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DEVELOPMENT AND CHARACTERIZATION OF GLYCEROGELATIN SUPPOSITORIES FOR ENHANCED EFFICACY

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ABSTRACT

Glycerogelatin suppositories are commonly used for the treatment of various diseases such as rectal related disease, constipation, haemorrhoids, or prostate diseases. The development of this type of suppository requires the evaluation of their physical and chemical properties. This research paper aims to review the existing literature on the preparation and evaluation of glycerogelatin suppositories. The review focuses on glycerogelatin suppositories, their preparation methods, and their quality control parameters. After method of preparation we conclude that Glycerogelatin suppositories are easy method of formulation. We performed drug identification test to authenticate the Diclofenac Na by UV spectrophotometer as well as calibrate the mould to avoid variations in the weights. We evaluated various parameters such as displacement value, disintegration test, dissolution test, melting point and drug content. All the results found to be satisfactory but we need to check out the effectiveness of formulation to performed clinical study.

KEYWORDS: Glycerogelatin suppositories, Rectal, Diclofenac Na, Displacement value etc.

INTRODUCTION

Suppositories are pharmaceutical preparations for the administration of drugs through the rectal or vaginal mucosa. Suppositories offer several advantages over other routes of administration such as oral, parenteral, or transdermal routes. They are particularly useful when oral administration is impractical or ineffective, or when a rapid and targeted effect is required.[1-5]

Fig. no. 01: Glycerogelatin suppositories.

Glycerogelatin suppositories are a type of suppository that has been widely used for various therapeutic purposes. The gelatin matrix of the suppository provides a hydrophilic environment that facilitates the absorption of drugs through the rectal mucosa. The addition of glycerol to the matrix enhances the lubricating and moisturizing properties of the suppository and improves patient comfort.[6-8]

The preparation and evaluation of glycerogelatin suppositories require attention to several critical factors such as the choice of excipients, the preparation method, and the quality control of the final product. This paper reviews the literature on the preparation and evaluation of glycerogelatin suppositories, highlighting the critical steps and factors that affect the quality and effectiveness of this type of suppository.

Types of glycerogelatin suppositories

Glycerogelatin suppositories can be classified according to their purpose, shape, and composition. The purpose of the suppository determines the type and amount of drug substance and other excipients in the formulation. The shape of the suppository affects its ease of administration and retention in the rectum. The composition of the suppository determines its biocompatibility, safety, and efficacy.[9]

Based on their purpose, glycerogelatin suppositories can be classified into several types such as therapeutic, prophylactic, diagnostic, and contraceptive. Therapeutic suppositories are used for the treatment of various

diseases or disorders such as constipation, hemorrhoids, prostatitis, or vaginal infections. Prophylactic suppositories are used to prevent the occurrence of certain diseases or infections, such as HIV or human papillomavirus. Diagnostic suppositories contain radio-opaque agents that facilitate the imaging of the rectum or colon. Contraceptive suppositories contain spermicides that prevent the fertilization of the egg.

Based on their shape, glycerogelatin suppositories can be classified into bullet, torpedo, or ovule shapes. Bullet-shaped suppositories are elongated and pointed at one end, designed to facilitate their insertion and retention in the rectum. Torpedo-shaped suppositories are tapered at both ends and have a more streamlined shape. Ovule-shaped suppositories are ovoid or ellipsoidal and designed for vaginal administration.[10]

Based on their composition, glycerogelatin suppositories can be classified into several categories such as hydrophilic, lipophilic, or mucoadhesive. Hydrophilic suppositories contain water-soluble or hydrophilic drug substances and excipients, which dissolve or disperse in the rectal fluid and facilitate drug absorption. Lipophilic suppositories contain lipid-soluble or lipophilic drug substances and excipients, which are released slowly from the suppository matrix and absorbed by the rectal mucosa. Mucoadhesive suppositories contain substances that adhere to the rectal mucosa and increase the contact time and drug absorption.[11]

METHODOLOGY

Materials used

- Glycerol, Gelatin,
- Active pharmaceutical ingredient (API): Diclofenac

Formula for glycerogelatin Suppository

Table No. 01: Formula design.

Sr. No.	Ingredient	Quantity (As per master formula)
1	Glycerin	7ml
2	Gelatin	3gm
3	Diclofenac	75mg

Method of preparation

1. **API selection:** The first step is to select the appropriate active pharmaceutical ingredient that requires delivery through the given route (Ex.Rectal). In this study, Diclofenac Na will be used as the model API.
2. **Base preparation:** Glycerol (70%) is mixed with gelatin (30%) and heated to a temperature of 100°C until a clear solution is obtained.
3. **API Incorporation:** The API is dispersed into the hot glycerogelatin base solution under continuous and gentle stirring until homogenously mixed.
4. **Escape Air Bubbles:** Prepared solution is withstand for 30 minute to escape out air bubble in the Suppository Base.
5. **Casting:** The base solution is filled into suppository moulds that have been previously cooled, and then maintained at a temperature of 25°C to solidify for approximately 30 minutes.

Evaluation of glycerogelatin suppositories[6,9,10]

The following tests can be used to evaluate glycerogelatin suppositories:

1. Drug authentication

Prepare 10µg/ml solution and identified the maximum lambda max for the identification of drug by using UV spectrophotometer.

2. Calibration curve of diclofenac sodium

Prepare 1000 µg/ml Stock solution and make dilution in increasing order such as 10µg/ml, 20 µg/ml,30 µg/ml,40 µg/ml,50 µg/ml,60 µg/ml and observed the reading in UV spectrophotometer at specific lambda max.

3. Calibration of the mould

Generally a standard mould of one gram capacity is used. The calibration of the mould is necessary. Because the size of the suppository from a particular mould remains the same, but the weight varies. This is due to the reason, that density of different bases and medicaments are different. So the mould should be calibrated for individual base and medicaments this is done by preparing a set of suppositories using the base, weighing the suppositories and then find the average mean which will indicate the true capacity of the mould.

4. Displacement value

The volume of suppositories from particular mode is uniform but its weight will vary because the density of the medicament usually differs from the density of the base which the mould was calibrated. To prepare the suppositories of uniform and accurate weight, allowance must be made for change in density of the mass due to added medicament. Displacement value the quantity of the drug which displaces one part of the base.

$$\text{The displacement value} = \frac{D}{A - C}$$

5. The physical properties of glycerogelatin suppositories

It include their appearance and pH. The appearance of the suppository should be uniform, smooth, and free of cracks, air bubbles, or discoloration.

6. Weight variation test

This test is used to determine the weight variation among suppositories. The test is carried out by weighing 20 suppositories individually and calculating the average weight. The individual weights are then compared with the average weight to determine the percentage deviation.

$$\text{Weight Variation} = \frac{\text{Individual suppository - Avg. wt of suppository}}{\text{Avg. wt of suppository}} \times 100$$

7. Disintegration test

This test is used to determine the time it takes for a suppository to disintegrate. The test is carried out by placing a suppository in a disintegration apparatus and allowing it to disintegrate in water. The time it takes for the suppository to disintegrate is recorded.

8. Percentage drug release

Percentage drug release find out by maintaining following parameters:

Table No. 02: Parameters for percentage drug release.

Sr. No.	Parameters	Observations
1	Media	6.8 pH phosphate buffer
2	Temperature	30-35ºC
3	Volume	900ml
4	Media withdrawal time interval	5 Min
5	Equipment/ Instrument	Electro lab Dissolution Instrument
6	Assembly used	Basket type
7	Identification by	UV spectrophotometer (Wavelength 271nm)

9. Melting point test

This test is used to determine the melting point of the suppositories. The test is carried out by placing a suppository on a glass slide and covering it with a cover slip. The slide is then heated gradually until the suppository melts. The melting point is recorded.

10. Content uniformity test

This test is used to determine the uniformity of drug content in each suppository. The test is carried out by randomly selecting ten suppositories and determining the amount of drug in each suppository. The individual amounts are then compared with the average amount of drug to determine the percentage deviation.

$$\text{Drug content} = \frac{\text{Amount of drug present}}{\text{Label Claim}} \times 100$$

RESULTS

1. The Physical properties of glycerogelatin suppositories

Table No. 03: The Physical properties of glycerogelatin suppositories.

Sr. No.	Physical properties	Observation
1	Appearance: a)Uniformity b)Smooth, c)Free of cracks d)Air bubbles, e)Discoloration.	 Uniform Suppositry Smooth in texture Free from cracks No Air bubble observed No Discolouration observed
2	pH	6.8 pH

Calibration of mould

Base used: Glycerogelatin

Drug used: Diclofenac

Table No. 04: Calibration of mould.

Sr. No.	Individual wt. of Suppository
1	1.2090
2	1.2071
3	1.2023
4	1.2406
*	Average Wt=1.2147

Calibration of mould performed by taking individual weight of suppositories and True weight (average weight) of suppository was found to be 1.2147gm.

Displacement value

Table No. 05: Parameters for displacement value.

Sr. No.	Parameters	Observations
1	Average wt of suppository	1.214gm
2	Amount of Base Found	1.131gm
3	Amount Drug Present	0.075gm
4	Displacement value calculate	0.903gm

The displacement value is a test to perform on suppositories to determine the amount of space they occupied in the rectum. It directly effects on the bioavailability and efficacy of the suppositories. The displacement value of suppository was found to 0.903gm.

Identification of drug

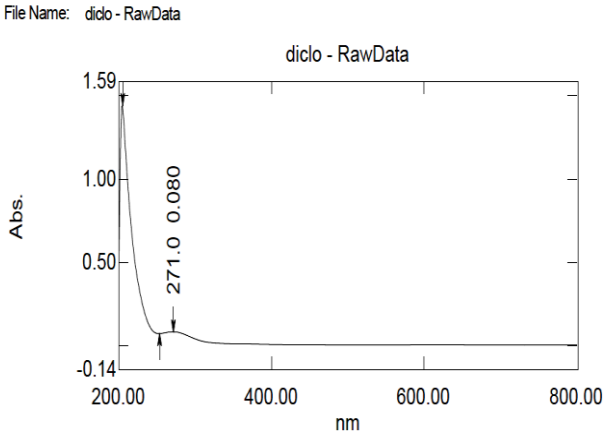

Fig. No. 02: Diclofenac Identified By UV.

UV spectrophotometer only detects the chromophore containing compound. Diclofenac identified by Spectrum mode (UV) at 271 nm in 6.8pH Phosphate Buffer.

Calibration curve

Table No. 06: Result of calibration curve.

Sr. No.	Concentration(µg/ml)	Absorbance
1	0	0
2	10	0.04
3	20	0.06
4	30	0.083
5	40	0.103
6	50	0.135
7	60	0.16

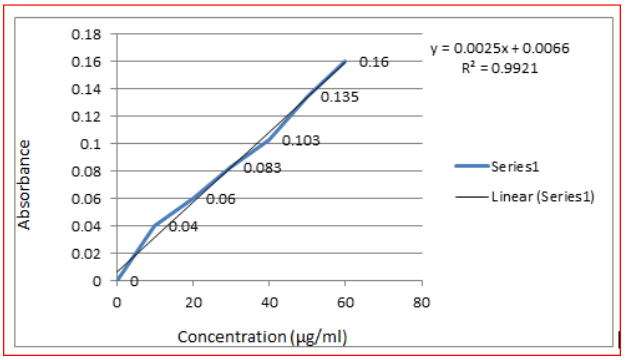

Fig. No. 03: Calibration curve of diclofenac sodium.

Calibration curve of Diclofenac Sodium in phosphate buffer observed that R^2 is 0.9921 it means prepared Dilution is more accurately performed. It does not contain any impurities. If any impurities found in solvent which is affects the calibration results.

Weight Variation test

Table No. 07: Results of weight variation test.

Sr. No.	Individual wt. of Suppository(gm.)	Observation
1	1.2090	±0.025
2	1.1068	±0.100
3	1.0705 (Lowest Wt.)	±0.091
4	1.2071	±0.0243
5	1.0933	±0.07221
6	1.1233	±0.04675
7	1.1110	±0.05719
8	1.2023	±0.02028
9	1.2406	±0.05278
10	1.4207 (Highest Wt.)	±0.2056
Avg.wt.	**1.1784**	**(±0.025 to ±0.2056)**

The average weight of suppository was found to be 1.1784gm and weight fluctuate between the range was found to be ±0.025 to 0.2056.

Disintegration test

Table No. 08: Result of disintegration test.

Sr. No.	Disintegration test (Min)
1	18
2	22
3	19
4	19
Average*	19.5 (Approx. 20min.)

The disintegration time of suppository was found to be 20 min (Approximately)

Dissolution

Table No. 09: Result of dissolution.

Sr. No.	Time(Min)	Absorbance	%Drug Release
1	5	0.080	72.0%
2	10	0.090	81.0%
3	15	0.108	97.0%
4	20	0.111	99.9% (Approx.100%)

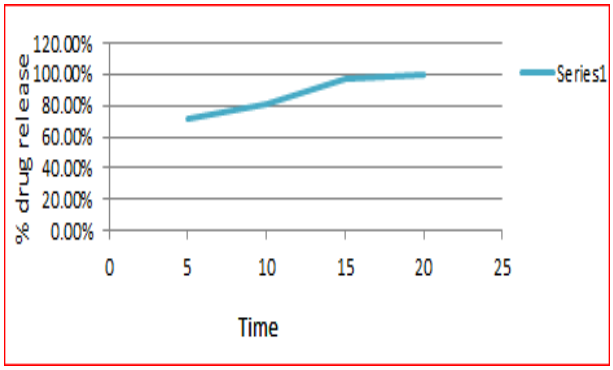

Fig. No. 04: Dissolution study of diclofenac in phosphate buffer.

The Suppository completely dissolved in 20 minutes and it shows 100% drug release during experimental work.

Melting point of suppository

Table No. 10: Result of melting point.

Sr. No	Melting point observed
1	33ºC
2	32ºC
3	34ºC
Average	33ºC

The melting point of glycerogelatin suppository was found to be 33˚C

Drug content of suppository

Table No. 11: Results of drug content of suppository.

Sr. No	Amount of active ingredient	Weight of suppository	%Drug content
1	75mg	77mg	97%
2	75mg	78mg	96%
3	75mg	76mg	98%
Average	75mg	77mg	97%

The percentage drug content of suppositories was found to be 97% during the experimental work.

CONCLUSION

It is concluded that glycerogelatin suppositories are easy to formulate & effective in the various treatments such as haemorrhoids, constipations and other prostrate disease. We performed drug identification test to authenticate the Diclofenac Na along with the calibration curve. We also calibrate the mould to avoid variations in the weights. We evaluated various parameters such as displacement value, disintegration test, dissolution test, melting point and drug content. All the results found to be satisfactory but we need to check out the effectiveness of formulation to performed clinical study**.**

Conflict of interest: Nil.

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