Formulation And Evaluation Of Diclofenac Sodium Matrix Tablet Using An Acacia Gum As Natural Polymer.

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Abstract

Diclofenac sodium is an agent shows Anti-Inflammatory , Antipyretic and Analgesic activity. Natural polymer chosen for the purpose of study is due to disintegrating property , non toxicity, Low cost , reliable free availability , Eco - friendly , potentially degradable and compatible. Diclofenac sodium was used as a model drug to study the in vitro release profile .Matrix tablet Of Diclofenac sodium were fabricated by varying the concentration. Of new natural polymer [Acacia] Via direct compression method. The formulation on has been prepared "Acacia" with various Different concentration method evaluation are conducted . The prepared formulation were Evaluated for pre-compression relevant to granules like angle of repose , bulk density , tapped Density , hausner's index , friability , content uniformity , disintegration time , dissolution time. The post compression parameters like tablet thickness , hardness , weight variation all the Formulations showed compliance with pharmacopoeial standards and found to be within the Limits ass per the standards .

Objectives - To sustained the release of the drug from tablet and to study the acacia on the drug Release.The sustained drug delivery system is specially designed to provide a drug in body at Predetermined and constant rate.

Key Word- Diclofenac sodium , Acacia gum , Sustained release .

Introduction

Drug delivery is the most important and vastly using technique for administration of an API to show pharmacological activity achieve a therapeutic effect, primarily due to patient acceptability,ease of administrative, inexpensive manufacturing process and release pattern.Oral route of drug administration is the most appealing, convenient , significant and popular route for the delivery of drug owing to ease of swallowing,self medication and most economic.Oral route of administration .Oral route of administration

has been used for both conventional and novel drug delivery system.In the modern era ,sustained release dosage form is suppressing the use of conventional dosage form.The sustained release tablet provides uniform release of drug over a long period of time.Controlled release dosage form covers a wide range of prolonged action.Formulation which provides continuous release of their active ingredient at a predetermined rate and time . Sustained or controlled drug delivery system is to reduce the frequency of dosing or to increase the effectiveness of drug by localization at the site of action.Reducing dosing frequency providing continuous drug delivery, reduce so many incidences of adverse effect.Matrix tablets serve as an important tool oral extended release dosage forms.Hence , various problems like patients compliance,drug targeting, local   side effects, frequent administration and fluctuations in blood concentration levels, associated with their counterparts, therefore the conventional dosage forms restricted.A Matrix tablet is the oral solid dosage form in which the drug of active Ingredient is homogeneously dispersed through out the hydrophilic or hydrophobic matrices which serve as release rate retardants .1,4 Polymer are high molecular weight compound originate from natural and synthetic source.diclofenac sodium is Non-Steroidal Anti-inflammatory drug (NSAIDS)with analgesic activity .It inhibits PG synthesis and is somewhat COX-2 Selectivity.

Methodology

Diclofenac sodium tablet, prepare by the wet granulation technique and acacia is used as binding agent to prolonged the release. Tablet manufactured by using the rotary tablet compression machine. Tablet are submitted to hardness, weight variation, drug content uniformalty test. Dissolution and disintegration tests are also performed

MERITS AND DEMERITS

Merits of the sustained release drug delivery system

➢ Reduces frequency of dose administration.

➢ Provide the increase pateint compliance

➢ Decrease the chances of side effects.

➢ Health care cost is reduce by improved therapy.

➢ Bio availability of he many drugs is improved by the formulating them into sustained release formulations.

➢ Drug cost is reduced which increases the patient acceptability

Demerits of the sustained release formulations

➢ There is more changes of fluctuation in plasma drug concentration.

➢ Prompt termination of therapy is not possible.

➢ Dose dumping is another problem.

➢ Less flexibility to the physician in does adjusting.

➢ Not all drugs are suitable candidates for sustained release preparation

MATERIALS AND METHOD

Material

➢ Diclofenac was received from the laboratory.

➢ All the other ingredients such as acacia, lactose, magnesium stearate and talc was taken from laboratory

Method

➢ Required quantity of all ingredient is weighed according to the quantity given in table.

➢ Polymer and granulating agent (water) is added slowly and mixed thoroughly.

➢ After enough cohesiveness was gotten, the mass sieved though No.10 mesh.

➢ Granules were dried at the 40 degree Celsius.

➢ Talc powder and magnesium stearate were at last included as glidant and lubricant for each group of granules.

Granules were compressed to the tablet using rotary tablet compression machine**Ingredient**	**Tablet1st**	**Tablet2nd**	**Tablet3rd**
Diclofenac sodium	33%w/w	33%w/w	33%w/w
Talc	3.33%w/w	3.33%w/w	3.33%w/w
Magnesium Stearate	3.33%w/w	3.33%w/w	3.33%w/w
Acacia	8%w/w	13.33%w/w	18.66%w/w
Lactose	qs	qs	qs

Table no.1:Formulation of Diclofenac Sodium Sustained Release Tablet

Pre-compression and evaluation parametres

Pre-compressional studies of powder blend

A pre-formulation study is the first step in same drug development.All studies which are performed period to the development of dosage form to reduce error and provide a remunerative date to carry out dosage form development for the treatment of various disease

1. Angle of repose

It is defined as the angle of heap to the horizontal plane.Angle of repose was determined by using fixed funnel method.Specified amount of powder drug was transferred to the funnel keeping the orifice of the funnel blocked by thumb When powder was cleared from funnel then measured it's angle of repose

$$\text{Angle of repose}(\tan\theta)= \text{height/radius}$$

FLOW PROPERTY	ANGLE OF REPOSE
Excellent	25-30
Good	31-35
Fair-aid not needed	36-40
Passable	41-45
Poor	46-55
Very poor	56-65
Very very poor	>66

Table no . 2

2.Bulk density

It is this ratio of bulk mass of bulk volume

$$\text{Bulk density=mass of powder bulk/bulk volume}$$

3.Tapped density

It is ratio of mass of the powder blend to the tapped volume of the powder blend.Measuring cylinder containing the porous mass of powder was tapped using density apparatu**s**

$$\text{Tapped density=mass of powder blend/tapped volume}$$

Compressibility Indices

4. Carr's index

Based on the apparent bulk density and the tapped density, the percentage compressibility of the powder mixture was determined by the following formula.

$$\text{Carr's Index} = \frac{\text{Tapped density} - \text{Bulk density}}{\text{Tapped density}} \times 100$$

5. Hausner's ratio

It is an indirect index of ease of measuring of powder flow. Lower Hausner's ratio (<1.25) indicates better flow properties than higher ones (<1.25)

$$\text{Hausner's ratio} = \frac{\text{Tapped density}}{\text{Bulk density}}$$

Sr.no	Flow character	Carr's Index	Haussner's Index
1	Excellent	≤10	1.00-1.11
2	Good	11-15	1.12-1.18
3	Fair	16-20	1.19-1.25
4	Passable	21-25	1.26-1.34
5	Poor	26-31	1.35-1.45
6	Very	32-37	1.46-1.59
7	Very very Poor	≥38	>1.60

Table no . 3

Post -compression evaluation parameters

1. Physical Appearance

➢ The general appearance and urbanity of tablet were studied visually.
➢ The tablet was round in shape, unstained in colour, smooth texture, and odourless.

2. Thickness

➢ It is expressed in mm.. The tablet thickness was calculated by vernier caliper.
➢ Tablet was put in between two jaws vertically and measured thickness.

3.Weight variation

➤ The weight of 20 tablets was measured and average weight was calculated.
➤ The individual weight of each tablet was measured to determine its variation.
➤ Weight variation was determined by comparison of individual tablet weight with average weight.

Sr.no	Average weight of the tablet (mg)	Percent weight variation Acceptable
1	130 mg<	10%
2	130-240mg	7.5%
3	>324mg	5%

Table no . 4: Specification for weight variation of tablets as per USP

4.Hardness

➤ Tablet hardness testing is laboratory technique used by pharmaceutical industry to determine the breaking point and structural integrity of tablet.Breaking point of tablet is based on its shape.

5.Friability

➤ It is calculated by Roche friability apparatus.
➤ It is expressed in percentage (%).

$$\text{Friability (\%)} = \frac{\text{Initial weight - Final weight}}{\text{Initial weight}} \times 100$$

6.Drug content uniformity

The test ensures that each tablet in batch contains specified amount of active ingredient.The prepared formulation of Diclofenac sodium was weight and crushed.

In vitro drug release test

7.Disintegration test

➤ Disintegration is rate limiting step in absorption

➤ Disintegration refers to the mechanical break up of a compressed tablet into small granules upon ingestion and therefore it is characterized by the breakdown of the inter particulate bonds,which were forged during the compaction of tablet.

8.Dissolution Test

Dissolution is a process in which a solid substance solubilize in a given solvent.

Dissolution is the rate determing step for hydrophobic ,poorly aqueous.

RESULT AND DISCUSSION

Pre - compressional study of powder blend

The powder blend was evaluated for various parameters . This showed that powder blend from all the formulations showing good flow property.

Formulation	Angle of repose	Bluk density	Tapped density	Carr's index	Haussners ratio
F1	27.02	0.3949	0.443	12.43	1.249
F2	26.1	0.29	0.33	12.127	1.137
F3	25.4	0.758	0.8939	15.11	1.178

Table no 5 : Post compression evalution of diclofenac sodium tablets

Post - Compression studies of prepared matrix tablets

Formulation	Weight variation (mg)	Thickness (mm)	Hardness (kg/cm^2)	Friability (%)	Disintegration (min)	Dissolution (%)
F1	150	2.8	3.8	0.0018	18.42	15.15
F2	148	2.7	3.6	0.012	15.22	24.04

F3	150	2.9	4.2	0.020	9.45	36.72

Table no 6: Post - compression evaluation of Diclofenac sodium tablets

Thickness

The determined thickness according to the die and punches size of all formulation was found to be 1.2 ± 0.001 mm. It was upon the die and punch size

Weight Variation

The determined weight variation of formulating tablets was found to be in the range of 145 mg-155mg

Hardness

On increasing the concentration of polymer hardness was also increases gradually

➢ Hardness of group 1 tablet was 3.8
➢ Hardness of group 2nd tablet was 3.6
➢ Hardness of group 3rd tablet was 4.2

The general appearance of tablet were studied visually. The tablet was round in shape, white in color, smooth texture, and odorless.

% Friability

The result of friability was found to be 0.04± 0.0018 to 0.61 ± 0.012. Highest concentrations of polymers in matrix tablet also affect the friability. It showed that tablets have sufficient strength to tolerate transportation

Disintegration test
Tablet with 20 percent acacia disintegrates very slowly.
Tablet with 12 percent acacia disintegrates faster than the former tablet with 20 percent acacia .

Tablet with 8 percent acacia disintegrates at faster rate than above mention both tablet

Dissolution test.

Polymer exhibit release over the longer time.The drug polymer ratio was found to influence the drug release, as the polymer level increased, the drug release rates were found to be decreased.Tablet with 20 percent acacia dissolution rate have higher dissolution time than the tablet with 12 percent acacia than the 8 percent acacia.

CONCLUSION

- ➢ From the above study, it was estimated that the natural polymer exhibit release over a long period of time

- ➢ The drug polymer ratio was found to influence the drug release, as the polymer level increased, the drug release rates were found to be decreased .

- ➢ Concentration of polymer also affects the hardness and drug release profile.

- ➢ The study was aimed to develop formulate in -vitro evaluation of diclofenac sodium with acacia powder with varying concentration various physical characteristics tests were performed for powder blend which were found to be in acceptable limits.

- ➢ As the polymer level increase, the drug release rates were found to be decrease. Disintegration time was decrease and mechanism of drug release from followed first order kinetics.

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