

NOVEL APPROACH FOR SPECTROPHOTOMETRIC ESTIMATION OF PIROXICAM IN TABLET DOSAGE FORM USING CO-MELT OF SODIUM ACETATE TRIHYDRATE AND RESORCINOL AS ECOFRIENDLY SOLVENT (MIXED SOLVENCY CONCEPT)

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ABSTRACT

The pollution and toxicity caused by most of the organic solvents is a big challenge. The researchers are doing much work to give eco-friendly solutions for this challenge. Maheshwari has given a nice concept, known as mixed-solvency concept. By application of this concept, innumerable solvent systems can be developed. Maheshwari is of the opinion that each substance possesses solubilizing power. He has given several eco-friendly methods in the area of drug estimations and formulations precluding the use of toxic organic solvents. The present research work also provides an eco-friendly method to estimate spectrophotometrically, a poorly water-soluble drug, piroxicam in

tablet formulations without the help of organic solvent. The present investigation is an attempt to show that solids can also be wisely used to act as solvent precluding the use of organic solvents. The main objective of the present study is to demonstrate the solvent action of solid. In the present investigation melted sodium acetate trihydrate and resorcinol were employed as solubilizing substances to extract out the drug to estimate piroxicam tablets spectrophotometrically At 358 nm. Sodium acetate trihydrate and resorcinol do not interfere in spectrophotometric analysis At 358 nm. Proposed method is novel, economic, eco-friendly, rapid, free from toxicity of organic solvent, accurate and reproducible. Recovery studies and statistical data proved the accuracy, reproducibility and precision of the proposed method. The presence of tablet excipients and co melt did not interfere in the spectrophotometric estimation at 358 nm.

KEYWORDS: Mixed-solvency concept, piroxicam, sodium acetate trihydrate, resorcinol, spectrophotometric analysis.

INTRODUCTION

Majority of drugs show the problem of poor solubility, whether in the case of their analytical estimations or in the field of liquid dosage forms in the form of solutions. Commonly used organic solvents for spectrophotometric analysis of water insoluble drugs include methanol, ethanol, chloroform, benzene, dichloromethane, dimethyl formamide, acetonitrile, ethyl acetate, toluene, carbon tetrachloride, acetone, hexane etc. The main drawbacks of organic solvents include high cost, toxicity and pollution. Organic solvents have innumerable adverse effects caused by single exposure like dermatitis, headache, drowsiness, nausea, eye irritation and long term exposure causes serious effects such as neurological disorders, chronic renal failure, liver damage, necrosis, mutagenesis disorder. They should be replaced by other eco-friendly alternative sources. The pollution and toxicity caused by most of the organic solvents is a big challenge. The researchers are doing much work to give eco-friendly solutions for this challenge. Maheshwari^[1-6] has given a nice concept, known as mixed-solvency concept. By application of this concept, innumerable solvent systems can be developed. Maheshwari is of the opinion that each substance possesses solubilizing power. He has given several eco-friendly methods in the area of drug estimations and formulations precluding the use of toxic organic solvents. The solubility of a large number of poorly soluble drugs has been enhanced by mixed solvency concept.^[1-21] The present research work also provides an eco-friendly method to estimate spectrophotometrically, the piroxicam drug in tablet formulations without the help of organic solvent.

The present investigation is an attempt to show that solids can also be wisely used to act as solvent precluding the use of organic solvents. The main objective of the present study is to demonstrate the solvent action of solids. In the present investigation melted sodium acetate trihydrate and resorcinol was employed as solubilizing substance to extract out the drug to estimate piroxicam tablets spectrophotometrically at 358 nm. Proposed method is novel, economic, eco-friendly, rapid, free from toxicity of organic solvent, accurate and reproducible. Recovery studies and statistical data proved the accuracy, reproducibility and precision of the proposed method. The presence of tablet excipients and co melt did not interfere in the estimation at 358 nm.

MATERIALS AND METHODS

Piroxicam bulk drug sample was a generous gift by M/S Shree Pharmaceuticals, Indore (India). Commercial tablets of piroxicam (Piroxits DT of Intas Pharmaceuticals Limited, Ahmedabad and Nesprex-DT of Nestor Pharmaceuticals Limited, Goa) were procured from the local market. All other chemicals used were of analytical grade.

A Shimadzu-1700 UV visible spectrophotometer with 1 cm matched silica cells was used for spectrophotometric analysis.

Calibration curve

1.5gm resorcinol and 0.5 gm sodium acetate trihydrate were transferred in a 500 ml volumetric flask. The flask was kept on a boiling water bath to Obtain the co-melt of resorcinol and sodium acetate trihydrate. Standard piroxicam drug (50 mg) was transferred in the flask and the drug was dissolved in co-melt by shaking the flask. After complete dissolution, about 400 ml distilled water (at 50 °C - 60°C) was poured in the volumetric flask and the contents were shaken for about 5 minutes to give a clear solutions. Then the flask was allowed to cool to room temperature and sufficient distilled water was added to make up the volume (500 ml). From this stock solution (100µg / ml), standard solution containing 5,10,15,20,25 µg/ml were prepared by suitable dilution with distilled water and the absorbances of the solutions were noted at 358nm against respective reagent blanks.

Preliminary solubility studies

To determine the solubility of the drug in distilled water at room temperature, sufficient excess amount of the drug was added to a 25 ml capacity vial containing distilled water. After putting the vial cap and applying the aluminium seal, the vial was shaken mechanically for 12 hours at room temperature ($27\pm 1^\circ\text{C}$) in an orbital flask shaker (Khera Instrument Pvt. Ltd., India). The solution was allowed to equilibrate for 24 hours undisturbed and then filtration was done through Whatmann filter paper # 41. The filtrate was appropriately diluted with distilled water and the absorbance was measured at 358 nm against reagent blank.

Approximate solubility of piroxicam in the co-melt of 0.5gm of sodium acetate trihydrate and 1.5gm of resorcinol at boiling waterbath temperature was determined. For this, 1.5 gm sodium acetate trihydrate and 0.5gm of resorcinol powders were taken in a test tube and this test tube was placed in a boiling waterbath to obtain a co-melt (clear liquid). Five milligram of piroxicam bulk drug was transferred to the test tube and the test tube was shaken to

dissolve the drug in the co-melt. When a clear solution was obtained, again 5 mg drug was transferred in the test tube and the same procedure was repeated. During this time, the test tube was frequently replaced in the water bath to maintain the fluidity of the co-melt. When the co-melt was nearly saturated with the drug (some drug remain undissolved), the addition of the drug was stopped. From this, the approximate solubility of piroxicam in the co-melt was determined.

Proposed method of analysis

5 gms of sodium acetate trihydrate and 15 gms of resorcinol were transferred in a 500ml volumetric flask, the flask was kept on a water bath to obtain a co-melt. Then, tablet powder equivalent to 50mg of piroxicam was transferred to the flask and the flask was shaken for 10 minutes to extract out (dissolve) the drug from tablet powder. During this shaking the flask was kept on boiling water bath several times to maintain the fluidity of the co-melt. Then, 400 ml distilled water (at 50-60°C) was added and the flask was again shaken for 5 min by hand. Then, the flask was allowed to cool to room temperature and sufficient distilled water was added to make up the volume (500 ml). Filtration was carried out through Whatmann filter paper # 41 to remove the tablet excipients. Ten ml filtrate was diluted to 50 ml with distilled water and the absorbance was noted at 358 nm against the reagent blank. The drug content was calculated using the calibration curve. Same procedure was repeated for tablet formulation II. The results of analysis are reported in table 1.

Recovery studies

To perform the recovery studies, standard piroxicam drug was added (15 mg and 30 mg, separately) to the pre-analyzed tablet powder equivalent to 50 mg piroxicam and the drug content was determined by the proposed method. Results of analysis are reported in table 2 with statistical evaluation.

Table 1: Analysis data of piroxicam tablet formulations with statistical evaluation (n=3).

Drug	Batch	Label claim mg/tab	% label claim estimated (mean \pm SD)	%RSD	S.E
Piroxicam	I	20	98.77 \pm 1.391	1.408	0.803
Piroxicam	II	20	100.42 \pm 1.448	1.442	0.836

Table 2 Results of recovery studies with statistical evaluation (n=3).

Tablet formulation	Drug in pre-analyzed tablet powder (mg)	Amount of standard drug added (mg)	% Recovery estimated (mean± SD)	Percent coefficient of variation	standard error
I	50	15	98.73±0.882	0.893	0.509
I	50	30	98.94±1.808	1.827	1.044
II	50	15	99.85±1.359	1.361	0.785
II	50	30	98.46±1.229	1.248	0.710

RESULTS AND DISCUSSION

The solubility of piroxicam in distilled water at room temperature was found to be 0.40 mg/ml. The solubility of piroxicam in co-melt of 1.5gm resorcinol and 0.5 gm sodium acetate trihydrate at boiling water bath temperature was more than 300mg.

It is evident from table 1, that the percent drug estimated in tablet formulation I and II were, 98.77±1.391 and 100.42±1.448 respectively, the values are very close to 100.0, indicating the accuracy of the proposed analytical method. Small values of statistical parameters viz. standard deviation, percent coefficient of variation and standard error (table 2) further validated the method. Further, table 2 shows that the range of percent recoveries varied from 98.46±1.229 to 99.85±1.359. which are again very close to 100.0, indicating the accuracy of the proposed method. Proposed analytical technique is further supported by significantly small values of statistical parameters viz. standard deviation, percent coefficient of variation and standard error (table 2).

CONCLUSION

The proposed method is new, simple, environment friendly, accurate and reproducible. The proposed method can be successfully employed in the routine analysis of piroxicam tablets. Resorcinol and sodium acetate trihydrate do not interfere at 358nm.

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