positions aimed at protecting skin from solar radiation in vigorous activity like swimming as well as for wash-off cosmetic preparations like soaps, shampoos, face washes etc.

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Spectrophotometric Determination of Ornidazole and Norfloxacin in Tablets

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Two simple spectrophotometric methods for the determination of ornidazole and norfloxacin in pharmaceutical preparations have been developed. First method is based on simultaneous equations. In the second method, derivative spectroscopy is used to eliminate spectral interference. Both drugs obey Beer's law in the concentration range employed for the analysis. The results of analysis have been validated statistically and by recovery studies.

Norfloxacin, 1-ethyl-6-fluoro-1,4-dihydro-4-oxo-7-(1-piperazinyl)-3-quinoline carboxylic acid is used as antibacterial[1]. Its methods of analysis are given in USP[2], IP[3] and BP[4]. Further literature survey revealed some more methods for its estimation from pharmaceutical preparations and includes spectrophotometry[5-9], HPLC[10] and HPTLC[11]. Ornidazole, 1-(3-chloro-2-hydroxypropyl)-2-methyl-5-nitroimidazole is used as an antiinfective[12]. Literature survey describes spectrophotometry[13-16] and pH metery[17] methods for its determination from pharmaceutical preparations. There is no single method for simultaneous determination of ornidazole and norfloxacin from pharmaceutical preparations.

A PC-based JASCO V-560 UV/Vis spectrophotometer with 10 mm matched quartz cuvettes was used for the experimental purpose. Sodium hydroxide of analytical reagent grade and double distilled water were used. Ornidazole and norfloxacin were obtained as gift sample from M/s Aristo Pharmaceuticals (P) Ltd., Bhopal. A combination of both these drugs, ornidazole (500 mg) and norfloxacin (400 mg) in each tablet, is marketed by Mankind Pharma (Noragyl-OZ).

Standard stock solutions of ornidazole, 100 μg/ml and norfloxacin, 100 mg/ml were prepared separately in 0.1 N sodium hydroxide solution. Each stock solution was suitably diluted to different concentrations and linearity was studied. Linear relationships were observed in the range 2–20 μg/ml for ornidazole and 1–10 μg/ml for norfloxacin. Sample stock solution was prepared by crushing 20 tablets to fine powder. Powder equivalent to 10 mg of ornidazole and 8 mg of norfloxacin was dissolved in 50 ml of 0.1 N sodium

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hydroxide solution by thoroughly shaking. This was transferred to 100 ml standard volumetric flask and volume was made up to the mark with sodium hydroxide solution. This solution was then filtered through Whatman filter paper # 41. This is sample stock solution. Further dilutions were made from this stock solution to get required concentration.

The overlain zero order spectra of ornidazole and norfloxacin are shown in fig. 1. The figure indicates that absorption maxima of ornidazole is at wavelength 317 nm while norfloxacin has absorption maxima at 272 nm. Spectra of standard solution of ornidazole having concentration 10 μg/ml was recorded in the range of 400–220 nm against 0.1 N sodium hydroxide. Absorption was determined at wavelengths 317 nm and 272 nm. In the first method, the molar absorptivity coefficients at these wavelengths were calculated. Similarly, spectra of standard solution of norfloxacin having concentration 5 μg/ml was recorded in the range of 400–220 nm against 0.1 N sodium hydroxide. Absorption was determined at wavelengths 317 nm and 272 nm. The molar absorptivity coefficients at these wavelengths were calculated. Molar absorptivity (ϵ_1) of ornidazole is $1.756X10^3$ l/mole.cm at 272 nm (λ_1) and $8.344X10^3$ l/mole.cm at 317 nm (λ_2), while molar absorptivity (ϵ_2) of norfloxacin is $1.756X10^3$ l/mole.cm at 272 nm (λ_1) and $8.344X10^3$ l/mole.cm at 317 nm (λ_2).

An aliquot of sample stock solution (5 ml) was transferred to 50 ml standard volumetric flask and volume was made up to the mark with sodium hydroxide solution. This solution was scanned in the range 400-220 nm against sodium hydroxide solution as blank. Absorbance ($A\lambda_1$, $A\lambda_2$) were recorded at wavelength 272 nm and 317 nm. The concentration of each drug was then calculated by using formula given below. Concentration of ornidazole=$\lambda_2\epsilon_2.A\lambda_1-\lambda_1\epsilon_2.A\lambda_2/\lambda_1\epsilon_1.\lambda_2\epsilon_2-\lambda_1\epsilon_2.\lambda_2\epsilon_1$ (1) and concentration of norfloxacin=$\lambda_1\epsilon_1.A\lambda_2-\lambda_2\epsilon_1.A\lambda_1/\lambda_1\epsilon_1.\lambda_2\epsilon_2-\lambda_1\epsilon_2.\lambda_2\epsilon_1$ (2).

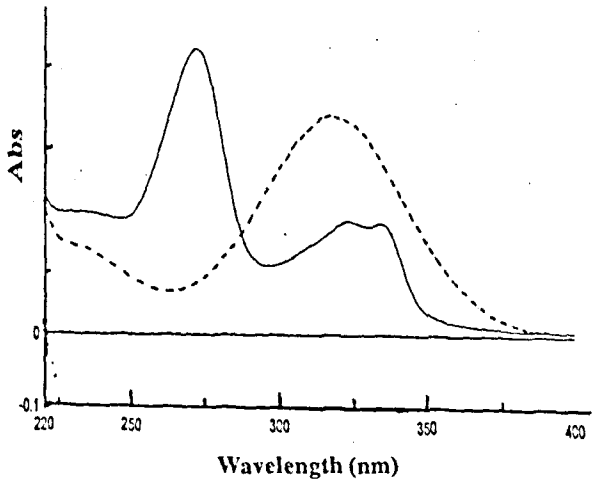

Fig. 1: Overlain spectra of ornidazole and norfloxacin.

UV absorption spectra of ornidazole (—) (10 μg/ml) and norfloxacin (- - -) (5 mg/ml) in 0.1 N sodium hydroxide.

The second method is based on first derivative spectroscopy to overcome spectral interference from other drug. First derivative spectra of both the drugs were recorded (fig. 2). It was observed that ornidazole showed dA/dλ zero at 260 nm in contrast to norfloxacin that has considerable dA/dλ. Further norfloxacin has zero dA/dλ at 296 nm, while at this wavelength ornidazole has significant dA/dλ. Therefore these two wavelengths can be employed for the estimation of ornidazole and norfloxacin without any interference. The calibration curves were plotted at these two wavelengths using different concentrations against absorbance within linearity range mentioned above. The equations obtained to determine concentration of ornidazole is Y=0.007X + 0.0029, r=0.998 (3) and for norfloxacin is Y=0.003X–0.0002, r=0.997 (4).

An aliquot of sample stock solution (5 ml) was transferred to 50 ml standard volumetric flask and volume was made up to the mark with sodium hydroxide solution. This solution was scanned in the range 400-220 nm against sodium hydroxide solution as blank. Then this spectra was

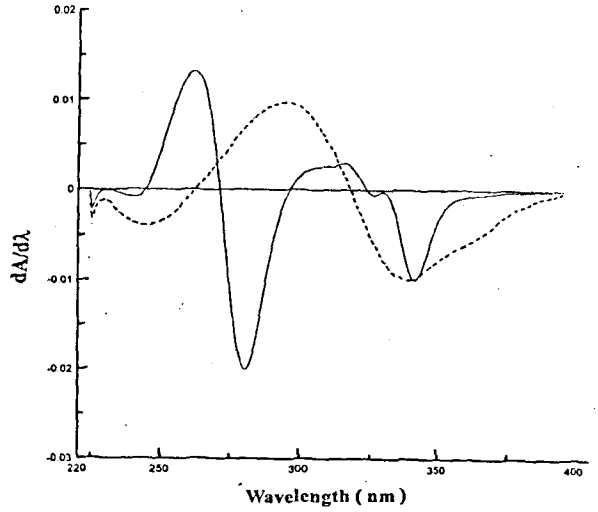

Fig. 2: Overlain first derivative spectra of ornidazole and norfloxacin

UV absorption first derivative spectra of ornidazole (—) (10 μg/ml) and norfloxacin (- - -) (5 mg/ml) in 0.1 N sodium hydroxide.

TABLE 1: RESULTS OF COMMERCIAL SAMPLE ANALYSIS.

Drug / Label Claim (mg/tablet)	Method I		Method II		't' Test
	Amount* found (mg)	% R.S.D.	Amount* found (mg)	% R.S.D.	
Ornidazole/ 500	498.5	0.89	498.8	0.78	1.12
Norfloxacin/ 400	398.5	0.95	399.2	0.65	0.87

Asterisk (*) denotes mean of five determinations. %R.S.D. = Relative standard deviation (n=5). 't' Test is the Student's t-test values were calculated at 95% confidence level between the results obtained from two methods.

TABLE 2: RECOVERY STUDY OF COMMERCIAL SAMPLE.

Drug	Amount added in final solution (mg/ml)	*Recovery (%)	
		Method I	Method II
Ornidazole	1.0	100.8	99.8
	1.5	99.7	98.6
	2.0	99.3	99.2
Norfloxacin	1.0	100.2	99.4
	1.5	99.1	98.7
	2.0	98.8	98.4

Asterisk (*) denotes mean of three analysis.

derivatised to first order derivative. $dA/d\lambda$ were measured at wavelength 260 nm and 296 nm. Using the equations 3 and 4 the concentrations of each drug was calculated.

Results of analysis for both methods are given in Table 1. To determine the precision and accuracy of the methods, recovery experiments were performed using the method of addition. A fixed volume of standard solution was added to different concentrations of sample solutions. The total amount of drug was then determined by these methods and the amount of added drug found by difference. The results of recovery are given in Table 2.

Both the methods were found to be accurate, simple and rapid for routine simultaneous analysis of the drugs from the formulations without prior separation. In the first method, once absorptivity coefficients were determined very little time is required for analysis as it would only require determination of absorbances of the sample solutions at the selected wavelengths and few calculations. The second method is used to eliminate the spectral interference from one of the two drugs while estimating the other drug by selecting the zero crossing point on the derivative spectra of each drug as the selected wavelengths. Both the methods are less time consuming and can be easily applied to routine analysis.

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Effect of Polyvinylpyrrolidone on Physical Characteristics of Ketoprofen-loaded Polystryrene Microparticles

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Ketoprofen-loaded polystyrene microparticles containing variable amount of polyvinylpyrrolidone as a copolymer were prepared by emulsion solvent evaporation method. The effect of polymer combination and initial drug loading on physical characteristics of the microparticles were studied. Although the microparticles were prepared by emulsification using different polymer combinations, the mean diameters were confined within a narrow range. However increase in initial drug loading increased the mean diameters of the microparticles. Polystyrene was found to be highly impermeable to drug release. Incorporation of polyvinylpyrrolidone easily modulated drug release. Mechanism of drug release was found to be a complex one.

Clinical studies have revealed that conventional dose dumping dosage forms of non-steroidal anti inflammatory drugs induce several adverse effects[1]. On the other hand, controlled release tablets minimize the emergence of adverse effects maintaining a steady state plasma drug concentration[2] and increase patient compliance due to reduced frequency of administration. However, when compared with single unit sustained release tablets, multi-unit controlled release dosage forms pass through the gut avoiding the vagaries of gastric emptying and different transit rates[3] and thereby release drugs more predictably[4]. Moreover, a multi-unit system spreads over a large area of absorbing mucosa and prevents exposure to high drug concentration on a chronic dosing[5]. Quite often, modulation of release of water-insoluble drugs from a single polymer appears to be difficult. Instead, mixtures of polymers can have properties significantly better than a single polymer for achieving desired release of drugs. The objective of this work is to study the feasibility of using mixtures of polystyrene and polyvinylpyrrolidone to modulate release chracteristics of ketoprofen which has been used as a model non-steroidal antiinflammatory drug.

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Ketoprofen and polystyrene (Grade McG-100) were obtained as generous gift samples from M/S Rhone Poulenc (I) Ltd., Mumbai and M/S. Hindustan Polymers, Kolkata respectively. Polyvinylpyrrolidone (Mol. wt. 40 000) was purchased from M/S. Loba Chemie, Mumbai. Span 80 was purchased from Fluka, Switzerland. Heavy liquid paraffin, Chloroform A.R., acetone A.R., n-hexane was purchased from S. D. Fine Chem., Mumbai.

Ketoprofen-loaded (20, 40 and 60% w/w) microparticles