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DEVELOPMENT AND EVALUATION OF CARISOPRODOL TABLETS WITH IMPROVED DISSOLUTION EFFICIENCY USING SOLID DISPERSION TECHNIQUE

Mogili Daya Sagar, Mohammed Shahidullah, Shaik Rabbani Basha, Shaik Shahnaz, Harish.G*
Department of Pharmaceutics, Nimra college of Pharmacy, Vijayawada, AP, India
***Corresponding author: E.Mail: harishgopinath4u@gmail.com**

ABSTRACT

Carisoprodol is indicated in patients with acute muscular pain. Carisoprodol is typically prescribed as 350 mg tablets. The aim of the present study is to design and development Carisoprodol tablets with improved dissolution efficiency using solid dispersion technique. The present work is planned to prepare solid dispersion system consisting of Carisoprodol with hydrophilic carriers by employing different methods, to study the physicochemical properties of Carisoprodol solid dispersions, develop fast dissolving tablets of Carisoprodol solid dispersions by using super-disintegrant such as starch, Croscarmelose sodium, sodium starch glycolate and to study the effect of the preparation methods of solid dispersions on dissolution characteristics.

Key words: Carisoprodol, Solid dispersion, super-disintegrant.

INTRODUCTION

The potential drug candidates are characterized by a low oral bioavailability. Often poor drug dissolution/solubility rather than limited permeation through the epithelia of the gastrointestinal tract are responsible for low oral bioavailability (Vasconcelos TF, 2007). Thus aqueous solubility of any therapeutically active substance is a key property as it governs dissolution, absorption and thus the *in-vivo* efficacy (Vemula VR, 2010). Drugs with low aqueous solubility have low dissolution rates and hence suffer from oral bioavailability problems. The rate and extent of dissolution of the active ingredient from any dosage form often determines the rate of extent of absorption of the drug. When an active agent is given orally, it must first dissolve in gastric acid and/or intestinal fluids before it can then permeate the membranes of the GI tract to reach systemic circulation. Therefore, a drug with poor aqueous solubility will typically exhibit dissolution rate limited absorption, and a drug with poor membrane permeability will typically exhibit permeation rate limited absorption. Hence, two areas focus on improving the oral bioavailability of active agents include:

- Enhancing solubility and dissolution rate of poorly water-soluble drugs
- Enhancing permeability of poorly permeable drugs

There are various techniques available to improve the solubility of poorly soluble drugs, such Micronization, Nanosuspension, Modification of the crystal habits, Eutectic mixtures, Solid dispersions, Microemulsions, Self micro emulsifying drug delivery systems, cyclodextrin inclusion and lipid based delivery systems etc (Sharma D, 2010).

Solid dispersion is one of the most promising approaches for solubility enhancement. In the biopharmaceutical classification system (BCS) drugs with low aqueous solubility and high membrane permeability are categorized as Class II drugs. Therefore, solid dispersion technologies are particularly promising for improving the oral absorption and bioavailability of BCS Class II drugs. In case of solid dispersion drug disperse in the matrix generally a hydrophilic matrix and a hydrophobic drug, thereby forming a solid dispersion. When the solid dispersion is exposed to aqueous media, the carrier dissolves and the drug releases as fine colloidal particles. The resulting enhanced surface area produces higher dissolution rate and bioavailability of poorly water-soluble drugs.

Solid dispersion: Solid dispersion technology is the science of dispersing one or more active ingredients in an inert matrix in the solid stage in order to achieve increased dissolution rate, sustained release of drugs, altered solid state properties, and enhanced release of drugs from ointment and suppository bases, and improved solubility and stability (Mohanachandran PS, 2010).

MATERIALS AND METHODS

Materials: Carisoprodol was obtained as gift sample from SYNED LABS LIMITED, Medak, AP, Starch, SSG, Cross carmelose sodium, Crospovidone, MCC, Lactose was obtained as a gift sample from ICPAHealthcare, Ankaleshwar. PVP, Talc and Magnesium Stearate were obtained from Signet Mumbai. All other chemicals and Solvents used in this study are of analytical grade.

Pre-formulation Studies: Pre-formulation study relates to pharmaceutical and analytical investigation carried out proceeding and supporting formulation development effort of the dosage forms of the drug substance. Pre-formulation studies yield basic knowledge necessary to develop suitable formulation. It gives information needed to define the nature of the drug substance and provide frame work for the drug combination with pharmaceutical excipients in the dosage forms. Hence the following pre-formulation studies were performed on the obtained sample of drug such as Solubility**,** bulk density, tapped density, Percentage compressibility, Identification of drug sample, Drug excipient compatibility studies (Patidar Kalpana, 2010).

Formulation of Carisoprodol Solid dispersion: The accurately weighed quantity of the drug and polymer in various ratios has been formulated by melting the polymer and dispersing the drug in it. The formulated SD has been dried and grounded by passing through mesh #22.

Formulation of Carisoprodol Tablet:

Preparation of the Fast dissolving tablet of Carisoprodol: Fast dissolving tablets of Carisoprodol had been formulated by direct Compression method using Super-disintegrants such as SSG, CP, Starch, CCS etc. in various ratios. These ingredients were weighed and mixed stoichometrically to obtain the final formulation. The weight of the tablet in all formulations was kept constant to 130mg. All the batches were prepared by direct compression method using the 16-station rotary punch tablet compression machine using 7 mm biconvex plain on both side die-punches set. The variables maintained in the formulation were the different types of super-disintegrant and their concentration (in mg) in the formulation. Completely dried complex used for the preparation of fast dissolving tablet. Tablets were prepared from blends by direct compression method. All the ingredients including drug were passed through mesh no. 60 excepting lubricants. Lubricants were passed through mesh no.80. Lubricants were added at the time of compression. Blend is mixed uniformly by manually for 30 minutes. Tablets of convex faced weighing 130mg each with 3.3mm thickness and 7mm in diameter.

Evaluation of Post-Compression Characteristics: The formulated Carisoprodol SD has been compressed in to tablet and the following evaluation has been performed as per BP pharmacopoeia. The following evaluation of tablets was performed such as Drug content, Weight variation, Hardness, Friability, Content uniformity, Thickness, In-Vitro Dissolution.

Table.1. Formulation of Carisoprodol solid dispersion

Drug:Polymer (Urea)	Drug:Polymer (Mannitol)
1:1	1:1
1:2	1:2
1:3	1:3

Table.2. Formulation of Fast dissolving tablet of Carisoprodol SD

INGREDIENTS	F1	F2	F3	X4	X5	X6	Z7	Z8	Z9	C10	C11
Carisoprodol SD (mg)	10	10	10	10	10	10	10	10	10	10	10
Starch	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	
SSG	2	4	6	-	-	-	-	-	-	-	-
CCS	-	-	-	2	4	6	-	-		-	-
CP	-	-	-	-	-	-	2	4	6	-	-
MCC	-	-	-	-	-	-	-	-	-	-	41
PVP	16	16	16	16	16	16	16	16	16	16	16
Lactose	11.5	10.5	8.5	12.5	10.5	8.5	12.5	10.5	8.5	14.5	36
Talc	10	10	10	10	10	10	10	10	10	10	10
Magnesium Stearate	18	17	17	17	17	17	17	17	17	17	17
Total Weight	130	130	130	130	130	130	130	130	130	130	130

RESULTS AND DISCUSSION

Evaluation of Blend:

Table.3. Pre-compression parameters of Carisoprodol SD

Formulation Series	Bulk Density(gm/ml)	Tapped Density(gm/ml)	Compressibility Index	Hausner's Ratio	Angle of Repose
F1	0.510	0.598	15.81	1.17	26°28'
F2	0.512	0.597	15.38	1.18	26 ° 85'
F3	0.512	0.60	14.87	1.17	27 ° 14'
X4	0.505	0.591	14.64	1.17	27 ° 75'
X5	0.507	0.595	14.72	1.17	28 ° 07'
X6	0.507	0.597	14.97	1.17	28 ° 07'
Z7	0.512	0.595	13.84	1.16	29 ° 39'
Z8	0.515	0.598	13.91	1.16	29 ° 74'
Z9	0.515	0.602	14.43	1.16	29 ° 02'
C10	0.510	0.641	20.40	1.22	32 ° 82'
C11	0.534	0.714	25.13	1.33	34 ° 59'

Table.4. Evaluation of Formulation Series

Batch no.	Weight variation	Hardnes kg/cm^2	Thickness (mm)	Friability (%)	Disintegration time (sec)	Wetting time (sec)	Water absorption ratio	Drug Content (%)
F-1	Passes	3.1	2.1	0.41	42	63	75	99.78
F-2	Passes	3.2	2.1	o.37	31	55	88.72	99.62
F-3	Passes	3.1	2.1	0.37	25	49	96.29	100.8
X-4	Passes	2.9	2.1	0.38	48	69	67.40	100.2
X-5	Passes	3.1	2.1	0.4	35	59	85.82	100.4
X-6	Passes	3	2.1	0.41	29	50	94.77	100.3
Z-7	Passes	2.8	2.1	0.41	55	71	64.70	99.9
Z-8	Passes	2.9	2.1	0.41	41	65	82.82	99.7
Z-9	Passes	2.9	2.1	0.43	34	56	93.28	100.1
C-10	Passes	3.5	2.1	0.41	74	79	58.33	99.6
C-11	Passes	4.1	2.1	0.32	161	93	42.69	99.5
M-1	-	5.3	-	-	257	429	68.33	101.1
M-2	-	5.6	-	-	291	486	63.01	99.7

M1:- Marketed Tablet of Carisoprodol; M2:- Marketed Tablet of Carisoprodol

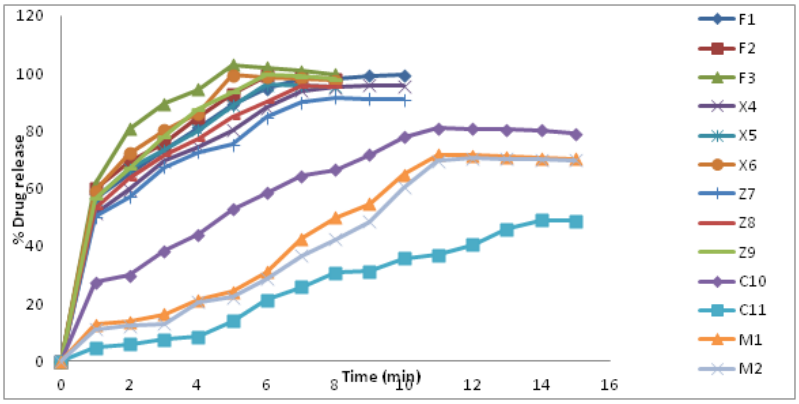

Fig.1.Percentage Drug release profile of Carisoprodol formulations

CONCLUSION

The Mannitol and Urea is used as polymer for the enhancement of the solubility of Carisoprodol solid dispersion and improve the rate of dissolution by fast dissolving tablet using various super disintegrates which shows rapid onset of action and faster rate of drug delivery. The formulation F3 and X6 showed faster disintegration time a faster rate of *in-vitro* dissolution above 99% at the end of 8min. hence formulation of Carisoprodol SD using the SSG (6%) and CCS (6%) showed a rapid onset of drug release. Hence, formulation of the poorly soluble drug with improved solubility using solid dispersion

and faster rate of action can be developed by following the method discussed so far in this study.

REFERENCES

Aggarwal S, Gupta GD and Chaudhary S, Solid dispersion as an eminent strategic approach in solubility enhancement of poorly soluble drugs. International Journal of Pharmaceutical Sciences and Research, 1, 2010, 1-13.

Batra V, Shirolkar VS, Mahaparale PR, Kasture PV, Deshpande AD, Solubility and Dissolution Enhancement of Glipizide by Solid Dispersion Technique, Indian J Pharm Educ Res, 42(4), 2008, 373-378.

Chaulang G, Patil K, Ghodke D, Khan S, Yeole P, Preparation and Characterization of Solid Dispersion Tablet of Furosemidewith Crospovidone, Research J Pharm andTech, 1(4), 2008, 386-389.

Kumar DS, Solubility improvement using solid dispersion; strategy, mechanism and characteristics: responsiveness and prospect way outs. International Research Journal of Pharmacy, 2, 2011, 55-60.

Mohanachandran PS, Sindhumo PG and Kiran TS, Enhancement of solubility anddissolution rate: an overview, International Journal of Comprehensive Pharmacy, 4, 2010, 1-10.

Patidar Kalpana, Solid Dispersion: Approaches, Technology involved, Unmet need & Challenges in Drug Invention Today, 2(7), 2010, 349-357.

Sharma D, Soni M, Kumar S and Gupta GD, Solubility Enhancement –Eminent Role in Poorly Soluble Drugs. Research Journal of Pharmacy and Technology, 2, 2009, 220-224.

Vanshiv SD, Rao MRP, Sonar GS, Gogad VK, Borate SG, Physicochemical Characterization and In Vitro Dissolution of Domperidone by Solid Dispersion Technique, Indian J Pharm Educ Res, 43 (1), 2009, 86-90.

Vemula VR, LagishettyV and Lingala S, Solubility enhancement techniques, International Journal of Pharmaceutical Sciences Review and Research, 5, 2010, 41-51.