effects, screening for different malarial parasites including the chloroquine and multiresistant strains of *Plasmodium* on different developmental stages, toxic manifestations, minimum therapeutic concentration and dose regimen and comparative studies on prepared formulation and in use antimalarial formulation with regard to dose and duration of treatment.

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Spectrophotometric Methods for The Estimation of Nicorandil in Tablet Dosage Forms

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Two simple, sensitive, accurate and rapid spectrophotometric methods have been developed for the estimation of nicorandil in tablets. Method A is based on the reaction of nicorandil with sulphanilic acid reagent in presence of cyanogen bromide solution giving yellow chromogen, which show maximum absorbance at 460 nm against reagent blank while method B is based on the estimation of nicorandil in 0.1 N HCl at 262 nm. Beer's law was obeyed in the concentration range of 10-80 µg/ml in method A and 5-40 µg/ml in method B. Results of the analysis were validated statistically and by recovery studies.

Nicorandil, a nitro vasodilator and potassium channel activator used as an antianginal drug. Chemically, nicorandil is N-[2-(Nitrooxy)ethyl]-3-pyridine carboxamide[1]. Nicorandil is not official in any pharmacopoeia, hence there is no official method for the estimation of nicorandil in pharmaceutical formulations. Only spectrofluorimetric[2], HPLC[3-5] , LC and LC-MS[6-7] methods are reported for the estimation of nicorandil especially in the biological fluids. The present work describes two new, simple spectrophotometric methods involving nicorandil with reagents such as sulphanilic acid and cyanogen bromide (method A) and UV measurement of nicorandil in 0.1N HCl (method B)

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TABLE 1: RESULTS OF ANALYSIS OF NICORANDIL IN PHARMACEUTICAL FORMULATIONS

Formulation#	Label claim (mg/tab)	Method	% of label Claim* ± S.D	%CV	SEM	%Recovery* ± S.D
Tablet 1	5	A	99.1±0.74	0.75	0.370	99.0±0.96
		B	99.1±1.12	1.13	0.565	98.9±0.89
Tablet 2	5	A	100±0.48	0.49	0.245	100 ±0.43
		B	99.4±1.38	1.39	0.695	101±1.25

TABLE 1: RESULTS OF ANALYSIS OF NICORANDIL IN PHARMACEUTICAL FORMULATIONS

*Mean of five determinations. #The commercial preparations used were, tablet 1 is Nikoran, Torrent Pharmaceuticals Ltd., Ahmedabad and tablet 2 is Korandil, Sun Pharmaceuticals Ltd., Mumbai.

The recovery experiments were performed by adding known amount of drug at three different levels to the preanalyzed formulation and reanalyzing the mixtures by proposed method. The results were validated statistically and the % recovery was found in the range of 98.9 to 100.7. The proposed method is new, simple, sensitive, accurate, and precise and can be successfully employed in the routine analysis of nicorandil in tablets dosage forms.

A Shimadzu 1601 UV/Vis. spectrophotometer with 1 cm matched quartz cells was used for absorbance measurements. Nicorandil (Torrent Pharmaceuticals Ltd., Ahmedabad) was used in this study. The tablets were procured from a local pharmacy. Aqueous solutions of sulphanilic acid and ammonia[8], cyanogen bromide[9](method A) and hydrochloric acid (0.1 M) were prepared in double distilled water.

A standard solution containing 1 mg/ml of nicorandil was prepared by dissolving 100 mg of pure drug in 100 ml of (distilled water in method A and 0.1 M hydrochloric acid in method B). It was further diluted with the same solvents to 500 µg/ml for method A and 100 µg/ml for method B. Twenty tablets were weighed and powdered. The powder

TABLE 2: OPTICAL CHARACTRISTICS AND PRECISION

Parameters	Method	
	A	B
λ max (nm)	460	262
Beer's Law limits (µg/ml)	1C 80	5-40
Sandell's sensitivity (µg/cm²/0.001 A.U.)	0.0856	0.0356
Molar extinction coefficient (l/mol.cm)	2.456×10^3	5.936×10^3
Correlation coefficient (r²)	0.9946	0.9997
Regression equation (b+ac)		
Slope (a)	0.0437	0.0285
Intercept (b)	0.0113	0.0029
% Coefficient of variance (%CV)	0.418	0.423
Standard Error of Mean (SEM)	±0.170	±0.190
% Range of error		
Confidence limit with 0.05 level	±0.417	±0.488
Confidence limit with 0.01 level	±0.343	±0.383

equivalent to 50 mg of nicorandil was accurately weighed and dissolved in distilled water to make 100 ml and filtered through Whatman filter paper No.41. It was diluted to 500 µg/ml for method A and 100 µg/ml for method B.

In the method A, aliquots of 0.2 to 1.6 ml portion of standard solution were transferred to a series of 10 ml corning volumetric flasks. To each flask, 0.2 ml of ammonia solution and 2.5 ml of cyanogens bromide solution were added and mixed. Then 1.0 ml of sulphanilic acid reagent was added to each flask and kept a side for 10.0 min for development of colour and volume in each flask was adjusted to 10.0 ml with distilled water. The absorbance of the solution in each flask was measured at 460 nm against the reagent blank and calibration curve was plotted. Similarly the absorbance of sample solution was measured and the amount of nicorandil was determined by referring to the calibration curve.

In the method B, aliquots of 0.5 to 4.0 ml portion of standard solution were transferred to a series of 10.0 ml corning volumetric flasks and were suitably diluted with 0.1 M hydrochloric acid to give final concentrations of 5.0 to 40.0 µg/ml. The absorbance was measured at 262 nm against 0.1 M HCl as a blank and the calibration curve was plotted. Similarly the absorbance of sample solution was measured and the amount of nicorandil was determined by referring to the calibration curve.

To test the accuracy and reproducibility of the proposed methods, recovery experiments were carried out by adding known amount of the drug to the preanalyzed formulation and reanalyzing the mixture by proposed methods. The results are shown in Table 1.

The colour of the chromogen in method A was intensified with solutions of cyanogen bromide (2.5 ml), sulphanilic acid (1.0 ml) and ammonia (0.2 ml). Stability study of the chromogen was carried out by measuring the absorbance values at time intervals of 10 min for 2 h and it was found to be stable for 1.5 h.

Sensitivity and the percentage range of error (95 % level confidence limit) calculated from 5 replicate readings are incorporated in Table 2. The Molar absorptivity and Sandell's sensitivity values show the sensitivity of both the methods, while the precision is confirmed by % CV (coefficient of variance) values included in Table 2, which are less than 2 %. The analysis results of tablets are in good agreement with the labeled claim. The reproducibility, repeatability and accuracy of these methods were found to be good, which is evidenced by low standard deviation. The percent recovery obtained (99.0-100.0 for method A and 98.9-100.7 for method B) indicates non-interference from the common excipients used in the formulations. Thus these methods developed in the present investigation are simple, sensitive and precise and can be successfully applied for the routine estimation of nicorandil in bulk and in tablets.

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