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Simultaneous Spectrophotometric Estimation of Ciprofloxacin and Tinidazole in Tablets Using Orthogonal Polynomial Function Method

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A simple, accurate and reproducible spectrophotometric method, requiring no prior separation, has been developed for simultaneous estimation of ciprofloxacin and tinidazole in combined tablet dosage form. The described method was applied for the determination of these combinations in synthetic mixtures and tablet dosage forms. Contents in the tablets were found to be 100.56 ± 1.50 for ciprofloxacin and 99.16 ± 1.05 for tinidazole of the label claim. The linearity was validated by least square method. The recovery was with in the limit of 98 to 102 %. The proposed method is simple, economical, accurate, reproducible and rapid.

Key Words: Spectrophotometric, Tinidazole, Estimation, Ciprofloxacin, Orthogonal polynomial function.

INTRODUCTION

Orthogonal polynomial function method is a mathematical model for the elimination of irrelevant absorption proposed by Glenn[1,2]. The method involves complex calculations to select the right combination of degree of polynomial, number of points in the spectrum, interval between the points. The optimization of these parameters can be simplified by using a software[3]. Ciprofloxacin (CIP) and tinidazole (TIN) are employed for the antidiarrhoeal and gastrointestinal antiinfective, respectively. Chemically ciprofloxacin is 1-cyclopropyl-6-fluoro-4-oxo-7-(piperazin-1-yl)-1,4-dihydroquinoline-3-carboxylic acid and tinidazole is 1-[2-(ethylsulphonyl) ethyl]-2-methyl-5-nitroimidazole. HPLC[4,5] RP-HPLC[6] and dual wavelength spectrophotometry[7] methods are reported for the simultaneous estimation of ciprofloxacin and tinidazole. Previously three different combinations were reported for analysis using this software[3] namely paracetamol and nimsulide[3], cinnarizine and domperidone[9] and amlodipine and enalapril[10].

EXPERIMENTAL

Ciprofloxacin was provided by the courtesy of Micro Labs (P) Ltd., Bangalore and tinidazole was provided by the courtesy of Cassel Research Laboratories, Chennai as gift samples. N,N-dimethyl formamide (AR-grade) was procured from S.D. Fine Chemicals Ltd., Mumbai. The spectra were recorded in UV spectrophotometer (Shimadzu, UV 1601 PC, Japan).

100 mg of ciprofloxacin and tinidazole were weighed in separate 100mL volumetric flask and added 10 mL of 10 % N,N-dimethyl formamide and made up to 100 mL with distilled water and further dilutions were made to get 10 µg mL^{-1} and UV spectra of 10 µg mL^{-1} solution of ciprofloxacin and 10 µg mL^{-1} solution of tinidazole were recorded from 450 to 240 nm and stored in ASCII format. From these spectral data, 112 convoluted graphs each for ciprofloxacin and tinidazole were obtained using the software developed in a previous study[3]. Convoluted graph of ciprofloxacin were compared with that of corresponding tinidazole and the optimum conditions for orthogonal polynomial function method were selected and given in (Table-1) taking following points into consideration, i) the coefficient value is negligible for one drug and as high as possible for the other and ii) as far as possible the wavelength range where there was steep rise in coefficient value of either drug was avoided.

TABLE-1
OPTIMISED PARAMETERS FOR ORTHOGONAL POLYNOMIAL FUNCTION METHOD OF ANALYSIS

Drug	Degree of polynomial	Number of points	Wavelengths (nm)
Ciprofloxacin	Quadratic	7	279.2, 284.2, 289.2, 294.2, 299.2, 304.2 and 309.2
Tinidazole	Quadratic	6	296, 302, 308, 314, 320 and 326

Determination of polynomial function (P) (1 %, 1 cm)

Coefficient of polynomial is directly proportional to the concentration of analyte and it can be calculated by using eqn. 1 for tinidazole and eqn. 2 for ciprofloxacin where the factors are those of 6 point quadratic polynomials obtained from the text of numerical analysis[8].

$$P_{tinidazole} = 5(A_{296})-1(A_{302})-4(A_{308})-4(A_{314})-1(A_{320})+5(A_{326}) \quad (1)$$

$$P_{ciprofloxacin} = 5(A_{279.2})\ 0(A_{284.2})-3(A_{289.2})-4(A_{294.2})-3(A_{299.2})\ 0(A_{304.2})+5(A_{309.2}) \quad (2)$$

where, $P_{tinidazole}$ and $P_{ciprofloxacin}$ are coefficients of polynomial of tinidazole and ciprofloxacin, respectively and A is absorbance at respective wavelength. The P (1 %, 1 cm) is a constant which represents the coefficient

corresponding to the absorbance of 1 % solution kept in 1 cm cell which can be used for the calculation of concentration of sample similar to the use of A (1 %, 1 cm) in conventional spectrophotometry. Coefficient values corresponding to the absorbance values of 10 µg mL^{-1} solution of ciprofloxacin or tinidazole were calculated as above and from this the P (1 %, 1 cm) value was calculated.

Analysis of tablet formulation

Weighed and powdered 20 tablets in a mortar and weighed the quantity of powder equal to 100 mg of ciprofloxacin (120 mg of tinidazole) and added in 10 mL of 10 % dimethyl formamide in 100 mL volumetric flask and make up to 100 mL with distilled water and filtered through whatman filter paper and dilution were made to get 10 mcg/mL of ciprofloxacin. The solution was scanned between 450 and 240 nm in UV visible spectrophotometer (Table-2).

TABLE-2
ANALYSIS OF TABLET FORMULATION FOR CIPROFLOXACIN AND TINIDAZOLE

Ciprofloxacin content		Tinidazole content	
mg/tab	Label claim (%)	mg/tab	Label claim (%)
254.26	101.70	299.20	99.73
256.31	102.52	292.44	97.48
245.23	98.09	295.94	98.64
248.83	99.53	300.65	100.21
253.88	101.55	296.37	98.79
249.94	99.97	300.39	100.13
Mean	100.56	Mean	99.16
SD	± 1.50	SD	± 1.05

Label claim: Each tablet contains 250 mg ciprofloxacin and 300 mg tinidazole

RESULTS AND DISCUSSION

Ciprofloxacin exhibit maximum absorbance at 272 and 322 nm in distilled water with 10 mL of 10 % DMF used initially to dissolve the drug. Tinidazole exhibit maximum absorbance at 318 nm in distilled water with 10 mL of 10 % DMF used initially to dissolve the drug. These spectral characters make this an ideal combination for orthogonal polynomial function method of analysis and estimation of both drugs with out separation of each other. The optimum analytical conditions were arrived at by using the software custom developed for the purpose. When the software was executed the user will enter the UV data file name, the degree of polynomial, number of wavelengths and interval between the wavelengths. When these information's are provided, the spectral file name is opened,

the wavelengths are chosen starting from the first wavelength of the spectrum and the average is calculated. The corresponding absorbance values are substituted in the respective equations[8] to calculate the coefficient of polynomial for the selected wavelength region. The process is repeated successively to cover the entire spectra. The output can be used for construction of convoluted graph. Comparing the convoluted graph of ciprofloxacin with that of corresponding convoluted graph of tinidazole the optimum condition was arrived at. The optimised conditions for the estimation of ciprofloxacin and tinidazole are given in Table-1. The convoluted graph for the optimized conditions for the estimation of ciprofloxacin and tinidazole are given in (Figs. 1 and 2).

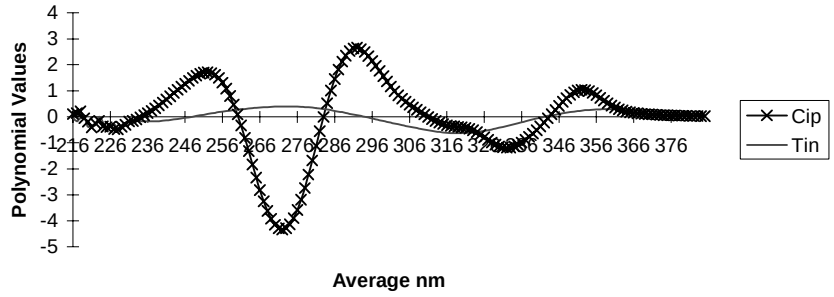

Fig. 1. Convoluted graph for estimation of ciprofloxacin

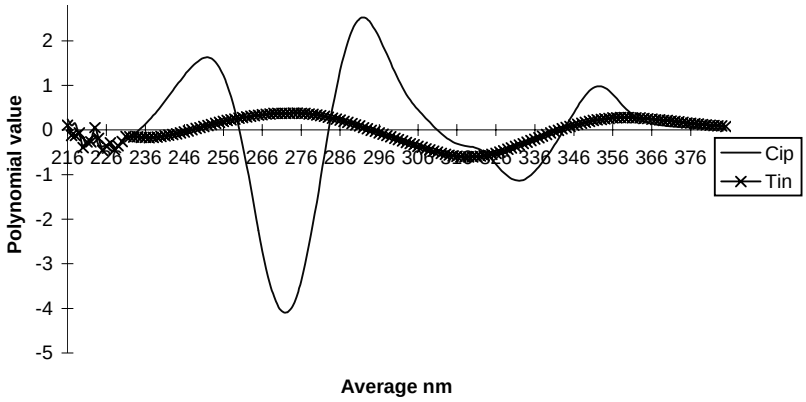

Fig. 2. Convoluted graph for estimation of tinidazole

Conclusion

The proposed method is simple, accurate and reproducible. The irrelevant absorptions are eliminated by the proposed method. It is suitable for the simultaneous estimation of ciprofloxacin and tinidazole in tablet formulations.

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