presence of small amounts of different, unmodelled, absorbing excipients.

Inés Toral, M et al\textsuperscript{77} proposed a simple and fast method for the simultaneous determination of amiloride and furosemide by digital derivative spectrophotometry. HCl 1 x 10\textsuperscript{-2} mol/L dissolved in ethanol was used as solvent and to extract drugs from formulations. Subsequently the samples were evaluated directly by first digital derivative spectrophotometry, using a smoothing factor of 8 and scale factor of 1 x 10\textsuperscript{-4}. The simultaneous determination of furosemide and amiloride can be carried out at 241.4 and 343.6 nm, respectively. In both cases, the zero crossing approach was used. When both compounds are present together in a sample, it is possible to quantify one in the presence of the other, without mutual interference.

The determination range was found to be of 6.9 x 10\textsuperscript{-8} to 16 x 10\textsuperscript{-5} and 6.8 x 10\textsuperscript{-8} to 8 x 10\textsuperscript{-5} mol/l, for amiloride and furosemide, respectively. A good level of repeatability (RSD) of 0.9 and 0.6\% was observed for amiloride and furosemide, respectively. The ingredients commonly found in commercial pharmaceutical
formulations do not interfere. The proposed method was applied to the determination of these drugs in pharmaceutical formulations.

**(g) Mosapride citrate**

Various methods are reported in literature for the estimation of mosapride citrate which include Colorimetric method\(^87\), Spectrophotometric method\(^88-89\) and HPLC method\(^90-93\).

B.S. Kuchekar et al\(^87\) proposed a simple colorimetric method for the estimation of mosapride citrate in solid dosage forms. Estimation of mosapride citrate is based on diazotization of mosapride and coupling of the diazonium salt with N-(1-napthyl) ethylene diamine dihydrochloride to form a stable purple colored chromogen. With absorbance maximum at 540 nm, the chromogen obeyed linearity over 20–160 μg/mL.

Appala Raju and Shobha M et al\(^88\) proposed a simple and sensitive UV spectrophotometric method for the estimation of mosapride citrate in bulk drug and its formulations. Mosapride citrate exhibits absorption maximum at 272 nm. Beer’s law obeyed in the concentration range of 2–10 μg/mL.

H.D. Revanasiddappa and M.A. Veena\(^89\), have developed two simple and sensitive spectroscopic methods (M1 and M2) for the determination of mosapride in pure and in pharmaceutical preparations. These methods are based on the interaction of diazotizes mosapride (MSP) couples with chrmotropic acid (CTA) [M1] in alkaline medium and diphenylamine (DPA) [M2] in acidic medium. The resulting azo-dyes exhibit maximum absorption at 560 nm and at 540 nm for methods M1 and M2.
respectively. All variables were studied in order to optimize the reaction conditions. No interferences were observed from excipients, and the validity of the each method was tested against reference method.

(h) Alfuzosin hydrochloride

Various methods are reported in the literature for the determination of ramipril in pharmaceutical formulations which include, spectrophotometric methods\textsuperscript{94–96}, spectrophotometric and spectrofluorimetric methods\textsuperscript{97}, HPLC and HPTLC stability-indicating methods\textsuperscript{98}, Reverse Phase HPLC and HPTLC methods\textsuperscript{99}, Rapid liquid chromatography–tandem mass Spectrometry method\textsuperscript{100}, high Performance liquid chromatographic determination\textsuperscript{101}, and Voltammetric Analysis\textsuperscript{102}.

M. Vamsi Krishna and D. Gowri Sankar\textsuperscript{94}, have described three accurate, simple and precise spectrophotometric methods for the determination of alfuzosin hydrochloride in bulk drugs and tablets. The first method is based on the reaction of alfuzosin with ninhydrin reagent in N,N′-dimethyl formamide medium (DMF) producing a colored product which absorbs maximally at 575 nm. Beer’s law is obeyed in the concentration range 12.5–62.5 µg/mL of alfuzosin. The second method is based on the reaction of drug with ascorbic acid in DMF medium resulting in the formation of a colored product, which absorbs maximally at 530 nm. Beer’s law is obeyed in the concentration of 10–50 µg/mL of alfuzosin. The third method is based on the reaction of alfuzosin with p–benzoquinone (PBQ) to form a colored product with \( \lambda_{\text{max}} \) at 400 nm. The products of the reaction were stable for 2 hours at room temperature.
The optimum experimental parameters for the reactions have been studied. The validity of the described procedures was assessed. Statistical analysis of the results has been carried out revealing high accuracy and good precision. The proposed methods could be used for the determination of alfuzosin in pharmaceutical formulations. The procedures were rapid, simple and suitable for quality control application.

M. Vamsi Krishna and D. Gowri Sankar proposed a simple, rapid and sensitive spectrophotometric procedures for the analysis of Alfuzosin hydrochloride (AFZ) in pure form as well as in pharmaceutical formulations. The methods are based on the reaction of AFZ with nitrite in acid medium to form diazonium ion, which is coupled with ethoxyethylene maleic ester (Method A) or ethyl cyano acetate (Method B) or acetyl acetone (Method C) in basic medium to form azo dyes, showing absorption maxima at 440, 465 and 490 nm respectively. Beer's law is obeyed in the concentration of 4–20 μg/mL of AFZ for methods A, B and 3–15 μg/mL of AFZ for method C.

The molar absorptivity and sandell's sensitivity of AFZ–ethoxy ethylene maleic ester, AFZ–ethyl cyano acetate and AFZ–acetyl acetone are $1.90 \times 10^4$, $1.93 \times 10^4$, $2.67 \times 10^4$ L mole$^{-1}$ cm$^{-1}$, $0.022$, $0.021$ and $0.015$ μg cm$^{-2}$ respectively. The optimum reaction conditions and other analytical parameters were evaluated. The methods were successfully applied to the determination of AFZ in pharmaceutical formulations.

Safwan Ashour et al. have proposed spectrophotometric method for the determination of determine alfuzosin hydrochloride either in pure form or in...
pharmaceutical formulations using bromocresol purple (bcp), bromophenol blue (bpb) and bromothymol blue (btb) dyes. Alfuzosin was extracted as an ion–pair complex from sample solution containing KCl–HCl buffer pH 2.2, 2.4 and 2.6 into chloroform and the absorbance was measured at 407, 413 and 412 nm with use of the cited reagents, respectively. The analytical parameters and their effects on the reported systems are investigated. The reactions were extremely rapid at room temperature and the absorbance values remains unchanged up to 24 h. Beer’s law was obeyed in the concentration ranges 1.20–38.3, 0.85–46.0 and 0.63–34.0 \( \mu g/mL \) and detection limits were 0.28, 0.24 and 0.18 \( \mu g/mL \) with BCP, BPB and BTB, respectively. Recoveries were 98.80–101.33%. Interferences of the other ingredients and excipients were not observed.

The proposed method is simple, fast and sensitive, and the first reported extractive method for the determination of alfuzosin in commercial tablets.

A.S. Fayad et al developed validated stability–indicating spectrophotometric and spectrofluorimetric assays for the determination of alfuzosin hydrochloride (AFZ) in the presence of its oxidative, acid, and alkaline degradation products. Three spectrophotometric methods were suggested for the determination of AFZ in the presence of its oxidative degradation product; these included the use of zero order (0D), first order (1D), and third order (3D) spectra. The absorbance was measured at 330.8 nm for (0D) method, while the amplitude of first derivative (1D) method and that of third derivative (3D) method were measured at 354.0 and 241.2 nm, respectively. The linearity ranges were 1.0–40.0 \( \mu g/mL \) for (0D) and (1D) methods, and 1.0–10.0 \( \mu g/mL \) for (3D) method. Two spectrofluorimetric methods were developed, one for determination of ALF in the presence of its oxidative degradation.
product and the other for its determination in the presence of its acid or alkaline
degradation products. The first method was based on measuring the native
fluorescence of ALF in de ionized water using λ(excitation) 325.0 nm and λ
(emission) 390.0 nm. The linearity range was 50.0–750.0 µg/mL. This method was
also used to determine ALF in human plasma with the aid of a suggested solid phase
extraction.

The second method was used for determination of ALF via its acid
degradation product. The method was based on the reaction of fluorescamine with the
primary aliphatic amine group produced on the degradation product moiety. The
reaction product was determined spectrofluorimetrically using λ (excitation) 380 nm
and λ (emission) 465 nm. The linearity range was 100–900 µg/mL.

All methods were validated according to the International Conference on
Harmonization (ICH) guidelines, and applied to bulk powder and pharmaceutical
formulations.

(i) Mesalamine

A few spectrophotometric method103–107, HPLC–ESI–MS/MS method108,
voltammetry method109, LC method110, HPLC methods111–116, for the estimation of
mesalamine have been reported in the literature.

Srinivasa Rao Narala and K. Saraswathi103 have developed three simple and
sensitive spectrophotometric methods (A, B and C) for the quantitative determination
of Mesalamine in bulk and tablet dosage forms. Method–A was based on
condensation of Mesalamine with p–dimethyl amino benzaldehyde to form Schiff’s
base, which was an yellow colored chromogen showed the absorption maximum at 450 nm.

The Beer’s law range, regression equation and % recovery studies were found to be 10–50 μg/mL, Y=0.00594, X=0.0074 and 99.95±0.045 respectively. Method B and C were based on the oxidation of Mesalamine with ferric chloride followed by complex formation with 2,2-bipyridyl or potassium ferri cyanide. The colored complexes formed were measured at 520 nm for method–B and 720 nm for method C respectively.

The Beer’s law range, regression equation and % recovery studies were found to 4–24 μg/mL, Y = 0.03318 X + 0.105008, and 99.93 ± 0.101 for method–B, 4–20 μg/mL, Y = 0.0365 X + 0.1198 and 99.76 ± 0.075 for method C. All the methods were validated and found to be satisfactory.

Rakesh Kumar Singh et al\textsuperscript{104}, proposed a simple UV spectrophotometric method for the determination of Mesalazine in pure and its pharmaceutical formulations. Mesalazine exhibiting maximum absorbance at 210 nm in methanol and obeyed linearity in the concentration range of 0.2–50 μg/mL. The proposed method was statistically validated.

Sasmita Kumari Acharya et al\textsuperscript{105}, have developed five simple, precise and cost effective spectrophotometric methods for the estimation of mesalamine in bulk and its pharmaceutical formulations. Mesalamine shows λ\textsubscript{max} at 232.0 nm in zero order derivative spectrum (Method A), 241.0 nm in first order derivative spectrum (Method B), 244.5 nm in second order derivative spectrum (Method C) and 240.5 nm in third
order derivative spectrum (Method D). Method E is based on calculation of Area under Curve (AUC) for analysis of mesalamine in the wavelength range of 227.0–237.0 nm. The drug follows the Beer–Lambert’s law in the concentration range of 2.0–25.0 μg/mL in all the methods. The methods were validated by following the analytical performance parameters suggested by the International Conference on Harmonization. All validation parameters were within the acceptable range. The developed methods were successfully applied to estimate the amount of mesalamine in bulk and pharmaceutical dosage forms.

Patel, K.M et al\textsuperscript{106}, have developed three simple and sensitive visible spectrophotometric methods (A, B, and C) for the quantitative estimation of mesalamine in bulk drug and pharmaceutical dosage forms. Methods were based on the formation of colored chromogens, which were measured at 552 nm, 440 nm, and 494 nm, respectively. The results obtained with the proposed methods were found to be unsatisfactory with the labeled amounts when the tablet dosage forms were analyzed. Method A is based on Diazotization of mesalamine with nitrous acid, to form diazotized mesalamine followed by its coupling with N–(1–naphthyl) ethylene–diamine dihydrochloride, to form a violet colored chromogen with maximum absorption at 552 nm; it obeyed the Beer's law in the concentration range of 2–30 μg/mL. Method B is based on the condensation of Mesalamine with p–dimethylaminobenzaldehyde to form the Schiff's base that is an yellow colored chromogen and exhibits maximum absorbance at 440 nm; The Beer's law is obeyed in the concentration range of 50–500 μg/mL.

In method C, mesalamine has a phenolic group when made to react with Gibb's reagent. In alkaline pH it forms a colored chromogen, exhibiting absorption
maximum at 494 nm, and Beer's law is obeyed in the concentration range of 5–60 μg/mL.

(j) Pramipexole

Very few analytical methods have been developed for its quantitative estimation in pharmaceutical formulations, which includes, spectrophotometric method\textsuperscript{117} and chromatographic methods\textsuperscript{118–121}. B.M. Gurupadayya et al\textsuperscript{117}, proposed two simple, sensitive, accurate and economic methods A and B for the quantitative estimation of pramipexole dihydrochloride drug and its formulations (Tablets).

Method A is based on the diazotization of primary amine group of pramipexole with sodium nitrate and hydrochloric acid followed by coupling with N–(1–napthyl) ethylene diamine hydrochloride (BM Reagent) to form a colored chromogen with a characteristic absorption maximum at 616 nm. Method B is based on the reaction of the drug in methanolic solution with pardimethylaminobenzaldehyde (PDAB) in acidic condition producing Schiff’s base having at 474.5nm. Beer’s law is obeyed in concentrations ranging from 4–20 μg/mL for method A and 50–150 μg/mL for method B. The results obtained with the proposed methods are in good agreement with labeled amounts when the marketed pharmaceutical formulations are analyzed. The results of analysis have been validated statistically and by recovery studies.
Section (ii): Objectives of the present investigations

Quality is important in every product or service and it is vital in medicine as it involves saving of life. Unlike ordinary consumer goods, there should not be and there is no "second" quality in drugs. Quality control is a concept, which strives to produce a perfect product by a series of measures designed to prevent and eliminate errors at different stages of production. As a matter of fact, it is built in from the time of inception of the thought to make a product, to the time it is finally made and sent out with an OK quality report.

In popular practice, the quality of medicines or pharmaceutical products is assured through quality control. It is, therefore, essential that quality assurance department must adopt "Good Laboratory Practice" to ensure reliability of pharmaceuticals together with their careful control which are our moral obligations arising from the humanism towards sick human beings. Consequently, the manufacturer and the control of drugs are very responsible and they need substantial knowledge of the science. The decision to release or reject a product is based upon one or two types of control action or combination of both. If the product is a single entity of high purity, the analytical data is the basis for decision but most of the time the formulation is a physical mixture of several potent drugs.

With the growth of pharmaceutical analysis involving complex instrumentations, providing simple analytical procedures for complex formulations has become a matter of foremost importance.

Drugs and pharmaceuticals play a very significant role today for prevention, control and curing of different kinds of human diseases. It is a common observation and the practical truth that a single drug of a particular composition is marketed in various brand names by different manufacturers. The possibility of minor changes in
the chemical composition and standard of the drug will have a profound effect on the physiological and biological activities of the patient. It is very much painful for the present day scientist in general and to the analytical pharmaceutical chemist in particular to note in the various dailies about the entry of spurious and substandard drugs into market, which definitely will have an adverse effect on the human beings at large.

It is with this challenge in mind; the author has taken up thorough investigations to evaluate the purity of the various drugs released into the market.

The author has made an extensive survey of the chemical and biochemical literature to know whether the reports involving simple experimental techniques such as the spectrophotometric techniques are available for ascertaining the assay and purity of the drugs. It is the observation of the author that not much attention is paid to simple and rapid spectrophotometric methods for the assay of drugs available in literature.

Various instrumental techniques (HPLC, GC, Fluorimetry, NMR, IR, UV and Visible regions) are available in literature for the assay of drugs. These methods are either expensive or are not reproducible. Usually spectrophotometric technique is simple and less expensive. The selectivity and sensitivity of the spectrophotometric methods depend only on the nature of chemical reactions involved in colour development and not on the sophistications of the experiment.

UV and Visible spectrophotometric methods are highly versatile, sensitive and reproducible. This made the author to develop new spectrophotometric methods for the estimation of selected drugs having varying uses in pharmaceutical preparations.