Asian Journal of Biomedical and Pharmaceutical Sciences
ISSN : 2249 - 622X

RESEARCH ARTICLE

literati Open Access
rapid dissimination of knowledge

Received on: 26-11-2014
Accepted on: 10-01-2015
Published on: 21-01-2015

Deepak Kumar Jain
Medicinal Chemistry Research Laboratory,
SLT Institute of Pharmaceutical Sciences,
Guru Ghasidas University, Bilaspur-495009, (CG) India
E-mail: jaindeepak2022@gmail.com,
Tel: +91-9424036795

QR Code for Mobile users

Conflict of Interest: None Declared !

DOI: 10.15272/ajbps.v4i40.638

"Solid as Solvent"- Novel Technique for Spectrophotometric Analysis of Ornidazole Tablets Using Melted Phenol as Solvent

Deepak Kumar Jain[1*], Vijay Patel[1], Laxmi Banjare[1], Nilesh Jain[2], R K Maheshwari[3]
[1*]Medicinal Chemistry Research Laboratory, SLT Institute of Pharmaceutical Sciences, Guru Ghasidas University, Bilaspur-495009, (CG) India
[2]Sagar Institute of Research & Technology-Pharmacy, Bypass Road, Bhopal-462041, (MP) India
[3]Department of Pharmacy, Shri G S institute of Technology and Science, Indore-452003, (MP) India

Abstract

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 numerous 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 present investigation is an attempt to show that solids can also be wisely used to act as solvent precluding the use of organic solvents. In a separate study, author has attempted soxhelation using phenol as solvent. The vapours of boiling phenol got condensed in extraction chamber to effect the extraction of active constituents from powder of crude drugs. The main objective of the present study is to demonstrate the solvent action of solids. Solid excipients can nicely be employed as solubilizers in the development of pharmaceutical dosage forms in solution form of poorly soluble drugs (mixed solvency concept). Present study describes the application of solvent character of melted phenol (at 50-60°C) for spectrophotometric estimation of ornidazole tablets. Solubility of ornidazole in distilled water is 8.03 mg/ml. More than 700 mg of ornidazole dissolves in one gram of melted phenol (at 50-60°C). In the present investigation, melted phenol (at 50-60°C) was utilized to extract out (dissolve) the drug from powder of ornidazole tablets. Distilled water was used for dilution purpose. Absorbances of standard solutions containing 5, 10, 15, 20 and 25 µg/ml were noted at 319 nm against reagent blanks to obtain calibration curve. 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 phenol did not interfere in the spectrophotometric estimation at 319 nm. Phenol does not interfere in spectrophotometric estimation above 300 nm.

Keywords - Mixed-solvency concept, Ornidazole, Phenol, Spectrophotometric analysis.

Cite this article as:
Deepak Kumar Jain, Vijay Patel, Laxmi Banjare, Nilesh Jain, R K Maheshwari. "Solid as Solvent"- Novel Technique for Spectrophotometric Analysis of Ornidazole Tablets Using Melted Phenol as Solvent. Asian Journal of Biomedical and Pharmaceutical Sciences; 04 (40); 2014, 26-29.

INTRODUCTION

There are very few safe liquids e. g. propylene glycol, glycerin, tweens, ethanol, liquid polyethylene glycols (like PEG 200, 300 etc) which are employed by pharmaceutical industries in various dosage forms for making solution type dosage forms of poorly soluble drugs. Mixed solvency concept, proposed by Maheshwari [1-5] provides a means to develop innumerable solvent systems employing combination of the pharmaceutical excipients in small concentrations. Each substance present on the earth has got solubilizing power. By combining the excipients, additive solvent actions and synergistic solvent actions can be obtained. The problem of toxicity issue due to high concentration of a solvent can be solved in this manner. The solubility of a large number of poorly soluble drugs has been enhanced by mixed solvency concepts [1-22]. Commonly used organic solvents for spectrophotometric analysis of water insoluble drugs include methanol, ethanol, chloroform, benzene, dichloromethane, dimethyl formamide, actonitrile, 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 alternative sources. 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. In a separate study, author has attempted soxhelation using phenol as solvent. The vapours of boiling phenol got condensed in extraction chamber to effect the extraction of active constituents from powder of crude drugs. The main objective of the present study is to demonstrate the solvent action of solids. Solid excipients can nicely be employed as solubilizers in the development of pharmaceutical dosage forms in solution form of poorly soluble drugs (mixed solvency concept). Present study describes the application of solvent character of melted phenol (at 50-60°C) for spectrophotometric estimation of ornidazole tablets. Solubility of ornidazole in distilled water is 8.03 mg/ml. More than 700 mg of ornidazole dissolves in one gram of melted phenol (at 50-60°C). In the present investigation, melted phenol (at 50-60°C) was utilized to extract out (dissolve) the drug from powder of ornidazole tablets. Distilled water was used for dilution purpose. Absorbances of standard solutions containing 5, 10, 15, 20 and 25 µg/ml were noted at 319 nm against reagent blanks to obtain calibration curve. 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 phenol did not interfere in the spectrophotometric estimation at 319 nm.

MATERIALS AND METHODS

Ornidazole bulk drug sample was a generous gift by M/S Parenteral Drug India Limited, Indore (India). All other chemicals used were of analytical grade. Commercial tablets of ornidazole (Ornida Tablets of Aristo Pharmaceuticals Limited, Mandideep, India and Dazolic Tablets of Sun Pharmaceutical Industries, Dadra, India) were procured from local market. A Shimadzu-1700 UV visible spectrophotometer with 1 cm matched silica cells was used for spectrophotometric analysis.

Calibration curve:

Accurately weighed 50 mg of ornidazole standard drug was transferred to a 500 ml volumetric flask. Crystals of phenol (10 g) were added and the flask was heated on a water bath (50-60°C) to melt the phenol. Then, complete dissolution of the drug was performed by shaking the flask. After complete dissolution, about 400 ml distilled water (at 50-60°C) was poured in the volumetric flask and the contents were shaken for about 5 min to give a clear solution. The flask was allowed to cool to room temperature and sufficient distilled water was added to make up the volume up to 500 ml. From this stock solution (100 µg/ml), standard solutions containing 5, 10, 15, 20 and 25 µg/ml were prepared by suitable dilution with distilled water. The absorbances of these solutions were noted at 319 nm against respective reagent blank.

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 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 Whatman filter paper # 41.The filtrate was appropriately diluted with distilled water to measure the absorbance at 319 nm. In order to determine the approximate solubility of drug in melted phenol, 1 g phenol crystals were transferred to a 10 ml volumetric flask. The weight of the stopered volumetric flask (initial weight) was noted. Then, the flask was heated on the water bath to melt the phenol (at 50-60°C). About 5 mg of drug was added and the flask was shaken to solubilize the drug. As soon as a clear solution was obtained again about 5

mg of drug was added and the flask was shaken to solubilize the drug to get a clear solution. Same process was repeated till the melted phenol (at 50-60°C) was saturated with drug. Again the weight of the volumetric flask was noted (final weight). Difference in these two weights (initial and final) gave the approximate amount of drug which saturates (nearly) one gram of melted phenol (at 50-60°C).

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 ornidazole was transferred to a 500 ml volumetric flask and 10 g phenol crystals were added. The flask was heated on a water bath (at 50-60°C) to melt the phenol. Then, the flask was shaken vigorously for 10 min by hand shaking to extract (solubilize) the drug from the tablet powder. Then, 400 ml distilled water (at 50-60°C) was added and the flask was again shaken for 5 min by hand to solubilize phenol and drug in the distilled water. The flask was allowed to cool to room temperature and sufficient distilled water was added to make up the volume up to 500 ml. Filtration was carried out through Whatman 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 319 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 ornidazole drug was added (15 mg and 30 mg , separately) to the pre-analyzed tablet powder equivalent to 50 mg ornidazole and the drug content was determined by the proposed method. Results of analysis are reported in table 2 with statistical evaluation.

RESULTS AND DISCUSSION

The solubility of ornidazole in distilled water at room temperature was found to be 8.03 mg/ml. The solubility of ornidazole in melted phenol (at 50-60°C) was more than 700 mg/gm of phenol. It is evident from table 1 that the percent drug estimated in tablet formulation I and II were 99.17 ± 0.714 and 100.86 ± 1.626, 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 further validated the method. Further, table 2 shows that the percent recoveries varied from 98.14±1.297 to 100.08±1.926 which are again very close to 100.0, indicating the accuracy of the proposed method which is further supported by significantly small values of statistical parameters viz. standard deviation, percent coefficient of variation and standard error (Table 2).

Tablet formulation	Label claim (mg/tablet)	Percent drug estimated (mean ± SD)	Percent coefficient of variation	Standard error
I	500	99.17 ± 0.714	0.720	0.412
II	500	100.86 ± 1.626	1.612	0.939

Table 1: Analysis Data of Ornidazole Tablet Formulations 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	98.14 ± 1.297	1.322	0.749
I	50	30	99.38 ± 1.887	1.899	1.089
II	50	15	98.77 ± 1.084	1.097	0.626
II	50	30	100.08±1.926	1.924	1.112

Table 2: Results of Recovery Studies with Statistical Evaluation (n=3)

CONCLUSION

The proposed method is new, simple, environment friendly, accurate and reproducible. The proposed method can be successfully employed in the routine analysis of ornidazole tablets. Melted phenol can also be tried with other water insoluble drugs which are estimated above 300 nm. Phenol does not interfere above 300 nm.

REFERENCES

1. Maheshwari RK. "Mixed-solvency approach"- Boon for solubilization of poorly soluble drugs. Asian Journal of Pharmaceutics 2010; 60-63.
2. Maheshwari RK. Solubilization of ibuprofen by mixed solvency approach. The Indian Pharmacist 2009; 8(87): 81-84.
3. Maheshwari RK. "Mixed- solvency" – A novel concept for solubilization of poorly water-soluble drugs. Delving J. Tech. Eng. Sci. 2009; 1(1): 39-43.
4. Maheshwari RK. "Solid as solvent", Novel spectrophotometric analysis of satranidazole tablets using phenol as solvent. The Indian Pharmacist 2014; XII: 37-40.

5. Maheshwari RK. Potentiation of solvent character by mixed solvency concept: A novel concept of solubilization. Journal of Pharmacy Research 2010; 3(2): 411-413.
6. Maheshwari RK, Shilpkar R. Formulation development and evaluation of injection of poorly soluble drug using mixed solvency concept. International Journal of Pharma and Biosciences 2012; 3(I):179-189.
7. 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): 3618-3623.
8. 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
9. Maheshwari Y, Mishra DK, Mahajan SC, Maheshwari P, Maheshwari RK, Jain J. 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.
10. Maheshwari RK, Rajagopalan R. Formulation and evaluation of tinidazole syrup made by mixed-solvency concept. Der Pharmacia Lettre 2011; 3(6): 266-271.
11. Bhawsar N, Maheshwari RK, Ansari A, Saktawat Y. New spectrophotometric estimation of gatifloxacin in the tablets using mixed solvency approach. International Journal of Pharmaceutical Science 2011; 2(2): 270-274.
12. 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;15: 167-195.
13. Maheshwari RK, Upadhyay N, Jain J, Patani M, Pandey R. New spectrophotometric analysis of gatifloxacin tablets utilizing mixed solvency concept (at 288 nm). Der Pharmacia Lettre 2012; 4(1): 1-4.
14. 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 Pharmaceutics 2011; 5(3); 131-140.
15. Sreegiriprasad B, Gupta VRM, Devanna N, Ramadevi M, Vishnuvarethan rao G. Mixed Solvency Concept: A promising tool to enhance solubility of poorly soluble drug aceclofenac. International Journal of Pharmaceutical Chemical and Biological Sciences 2012; 3: 338-342.
16. Chandna C, Maheshwari RK. Mixed solvency concept in reducing surfactant concentration of self emulsifying drug delivery systems of candesartan cilexetil using D-optimal mixture design. Asian Journal of Pharmaceutics 2013; 7(2): 83-91.
17. Vijayranga G, Deveswaran R, Bharath S, Basavraj 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; 4:1053-1056.
18. Prashant B, Rawat S, 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; 2: 152-166.
19. 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.
20. Maheshwari RK, Rajagopalan R. Formulation and evaluation of paracetamol syrup made by mixed-solvency concept. Der Pharmacia Lettre 2012; 4(1): 170-174.
21. Jain N, Jain R, Kulkarni S, Jain DK, Jain S. Ecofriendly spectrophotometric method development and their validation for quantitative estimation of Pramipexole Dihyrochloride using mixed hydrotropic agent. J. Chem. Pharm. Res., 2011; 3(1):548-552.
22. Jain N, Jain R, Jain DK, Maheshwari RK, Jain S. Novel UV-spectrophotometric method for quantitative estimation of furazolidone using mixed hydrotropic agent. Pak. J. Pharm. Sci., 2013; 26(1) :159-162