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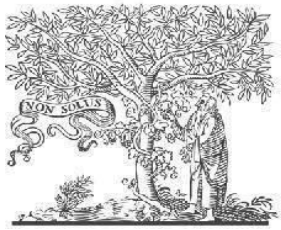

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CHARACTERIZATION AND OPTIMIZATION OF LIQUISOLID TABLETS TO ENHANCE DISSOLUTION RATE AND SOLUBILITY OF BILASTINE

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Abstract
This study aimed to enhance the dissolution rate of bilastine, a poorly soluble drug used for allergic rhinitis, allergic rhinoconjunctivitis, asthma, and urticaria, using the liquisolid technique. Liquisolid compacts were formulated employing Propylene glycol as a non-volatile solvent, Avicel PH102 as a carrier, and Lactose as the coating material. Various concentrations of bilastine in the non-volatile vehicle and different excipient ratios were evaluated. The prepared liquisolid powders demonstrated favorable flow properties. These powders were blended with a superdisintegrant and compressed into tablets. The tablets underwent evaluation for hardness, friability, content uniformity, disintegration time, and dissolution rate. Results indicated that the formulated liquisolid compacts exhibited good flowability and compressibility. They showed significantly enhanced drug release compared to directly compressed formulations. Among the tablet formulations tested, F12 displayed the highest dissolution rate, attributed to improved wetting properties and increased drug surface exposure. FTIR analysis confirmed no drug-excipient interactions, ensuring compatibility. DSC analysis revealed that bilastine was molecularly dispersed and in an amorphous form in the final formulation. Powder X-ray diffraction patterns indicated the absence of characteristic drug peaks, suggesting complete conversion to an amorphous or solubilized state. Particle size analysis demonstrated an increase in particle size, thereby enhancing flow properties and compressibility. This study demonstrates that the liquisolid technique effectively improves the dissolution rate of bilastine. These findings propose that the liquisolid approach is a promising strategy for enhancing the solubility and dissolution properties of poorly soluble drugs such as bilastine in pharmaceutical formulations.

Keywords: Bilastine, Liquisolid Compacts, Solubility, Dissolution, Design of Experiment.

Introduction
Pharmaceutical drugs classified under the Biopharmaceutics Classification System (BCS) as Class II often suffer from low solubility and dissolution rates, leading to poor bioavailability. Liquisolid compacts have emerged as a successful strategy to enhance the bioavailability of such drugs, alongside techniques like micronization, lyophilization, solid dispersion, co-solvency, and complexation agents. Liquisolid technology transforms liquid drugs into dry, non-sticky powders by blending them with suitable carriers and coating materials.

The dissolution profiles of drugs significantly improve with the liquisolid method due to enhanced wetting properties and increased surface area exposure. However, this technique is generally suitable for low-dose drugs with poor water solubility. Effective liquisolid compacts necessitate carriers with high adsorption capacity and a porous structure to accommodate liquid medications, typically utilizing microcrystalline cellulose (e.g., Avicel PH 20, 102, 200) as a carrier. Coating materials like silica improve flowability and uniformity, while disintegrants such as starch glycolate and crospovidone enhance the drug release rate. Non-volatile solvents like polyethylene glycol and glycerin contribute to binding actions.

Liquisolid systems are versatile and can be applied to enhance the bioavailability of poorly soluble drugs administered orally (e.g., Risperidone, Griseofulvin, Carvedilol). They offer advantages over soft gelatin capsules in terms of lower manufacturing costs and the flexibility to formulate drugs as tablets, capsules, or encapsulated liquisolid microsystems. These systems present drugs in a solubilized state, promoting improved wetting phenomena and enhanced drug release profiles. Both instant release and sustained release dosage forms can be formulated using liquisolid compacts, depending on the characteristics of the carriers employed.

Hydrophobic carriers like Eudragit RL facilitate sustained release formulations, while surface-active agents such as polysorbate 80 enhance wettability and dissolution profiles. The scalability of the liquisolid technique supports manufacturability at larger scales. Compared to conventional tablets, liquisolid compacts can improve drug absorption efficiency by up to 15%, thereby enhancing manufacturing efficiency as well.

Materials and Methodology

2.1 Materials

Bilastine was generously provided as a gift sample by Ajanta Pharmaceuticals, Aurangabad. Propylene glycol, Avicel PH102, Lactose, Cross Povidone, Magnesium Stearate, and Talc were procured from Chemdyes Corporation, Rajkot.

2.2 Methodology

2.2.1 Pre-formulation Study of Drug and Excipients

The pre-formulation study of the drug and excipients followed methods recommended in the Indian Pharmacopoeia, including organoleptic characteristics assessment, melting point determination, UV Spectroscopy, FTIR, and solubility studies.

2.2.1.1 Identification of Pure Drug and Drug-Excipients Compatibility Study by Fourier Transform Infrared Spectroscopy (FT-IR)

To assess drug compatibility, FTIR spectra of the drug were recorded using an FTIR instrument with KBr. Scanning was performed in the wave number range of 4000-400 cm^-1 and compared against reference spectra of Bilastine to confirm its purity.

For investigating drug-excipient compatibility, FTIR spectra of the drug combined with all excipients were obtained using the same FTIR spectrophotometer with KBr. This analysis provided crucial insights into interactions between the drug and excipients.

2.2.1.2 Solubility Study

The solubility of Bilastine in various non-volatile solvents such as Polyethylene glycol 200, 400, 600, Propylene glycol, Tween 20, 80, Span 20, and Span 80 was evaluated. The drug was mixed in these solvents, subjected to shaking and centrifugation for 48 hours. The supernatant was filtered, diluted with methanol, and analyzed spectrophotometrically to determine drug content. Solubility values were calculated using a methanol calibration curve.

2.2.2 Flowability and Liquid-Retention Potential (φ-value) of Excipients (Avicel PH102 and Lactose)

2.2.2.1 Determination of Angle of Repose

The angle of repose of carrier and coating materials (10 g of Avicel PH102 and Lactose) was measured as follows: The materials were weighed and placed on a polished metal plate. The plate was gradually raised until the material began to slide, recording the angle formed with the horizontal plane. The optimal angle of repose was determined to be 33º.

Table 2.1 Selection of dependent and independent variables

Translation of coded value in actual units			
Independent variables	**Variable level**		
	Low (-1)	Medium (0)	High (+1)
Ratio of Drug:Non-Volatile Solvent **(X_1)**	1	2	3
R Value**(X_2)**	10	15	20
Dependent Variables			
1	Solubility**(Y_1)**		
2	%CDR at 30 min **(Y_2)**		

Table 2.2The relation between angle of repose and flow property

Angle of repose(θ)	**Flow**
<25	Excellent
25-30	Good
30-40	Passable
>40	Very poor

Results and Discussion

3.1 Pre-formulation Study of Drug and Excipients

3.1.1 Organoleptic Characteristics

The organoleptic characteristics of the drug were observed and found to be consistent with standard data.

Table 3.1 Organoleptic characteristics of drug

Sr. No.	Organoleptic characteristics	Observation	Inference
1.	Colour	White Powder	Complies with standard data which confirms identity of drug sample.
2.	Odour	Odourless	
3.	State	Solid	

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Table 3.2 Melting point of Bilastine

Drug	Standard Value	Observed Value (Mean ± S.D.) (n=3)	Inference
Bilastine	194- 197 °C	195.33 °C ± 0.57°C	Complies with standard data which confirms identity of drug sample.

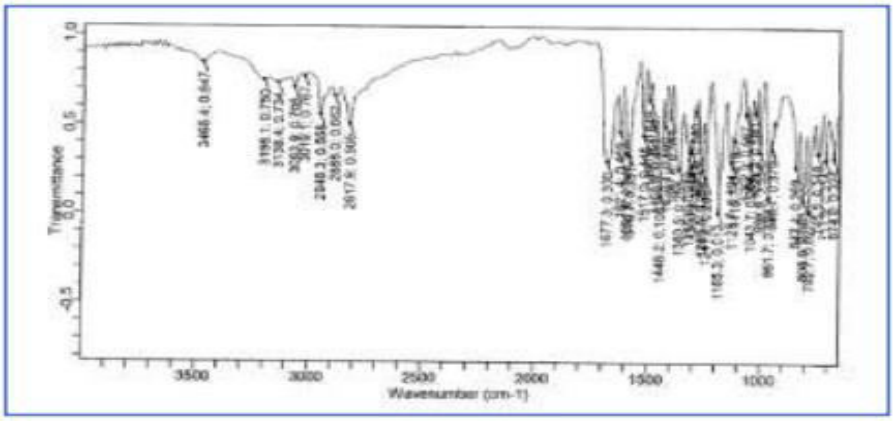

Figure 3.1 FTIR Spectrum of Bilastine Pure Drug

Table 3.5 Composition of preliminary trial batch of Liquisolid Compacts

Formulation Code	Ratio	Non-volatile Solvent	R Value	API (mg)	Non-volatile Solvent (mg)	Lf Liquid load factor	Avicel PH102 Q (mg)	Lactose q (mg)
F1	1:1	Propylene Glycol	5	20	20	0.828	48.309	9.662
F2	1:1	Propylene Glycol	10	20	20	0.494	80.972	8.097
F3	1:1	Propylene Glycol	15	20	20	0.383	104.439	6.963
F4	1:1	Propylene Glycol	20	20	20	0.327	122.324	6.116
F5	1:2	Propylene Glycol	5	20	40	0.828	72.464	14.493
F6	1:2	Propylene Glycol	10	20	40	0.494	121.457	12.146
F7	1:2	Propylene Glycol	15	20	40	0.383	156.658	10.444
F8	1:2	Propylene Glycol	20	20	40	0.327	183.486	9.174
F9	1:3	Propylene Glycol	5	20	60	0.828	96.618	19.324
F10	1:3	Propylene Glycol	10	20	60	0.494	161.943	16.194
F11	1:3	Propylene Glycol	15	20	60	0.383	208.877	13.925
F12	1:3	Propylene Glycol	20	20	60	0.327	244.648	12.232
F13	1:3	Propylene Glycol	25	20	60	0.294	272.109	13.605

Table 3.14 Stability data of optimized batch of Liquisolid compacts

Condition	Angle of repose	% Drug content	Cumulative % drug release at 30 min	
Initial	24.43 ± 0.071	99.10 ± 0.20	**Time (min)**	**% CDR**
			0	0
			10	64.07
			20	78.94
			30	92.57
After 15 days				
40 ± 2°C/ 75 ± 5% RH	24.59 ± 0.075	98.75 ±0.02	0	0
			10	62.34
			20	76.61
			30	91.29
After 30 days				
40 ± 2°C/ 75 ± 5% RH	24.71 ± 0.040	98.08 ±0.16	0	0
			10	62.23
			20	76.48
			30	90.52

Conclusion

The liquisolid compact technique proves to be an effective method for improving the dissolution rate of poorly water-soluble drugs such as Bilastine. In this study, Propylene Glycol was utilized as a liquid vehicle, which significantly contributed to enhancing the dissolution profiles of Bilastine in liquisolid formulations. The choice of an appropriate liquid vehicle based on its solubility characteristics played a crucial role in achieving enhanced dissolution rates and thereby increasing oral bioavailability.

The prepared liquisolid compacts of Bilastine, using Propylene Glycol at various ratios (1:1, 1:2, 1:3 of drug to Propylene Glycol), employed Avicel PH102 as a carrier for improved absorption and Lactose as a coating material to enhance flowability and ensure optimal drug release within the formulation. This formulation strategy effectively enhanced the solubility and dissolution rate of Bilastine, demonstrating a novel approach that may significantly improve oral bioavailability in pharmaceutical applications. The study underscores the promising potential of the liquisolid approach for enhancing the solubility and dissolution properties of poorly soluble drugs like Bilastine.

References

1. Vajir S, Sahu V, Ghuge N, Bakde BV. Liquisolid compact: a new technique for enhancement of drug dissolution. Int J Pharm Res Dev 2012;4:302-6.
2. Sowmya C, Reddy CS, Anilkumar D, Amrutha V. Liquisolid technique: A novel approach to enhance solubility and bioavailability of BCS II drugs. Int Res J Pharm 2012;3:108-15.
3. Sanjay PD, Deepak M, Bhanudas SR. Liquisolid technology: a technique for formulation with enhanced bioavailability. World J Pharm Pharm Sci 2013;3:368-87.
4. Sanka Krishna, Sravanthi Poienti, Abdul Bari Mohd, Prakash V Diwan. Improved oral delivery of clonazepam through Liquisolid powder compact formulation: in vitro and ex vivo characterization. Powder Technol 2014;256:336-44.

5. Peddi MG. Novel drug delivery system: liquisolid compact. J Mol Pharm Org Proc Res 2013;1:1-5.
6. Swati M. Solubility enhancement of a drug by liquisolid technique. Int J Pharm Chem Bio Sci 2014;4:339-44.
7. Sahir V, Ghuge N, Bakde BV. Liquisolid compact: a new technique for enhancement of drug dissolution. Int J Pharm Res Dev 2012;4:302-6.
8. Baby JN, Manjila SB, Bijen EN, Constantine I, Pramod K, Valsalakumari J. Design and technology of liquisolid compacts. J Appl Pharm Sci 2013;3:111-9.
9. Grover R, Series S, Wang T. Effect of powder substrate on the dissolutionproperties of chrothiazide liquisolid compacts. Drug Dev Ind Pharm 1999;25:163-8.
10. Corco stegui R, Labeaga L, Innerarity A, et al. Preclinical pharmacology of bilastine, a new selective histamine H1 receptor antagonist. Drugs R D, 2005; 6:371-384.
11. Product monograph including patient medication information. BLEXTEN®. Available from: https://pdf.hres.ca dpdpm/00040644.PDF. Last accessed September 6, 2022.
12. Sadrani Dolly A, Ajay N.Talele, Anuradha P. Prajapatti, Sachin B.Narkhede. Formulation, development and evaluation of sublingual drug delivery system of Bilastine for allergic rhinoconjuctivitis. Indo Am. j. Pharm. Sci, 2021; 08(04): 166-181.
13. Padmapreetha J, Arul kumaran KS. Effect of kolliphor EL on dissolution rate of leflunomide liquisolid compacts. Journal of Pharmaceutical Sciences and Research. 2016; 8(7):586.