WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 3, 628-634. Research Article ISSN 2277–7105

"SOLID AS SOLVENT"- SPECTROPHOTOMETRIC ESTIMATION OF SATRANIDAZOLE TABLETS USING SOLIDS (EUTECTIC LIQUID OF PHENOL AND LIGNOCAINE HYDROCHLORIDE) AS SOLUBILIZING AGENTS (MIXED SOLVENCY CONCEPT)

R. K. Maheshwari, *Shraddha Kori, Neha Sonkesariya and Aparajit Joshi

Department of Pharmacy, S.G.S.I.T.S, Indore – 452003, M.P., India.

Article Received on
26 Dec. 2016,
Revised on 16 Jan. 2017,
Accepted on 06 Feb. 2017
DOI: 10.20959/wjpr20173-7823

***Corresponding Author'**
Shraddha Kori
Department of Pharmacy,
S.G.S.I.T.S, Indore –
452003, M.P., India.

ABSTRACT

The present attempt of research is to provide an alternate method based on mixed solvency concept to estimate poorly water-soluble drug, satranidazole, in tablet formulations without the help of organic solvent, spectrophotometrically. The main objective of the present study is to demonstrate the solvent action of solids. A eutectic liquid (PL 41) obtained by triturating phenol crystals and lignocaine hydrochloride in 4:1 ratio on weight basis was employed to extract (dissolve) satranidazole drug from fine powder of its tablets. Distilled water was used for dilution to carry out spectrophotometric estimation at 320 nm. The solubility of satranidazole in distilled water at room temperature was found to be 0.641 mg/ml. The solubility of same drug in PL 41 was more than 180 mg/ml. Present spectrophotometric analytical method is novel, economic, rapid, free from toxicity of organic solvents, accurate and reproducible. Recovery studies and statistical data proved the accuracy, reproducibility and precision of the proposed method. The presence of tablet excipients, phenol and lignocaine hydrochloride did not interfere in the spectrophotometric estimation at 320 nm. Phenol does not interfere above 300 nm while lignocaine hydrochloride does not interfere above 310 nm.

KEYWORDS: Mixed-solvency concept, satranidazole, phenol, lignocaine hydrochloride, spectrophotometric analysis, eutectic liquid.

INTRODUCTION

In the pharmaceutical analysis and formulation development field, it is most often required to increase the aqueous solubility of poorly soluble drugs. Most of the newly developed drug molecules are lipophilic in nature and poor solubility is one of the frequent problems encountered. It is well known that drug efficiency can be severely limited by poor aqueous solubility. Commonly used organic solvents for spectrophotometric analysis of water insoluble drugs including methanol, ethanol, ethyl acetate, toluene, carbon tetrachloride, acetone, hexane etc. The main drawbacks of organic solvents include high cost, toxicity and pollution. Organic solvents have innumerous 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 alternatives.

Maheshwari has proposed the mixed solvency concept.[1-3] The mixed solvency concept states that all substances whether liquid, gas or solid possess solubilizing power. In order to improve aqueous solubility solution containing various dissolved excipients (liquids and solids both) can give successful results. By combining the excipients, additive solvent actions and synergistic solvent actions can be obtained in this manner. The solubility of a large number of poorly soluble drugs has been enhanced by mixed solvency concept.[1-28]

In the present study, eutectic liquid obtained by triturating two solids i.e. phenol crystals and lignocaine hydrochloride in 4:1 ratio on weight basis was employed as solvent system. Proposed method is novel, economic, rapid, free from toxicity of organic solvents, accurate and reproducible. Recovery studies and statistical data proved the accuracy, reproducibility and precision of the proposed method.

MATERIALS AND METHODS

Commercial tablets of satranidazole were procured from 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.

Preparation of Eutectic Liquid

Phenol and lignocaine hydrochloride were triturated in 4:1 ratio on weight basis to obtain a eutectic liquid (PL 41).

Calibration Curve

Accurately weighed 50 mg of satranidazole standard drug was transferred to a 500 ml volumetric flask. Ten ml of PL 41 was added and the flask was shaken to dissolve the drug. Then, about 400 ml of distilled water was added and the flask was shaken for 5 min to solubilise the contents. Then, the stock solution was suitably diluted with distilled water to prepare standard solutions of 10-50 µg/ml. The absorbances of these standard solutions were noted at 320 nm against respective reagent blanks.

Preliminary solubility studies

To determine the solubility of the drug (satranidazole) 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 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 to measure the absorbance at 320 nm.

In order to determine the approximate solubility of drug in PL 41, 1 ml of PL 41 was transferred to 10 ml volumetric flak. The weight of the stopered volumetric flask (initial weight) was noted. About 5 mg of drug was added and the flask was shaken to solubilise the drug. As soon as a clear solution was obtained again about 5 mg of drug was added and the flask was shaken to solubilise the drug to get a clear solution. Same process was repeated till the liquid was saturated with the drug. Again the weight of volumetric flask was noted (final weight). Difference in these two weights (initial and final) gave the approximate amount of drug which saturates (nearly) 1 ml of PL 41.

Proposed method of analysis

Twenty tablets of tablet formulation-I were weighed and crushed to get a fine powder. Tablet powder equivalent to 50 mg satranidazole was transferred to a 500 ml volumetric flask. Then, 10 ml of PL 41 was transferred to it and the flask was shaken vigorously for 10 min by hand shaking to extract the drug from the tablet powder. Then, about 400 ml distilled water was

added and the flask was shaken for about 5 min to homogenize the contents. Then, sufficient distilled water was added to make up the volume up to 500 ml. Filtration was carried out through Whatmann filter paper #41 to remove the insoluble tablet excipients. Ten ml of the filtrate was diluted to 50 ml with distilled water and the absorbance was noted at 320 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

The recovery studies were performed in which standard satranidazole drug was added (15 mg and 30 mg, respectively) to the pre-analysed tablet powder equivalent to 50 mg satranidazole and drug content was determined by the proposed method. Results of analysis are reported in table 2 with statistical evaluation.

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

Tablet formulation	Label claim(mg/tablet)	Percent drug estimated (mean ± SD)	Percent coefficient of variation	Standard error
I	300	99.08 ± 1.271	1.283	0.734
II	300	98.41 ± 1.418	1.441	0.819

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

Tablet formulation	Drug in pre-analysed tablet powder(mg)	Amount of standard drug added(mg)	% Recovery estimated (mean ± SD)	Percent coefficient of variation	Standard error
I	50	15	100.41 ± 1.779	1.772	1.027
I	50	30	100.87 ± 0.971	0.963	0.561
II	50	15	98.91 ± 1.626	1.644	0.939
II	50	30	99.16 ± 0.862	0.869	0.498

RESULTS AND DISCUSSION

The solubility of satranidazole in distilled water at room temperature was 0.641 mg/ml where as the solubility of satranidazole in PL 41 was found to be more than 180 mg/ml. It is evident from table 1 that the percent drug estimated in tablet formulation I and II were 99.08 ± 1.271 and 98.41 ± 1.418, respectively. The values are very close to 100.0, indicating accuracy and precision of the proposed method. Further, table 2 shows that the range of percent recoveries varied from 98.91 ± 1.626 to 100.87 ± 0.971 which are again very close to 100.0, indicating

the accuracy of the proposed method. Proposed analytical technique is supported by significantly small values of statistical parameters viz. standard deviation, percent coefficient of variation and standard error (table 2).

CONCLUSION

In the present study, a eutectic liquid obtained by triturating phenol crystals and lignocaine hydrochloride in 4:1 ratio on weight basis was employed to extract (dissolve) satranidazole drug from fine powder of its tablets. Dilution was made with distilled water to carry out spectrophotometric estimation at 320 nm without the help of organic solvents. Recovery studies and statistical data proved accuracy, reproducibility and precision of the proposed method. The presence of Phenol, lignocaine hydrochloride and the tablet excipients did not interfere in the spectrophotometric estimation at 320 nm. Phenol does not interfere above 300 nm while lignocaine hydrochloride does not interfere above 310 nm.

ACKNOWLEDGEMENT

Satranidazole bulk drug sample was a generous gift by M/S Alkem Laboratories Limited, Mumbai. Lignocaine hydrochloride was a gift sample from M/S Modern Laboratories, Indore.

REFERENCES

1. Maheshwari RK. “Mixed-solvency approach”- Boon for solubilization of poorly soluble drugs. Asian Journal of Pharmaceutics, 2010; 60-63.
2. Maheshwari RK. “Mixed-solvency”- A novel concept for solubilization of poorly water soluble drugs. Journal of Technology and Engineering Sciences, 2009; 1(1): 39-44.
3. Maheshwari RK. Solubilization of ibuprofen by mixed solvency approach. The Indian Pharmacist, 2009; 8(87): 81-84.
4. Maheshwari RK. “Solid as solvent”- Novel spectrophotometric estimation of piroxicam tablets using solids (eutectic liquid of phenol and niacinamide) as solubilizing agents (mixed solvency concept). The Pharma Review, 2015; 113-117.
5. Maheshwari RK. “Solid as solvent”- Novel spectrophotometric analysis of satranidazole tablets using phenol as solvent. The Indian Pharmacist, 2014; XII: 37-40.
6. Maheshwari RK, Upadhyay N, Jain J, Patani M, Pandey R. New spectrophotometric analysis of gatifloxacin tablets utilizing mixed solvency concept (at 228 nm). Der Pharmacia Lettre, 2012; 4(1): 1-4.

7. Jain DK, Patel V, Banerjee L, Jain N, Maheshwari RK. "Solid as solvent"- Novel spectrophotometric analysis of ornidazole tablets using melted phenol as solvent. Asian Journal of Biomedical and Pharmaceutical Sciences, 2014; 4(40): 26-29.
8. Maheshwari RK. "Solid as solvent"- Novel spectrophotometric analysis of frusemide tablets using phenol as solvent. Bulletin of Pharmaceutical Research, 2014; 4(2): 104-107.
9. Maheshwari RK, Chaklan N, Singh S. Novel pharmaceutical application of mixed solvency concept for development of solid dispersion of piroxicam. European Journal of Biomedical and Pharmaceutical Sciences, 2015; 1(3): 578-591.
10. VittalGV, Deveswaran R, Bharath S, Basavaraj BV, Madhavan V. Development of an analytical method for spectrophotometric estimation of Ketoprofen using mixed solvency approach. International Journal of Pharmaceutical Sciences and Research, 2012; 3(4): 1053-1056.
11. Jain DK, Patel VK, Bajaj S, Jain N, Maheshwari RK. Novel approach for spectrophotometric estimation of solid dosage forms of tinidazole using solids (eutectic liquid of phenol and niacenmide) as solubilizing agent (mixed solvency concept). World Journal of Pharmacy and Pharmaceutical Sciences, 2015; 4(4): 763-769.
12. Maheshwari RK, Upadhyay N, Jain J, Patani M, Mathuria KC. New spectrophotometric estimation of naproxen tablet formulation employing mixed solvency concept (at 331 nm). International Journal of Pharmacy and Technology, 2011; 3(4): 3618-3632.
13. Maheshwari RK, Karawande VU. Application of novel concept of mixed solvency in the design and development of floating microspheres of furosemide. International Journal of Pharmacy and Pharmaceutical Sciences, 2013; 5(3): 167-195.
14. Soni LK, Solanki SS, Maheshwari RK. Solubilization of poorly water soluble drug using mixed solvency approach for aqueous injection. British Journal of Pharmaceutical Research, 2014; 4(5): 549-568.
15. Chandan C, Maheshwari RK. Mixed solvency concept in reducing surfactant concentration of self emulsifying drug delivery systems of candesartan cilexetil using D-optimal mixure design. Asian Journal of Pharmaceutics, 2013; 7: 83-91.
16. Maheshwari RK, Shilpkar R. Formulation development and evaluation of injection of poorly water soluble drug using mixed solvency concept. International Journal of Pharma and Biosciences, 2012; 3(1): 179-189.
17. Maheshwari RK. Potentiation of solvent character by mixed solvency concept: A novel concept of solubilization. Journal of Pharmacy Research, 2010; 3(2): 411-413.

18. Agrawal A, Maheshwari RK. Formulation development and evaluation of in situ nasal gel of poorly water soluble drug using mixed solvency concept. Asian Journal of Pharmacetics, 2011; 5(3): 131-140.
19. Maheshwari Y, Mishra DK, Mahajan SC, Maheshwari P, Maheshwari RK, Jain V. Novel pharmaceutical application of mixed solvency in the formulation development of syrups (liquid oral solutions) of poorly water-soluble drugs. International Journal of Pharmacy, 2013; 3(4): 753-758.
20. Maheshwari RK, "Solid as solvent"- Novel spectrophotometric analysis of tinidazole tablets using melted phenol as solvent. Asian Journal of Pharmaceutical Research, 2015; 5(1): 21-24.
21. Pawar PB, Rawat SS, Mahajan YY, Galgatte UC, Maheshwari RK. Formulation development and evaluation of aqueous injection of poorly soluble drug made by novel application of mixed solvency concept. International Journal of Drug Delivery, 2013; 5(2): 152-166.
22. Maheshwari RK, Gupta S, Gharia A, Garg SK, Shilpkar R. Simple eco-friendly spectrophotometric estimation of tinidazole tablets by application of mixed-solvency technique. Bulletin of Pharmaceutical Research, 2011; 1(1): 22-25.
23. Maheshwari RK, Padiyar A, Putliwala M. Utilization of mixed solvency technique in spectrophotometric analysis of cefixime trihydrate tablets. International Journal of Pharmaceutical Research and Analysis, 2015; 5(1): 1-3.
24. Maheshwari RK, Putliwala M, Padiyar A. Novel approach for spectrophotometric estimation of naproxen in tablet dosage form using solids (eutectic liquid of phenol and niacenamide) as solubilizing agent (mixed solvency concept). Asian Journal of Pharmaceutical Research, 2015; 5(1): 25-28.
25. Maheshwari RK, Jawade S, Fouzdar A. Formulation development of aqueous injection of poorly soluble drug using mixed hydrotropic solubilization concept and its evaluation. International Journal of Pharmaceutical Sciences and Drug Research, 2015; 7(1): 8-12.
26. Maheshwari RK, Rajagopalan R. Formulation and evaluation of tinidazole syrup made by mixed-solvency concept. Der Pharmacia Lettre, 2011; 3(6): 266-271.
27. Maheshwari RK, Rajagopalan R. Formulation and evaluation of paracetamol syrup made by mixed-solvency concept. Der Pharmacia Lettre, 2012; 4(1): 170-174.
28. Bhawsar N, Maheshwari RK, Ansari A, Saktawat Y. New spectrophotometric estimation of gatifloxacin in the tablets using mixed solvency approach. International Journal of Pharmaceutical sciences, 2011; 2(2): 270-274.