Journal of Pharmaceutical and Scientific Innovation

www.jpsionline.com (ISSN : 2277 -4572)

Research Article

SOLUBILITY DATA OF NARINGIN AND RUTIN IN DIFFERENT pH MEDIA USING UV VISIBLE SPECTROPHOTOMETER

S. Nagarjuna [1]*, T.E. Gopala Krishna Murthy [2], A. Srinivasa Rao [3]

[1]Division of Pharmacology, Raghavendra Institute of Pharmaceutical Education and Research, Krishnam Reddy Palli cross, Chiyyedu, Anantapuramu, Andhra Pradesh, India

[2]Division of Pharmaceutics, Bapatla College of Pharmacy, Bapatla, Guntur, Andhra Pradesh, India

[3]Division of Pharmacology, Bhaskara Pharmacy College, Moinabad, Hyderabad, Telangana, India

*Corresponding Author Email: nagarjunaspharma@gmail.com

DOI: 10.7897/2277-4572.05213

Received on: 05/01/16 Revised on: 28/01/16 Accepted on: 07/04/16

ABSTRACT

This study describes the solubility and stability profile of naringin and rutin. Solubility of naringin and rutin was studied in different mediums like HCl Buffer pH 1.2, Acetate buffer pH 4. 6, Phosphate buffer pH 6.8 and also in water. Stability studies were also performed for naringin and rutin in HCl Buffer pH 1.2 and Phosphate buffer pH 6.8. The samples were analyzed by using UV Visible spectrophotometer. Naringin and rutin showing very poor solubility profile in all pH media and also in water. Naringin shows highest solubility in acetate buffer pH 4.6 whereas rutin showing highest solubility in phosphate buffer pH 6.8. Naringin shows lowest solubility in water whereas rutin showing lowest solubility in HCl Buffer pH 1.2. Naringin and rutin was stable in both HCl Buffer pH 1.2 and Phosphate buffer pH 6.8. The solubility data in various media is helpful in predicting the bioavailability and also in dissolution method development.

Keywords: Naringin, Rutin, Solubilty, Stability, Absorption, Bioavailability.

INTRODUCTION

The solubility of a drug is defined as the maximum quantity of a drug dissolved in a given volume of a solvent at chosen temperature, pressure and pH. Solubility is one of the most critical preformulation properties that have a significant impact on performance of a molecule. Solubility and permeability form the backbone of Biopharmaceutics Classification System (BCS) that provides scientific framework for designing of drug delivery systems and many regulatory decisions. Solubility assessment is one of the first most important and extensively studies, preformulation parameter. Various aspects like aqueous solubility, pH solubility profile, dissociation constant, partition coefficient and solubility in non-aqueous solvents are studied during preformulation. The oral bioavailability of a drug is a highly complicated property. It is mainly depending on the drug's solubility in the gastrointestinal tract and its absorption into the blood stream[1,2].

Solubility is not only a property of interest to many areas of academic research, but also a key parameter when it comes to drug design and formulation development in the pharmaceutical industry[3]. The solubility of active ingredient(s) is one of the key aspects in screening of possible dissolution media[4] for the oral dosage forms. The dissolution of formulations in different media is a regulatory requirement[5] and is directly useful in predicting the drug absorption throughout the gastrointestinal tract. However, the solubility of drug molecules varies considerably with the pH, and as the pH takes different values throughout the gastrointestinal tract. pH - dependent solubility would significantly assists in improving the modeling of oral bioavailability of drugs. In pre-formulation drug solubility in different pH media is important aspect because it directly simulates the drug absorption throughout the GI tract[6,7,8]. Drug release is a crucial and limiting step for oral drug bioavailability, particularly for drugs with low gastrointestinal solubility and high permeability. By improving the drug release profile of these drugs, it is possible to enhance their bioavailability and reduce their side effects[9].

Naringin is a flavanone-7-o-glycoside between the flavanone Naringenin and the disaccharide neohesperidose. Naringin occur naturally in citrus fruits, especially in grapefruit, where naringin is responsible for the fruit's bitter taste[10].

Rutin, also called rutoside, quercetin-3-O-rutinoside and sophorin, is the glycoside between the flavonol quercetin and the disaccharide rutinose. Rutin is a citrus flavonoid glycoside found in many plants including green tea infusions[11].

A variety of pharmacological effects have been observed for naringin and rutin in animal studies but their relevance to human health is unknown[12]. In our earlier work we studied the antidiabetic activity of naringin and rutin in animals.

In the present research work we have studied the solubility of naringin and rutin in different mediums like HCl Buffer pH 1.2, Acetate buffer pH 4. 6, Phosphate buffer pH 6.8 and also in water.

MATERIALS AND METHODS

Chemicals and reagents

All the reagents were of analytical reagents grade unless state otherwise. Potassium chloride, Hydrochloric acid, Potassium

dihydrogen phosphate, Sodium hydroxide, Sodium acetate, Glacial acetic acid, Naringin and Rutin.

Instruments

All the absorbance values were measured on UV-Visible spectrophotometer LABINDIA UV- 3000.

Preparation of Different P^H Media Buffer

The solubility of naringin and rutin has been performed in the following media

a) HCl Buffer pH 1.2: Transferred 50ml of 0.2M potassium chloride into a 200ml volumetric flask, added 85ml of 0.2M HCl and made upto volume with water.

b) Acetate buffer pH 4.6: 5.4g of sodium acetate was dissolved in 50 ml of water, added 2.4ml of glacial acetic acid and diluted with water to 100ml.

c) Phosphate buffer pH 6.8: Transferred 50ml of 0.2M potassium hydrogen phosphate into a 200ml volumetric flask, added 22.4 ml of 0.2M sodium hydroxide and made upto volume with water.

Construction of Standard Calibration Curves for Naringin and Rutin

Accurately weighed quantity of naringin was transferred in to the volumetric flask. Required quantity of water was added to the above volumetric flask. Shake the volumetric flask until the complete solubility of the drug and make up the volume with remaining quantity of water. This stock solution used for the construction of naringin standard calibration curve. Similarly, stock solutions for naringin were prepared in the following media such as HCl Buffer pH 1.2, Acetate buffer pH 4. 6 and Phosphate buffer pH 6.8. Standard calibration curves for naringin were constructed using above stock solutions. Similarly, above mentioned procedure was applied to rutin for the construction of standard calibration curves.

Determination of Solubility for Naringin and Rutin in various pH media

Required quantity of water was transferred in to volumetric flask. The water was heated up to $37+0.5^0$C using magnetic stirrer provided with heat. Previously weighed quantity of naringin was added to the above volumetric flask until the saturation point occurs. The total quantity of naringin added was recorded. Stirring was continued up to 5 hours at $37+0.5^0$C. The sample was filtered through 0.45 µm membrane filter (MILLIPORE). A measured quantity of filtered sample was transferred in to another volumetric flask and made further dilutions. The absorbance was measured using UV visible spectrophotometer. Repeat the same process mentioned above using HCl Buffer pH 1.2, Acetate buffer pH 4. 6 and Phosphate buffer pH 6.8. Similarly, the above process was applied to rutin for the determination of solubility.

Stability Studies

Stability studies were performed for naringin and rutin in HCl Buffer pH 1.2 and Phosphate buffer pH 6.8. An accurately weighed quantity of naringin was transferred to 100 ml volumetric flask, dissolved in sufficient quantity of HCl Buffer pH 1.2 and phosphate buffer pH 6.8. The volume was made up to the mark with HCl Buffer pH 1.2 and phosphate buffer pH 6.8 to get the concentration of 100 µg/ml. An aliquot (1 ml) of this solution was diluted with HCl Buffer pH 1.2 and phosphate buffer pH 6.8 in a 10 ml volumetric flask up to mark to get final concentration of 6 µg/ml. All the solutions were prepared in three replicates. Aliquots of samples were analyzed spectrophotometrically at regular interval of 30min up to 2 hours in case of HCl Buffer pH 1.2 and upto 3 hours in case of phosphate buffer pH 6.8.

Table 1: Standard calibration curves for Naringin and Rutin

S.No.	Name of the buffer solution	Naringin		Rutin	
		Regression equation	R^2 value	Regression equation	R^2 value
01.	Water	y=0.026x+0.023	0.994	y=0.0254x-0.0016	0.994
02.	HCl Buffer pH 1.2	y=0.0311x+0.015	0.996	y=0.0294x-0.0195	0.99
03.	Acetate buffer pH 4. 6	y=0.026x+0.038	0.99	y=0.0236x+0.0179	0.996
04.	Phosphate buffer pH 6.8	y=0.032x+0.011	0.998	y=0.0243x	0.993

Table 2: Solubility data of Naringin and Rutin in various pH media

S. No.	Name of the buffer solution	Naringin solubility in mg/mL	Rutin solubility in mg/mL
01.	Water	0.607	0.16
02.	HCl Buffer pH 1.2	0.898	0.138
03.	Acetate buffer pH 4. 6	0.992	0.19
04.	Phosphate buffer pH 6.8	0.945	0.223

Table 3: Stability of Naringin and Rutin in HCl buffer pH 1.2 and phosphate buffer pH 6.8 media

Time (min)	Naringin 6 µg/ml Absorbance		Rutin 6 µg/ml Absorbance	
	0.2 M HCl Buffer pH 1.2	0.2 M Phosphate buffer pH 6.8	0.2 M HCl Buffer pH 1.2	0.2 M Phosphate buffer pH 6.8
0	0.224	0.213	0.146	0.152
30	0.224	0.219	0.153	0.164
60	0.224	0.219	0.149	0.162
90	0.226	0.219	0.150	0.159
120	0.231	0.246	0.150	0.158
150	-------	0.252		0.159
180	-------	0.255		0.158

RESULTS

Standard Calibration Curves for Naringin and Rutin
Naringin and rutin in different mediums like HCl Buffer pH 1.2, Acetate buffer pH 4. 6, Phosphate buffer pH 6.8 and also in water follow Beer-Lambert law in the concentration range of 2-12 µg/mL. The table 1 represents the regression equation and R^2 value for naringin and rutin in different mediums like HCl Buffer pH 1.2, Acetate buffer pH 4. 6, Phosphate buffer pH 6.8 and also in water.

Solubility of Naringin and Rutin in Various pH media
The solubility of naringin and rutin in various pH media was summarized in the Table 2.

Stability Studies
The stability of naringin and rutin in HCl Buffer pH 1.2 and Phosphate buffer pH 6.8 media was studied and summarized in the Table 3.

DISCUSSION

The objective of this study was to estimate the solubility of naringin and rutin in different mediums like HCl Buffer pH 1.2, Acetate buffer pH 4. 6, Phosphate buffer pH 6.8 and also in water and also to study the stability of naringin and rutin in HCl Buffer pH 1.2 and Phosphate buffer pH 6.8. Naringin and rutin showing very poor solubility profile in all pH media and also in water. Naringin shows highest solubility in acetate buffer pH 4.6 whereas rutin showing highest solubility in phosphate buffer pH 6.8. Naringin shows lowest solubility in water whereas rutin showing lowest solubility in HCl Buffer pH 1.2. Naringin and rutin was stable in both HCl Buffer pH 1.2 and Phosphate buffer pH 6.8.

CONCLUSION

Solubility determination in various pH media is a prerequisite in drug development because it gives the complete idea of drug behavior in various pH media. With the solubility data we can predict the drug absorption. Based on the solubility data we can develop a good dissolution medium which is essential for absorption of drugs. Based on the above solubility data we can conclude that both naringin and rutin have very poor solubility profile in all pH media and also in water and further studies are required to enhance the solubility of these agents by various techniques.

ACKNOWLEDGMENTS

Authors sincerely express their thanks to Y. Padmanabha reddy, principal of RIPER and C. Surya Prakash Reddy, faculty of RIPER, Anantapuramu for their valuable guidance and for providing necessary facilities to carry out this work.

REFERENCES

1. Ansal H C, Popovich N G and Allen L V Jr. Pharmaceutical dosage forms and drug delivery systems. B.I Waverly, 6th Ed, New Delhi, 1999; 61.
2. Cuny L D, Huwyler J, Wiese M and Kansy M. Solubility and Dissolution Rate Determination of Different Antiretroviral Drugs in Different pH Media Using UV Visible Spectrophotometer. Eur J Med Chem 2008; 43:501.
3. Lipinski C A, Lombardo F, Dominy B W and Feeney P J. Experimental and computational approaches to estimate solubility and permeability in drug discovery and development. Adv Drug Delivery Reviews 2001; 46:3.
4. Gray V A, Brown C K, Dressman J B and Lesson J. New General Information on Dissolution. Pharmacopeial Forum 2001; 27: 3432.
5. Guidance for Industry, Dissolution Testing of Immediate Release Solid Oral Dosage Forms. Center for Drug Evaluation and Research, www.fda.gov,1997.
6. Guidance for Industry, Dissolution testing of immediate release solid oral dosage forms. Extended release oral dosage forms, Center for drug evaluation and research (CDER), www.fda.gov, 1997.
7. Moore J and Flanner H. Mathematical comparison of dissolution profiles. Pharm.Tech 1996; 20: 64-74.
8. Shah. P, Tsong L, Sathe P and Williams R L. Dissolution profile comparison using similarity factor. Dissolution Technol 1999; 6(3): 21.
9. Shirse Prabhakar. Formulation and evaluation of fast dissolving tablets of cyclodextrin inclusion complexed water insoluble drug: Glimipride. Int. J Res Ayurveda Pharm 2012; 3(3): 465-470.
10. Ho PC, Saville DJ and Wanwimolruk S. Inhibition of human CYP3A4 activity by grapefruit flavonoids, furanocoumarins and related compounds. J Pharm Pharm Sci 2001; 4 (3): 217–227.
11. Andrea R, Malagutti, Vania Zuin, Eder T.G. Cavalheiro and Luiz Henrique Mazo. Determination of Rutin in Green Tea Infusions Using Square-Wave Voltammetry with a Rigid Carbon-Polyurethane Composite Electrode. Electroanalysis April 2006; 18(10): 1028-1034.
12. Santos KF, Oliveira TT, Nagem TJ, Pinto AS and Oliveira MG. Hypolipidaemic effects of naringenin, rutin, nicotinic acid and their associations. Pharmacological Research Dec 1999; 40 (6): 493–496.

How to cite this article:
S. Nagarjuna, T.E. Gopala Krishna Murthy, A. Srinivasa Rao. Solubility data of Naringin and Rutin in different pH media using UV visible spectrophotometer. J Pharm Sci Innov. 2016;5(2):63-65 http://dx.doi.org/10.7897/2277-4572.05213

Source of support: Nil, Conflict of interest: None Declared