

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Formulation and Evaluation of Trilayer Matrix Tablet of Metformin: Efficacy of Guar Gum as a Drug Release Retardant

Mangesh Thorat¹, R.S. Gaikwad²

¹Student, ²Guide

Department of Pharmaceutics , Samarth institute of Pharmacy, Belhe, Pune- 412410 Maharashtra

ABSTRACT

The goal of the current studies is to formulate the controlled released drug delivery system of anti-diabetic tablets by using natural controlling polymer guar gum. The anti-diabetic drug requires prolonged or sustained release of drugs for controlling the blood sugar level for a long period. The current study focuses on the use of alternative options for the synthetic controlling polymer. Guar gum is a potential polymer for sustained release and for controlling the release rate we formulate the tri layer matrix tablet of Metformin hydrochloride. In which the upper and lower layers of the tablet consist of guar gum granules and the middle layer is the matrix granules of Metformin consisting of guar gum. The guar gum is biodegradable, easily available, and less expensive than the synthetic polymer hence it is used in the study.

KEYWORDS : Controlled drug delivery system, Trilayer tablet, Matrix tablet, Guar gum.

1. Introduction

Metformin HCl is a widely used antidiabetic drug with a short half-life (~4-6 hrs), requiring frequent dosing. Controlled-release systems like trilayer matrix tablets can improve therapeutic efficiency and patient compliance. Guar gum, a natural polysaccharide, has potential as a hydrophilic matrix-forming agent for controlled release.

2. Objectives

To formulate trilayer matrix tablets of Metformin using guar gum as the primary retardant. To evaluate the drug release profile and compare it with standard formulations. To assess the physicochemical properties and mechanical integrity of the trilayer structure.

3. Materials and Methods

Materials: Metformin HCl Guar gum Microcrystalline cellulose (MCC) Magnesium stearate Lactose Hydroxypropyl methylcellulose (optional as a secondary polymer) Other excipients as needed **Formulation:** Core layer: Immediate-release layer (Metformin + lactose + disintegrant) Middle layer: Sustained release with high guar gum concentration Top layer: Sustained release with lower guar gum or combination with HPMC

Tablet compression: Using a trilayer tablet compression machine or manual layering.

4. Evaluation Parameters

Pre-compression: Flow properties: angle of repose, bulk density, tapped density, Carr's index Post-compression: Tablet hardness Friability Thickness and weight variation Drug content uniformity Swelling index (hydration behavior) In vitro drug release (using USP dissolution apparatus in pH 1.2 and pH 6.8 media)

5. Drug Release Study

Dissolution profile up to 12-24 hours

Kinetic modeling: Zero-order, First-order, Higuchi, Korsmeyer–Peppas models Comparison with marketed extended-release tablets

Parameter	Information
Drug Name	Metformin
Brand Name	Glucophage, Metabet
Structure	$H_{3}C$ H
Weight	129.16 g/mol
Chemical formula	C14H11N5
	3-(diaminomethylidene)-1,1-dimethylguanidina.
IUPAC Name	N,N-dimethylimidodi-carbonimidic diamide
BCS Class	Class III
Half life	Approx. 17.6 hours.
Pka	12.4
Log P	-0.92 to -2.6
Particle size	400 to 600 μm
Hygroscopicity	Metformine is a white crystalline powder that is highly hygroscopic, meaning it absorbs water easily.
Polymorphic form	Form A, Form B, Form I and Form II

Solid state Stability	It is very stable in solid form and can withstand temperatures up to 230°C.
Melting Point	219 to 242°C
T max	A single oral dose of 1000 mg (GLUMETZA) after a meal the time to reach maximum plasma metformin concentration (Tmax) approximately 7 to 8 hours.
Solubility	Metformin highly soluble in water.

6. RESULT AND DISCUSSION

Analysis of release pattern and mechanism Effect of guar gum concentration on release rate Integrity and layering behavior of trilayer tablets Compatibility studies (e.g., FTIR/DSC) if applicable Guar gum can effectively retard drug release in trilayer tablets. Trilayer design offers dual-release control: initial burst and prolonged maintenance. Potential for further development into commercial sustained-release Metformin products.

REFRENCECS

1. Patel N, Kumar PA, Damien T, Rao BS, Kulkarni SV. Use of Hydrophilic Natural Guar Gum in Formulation of Controlled-Release Matrix Tablets of Metformin Hydrochloride and Its Comparison with Marketed Product. Research Journal of Pharmaceutical Dosage Forms and Technology. 2010;2(2):193-7.

2. Chavda HV, Patel MS, Patel CN. Preparation and in vitro evaluation of guar gum based triple-layer matrix tablet of diclofenac sodium. Research in Pharmaceutical Sciences. 2012 Jan;7(1):57.

3. Wadher KJ, Kakde RB, Umekar MJ. Formulation of sustained release metformin hydrochloride matrix tablets: Influence of hydrophilic polymers on the release rate and in vitro evaluation. International Journal of Research in Controlled Release. 2011;1(1):9-16.

4. Wadher KJ, Kakde RB, Umekar MJ. Development of a sustained-release tablet of metformin hydrochloride containing hydrophilic eudragit and ethyl cellulose polymer. International Journal of Comprehensive Pharmacy. 2011;2(5):1

5. Krishnaiah YS, Satyanarayana S, Prasad YR, Rao SN. Gamma scintigraphic studies on guar gum matrix tablets for colonic drug delivery in healthy human volunteers. Journal of controlled release. 1998 Nov 13;55(2-3):245-52.

6. George A, Shah PA, Shrivastav PS. Guar gum: Versatile natural polymer for drug delivery applications. European Polymer Journal. 2019 Mar 1;112:722-35.

7.Raju DB, Sreenivas R, Varma MM. Formulation and evaluation of floating drug delivery system of metformin hydrochloride. J Chem Pharm Res. 2010;2(2):274-78.

8.Diwedi R, Alexandar A, Chandrasekar MJ. Preparation and in vitro evaluation of sustained release tablet formulations of metformin HCL. Asian Journal of Pharmaceutical and Clinical Research. 2012;5(1):45-8

9.Uma U, Rathore KS. Formulation and Evaluation of Sustained Release Matrix Tablets of Metformin Hydrochloride. Pharm. Chem. J. 2014;1:5-13.

10.Bookya PA, Raparla RA, Sriramula HP, Tarrigopula SU, Vanga SR. Formulation and evaluation of metformin hydrochloride sustained-release oral matrix tablets. Asian J Pharm Clin Res. 2018 Mar 1;11(3):342-5