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"Formulation And Evaluation Of Metformin mouth dissolving film by using flaxseed extract."

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AIM-:

Formulation and evaluation of Metformin mouth dissolving film by using flaxseed extract.

ABSTRACT-:

The seed of a multipurpose plant of pharmacological interest is flaxseed (Linum usitatissimum L.), whose mucilage can be utilized as a natural matrix to create dosage forms with longer release and possibly replace synthetic polymers.The high concentration of α-linolenic acid (ALA, omega-3 fatty acid), lignans, and fiber found in flaxseed is making it a popular addition in functional foods.Flaxseed may enhance the blood sugar-lowering benefits of several diabetes medications and may also lower blood sugar levels, according to some research. Blood sugar levels falling too low is a worry. Pay special attention to your blood sugar levels if you use flaxseed and have diabetes.According to some, it's among the planet's most potent plant-based foods. Using a cheap, naturally occurring flax seed polymer that is safe for use in fast-dissolving films is the goal of this work. The concept of Fast dissolving drug delivery system offers a solution for those patients having difficulty in swallowing tablets/capsules etc.This work investigated the possibility of developing rapid dissolving films allowing fast, reproducible drug dissolution in the oral cavity. Fast mouth dissolving thin film is a solid dosage form, which disintegrate or dissolve within 1 min when placed in the mouth without drinking of water or chewing. Oral film includes various ingredients for its formulation which includes polymers, active pharmaceutical ingredient, sweeteners, saliva stimulating agents, disintegration agent, plasticizer etc . but the first and far most a very essential ingredient which helps in film formation is a Polymer. Fast dissolving Film is prepared using hydrophilic polymers that rapidly dissolves on the tongue or buccal cavity, delivering the drug to the systemic circulation via dissolution when contact with liquid is made. Water-soluble polymers are used as film formers for fast dissolving films. Our current work is designed to manufacture oral thin films (the mouth dissolving film of domperidone) using the solvent casting method, taking into

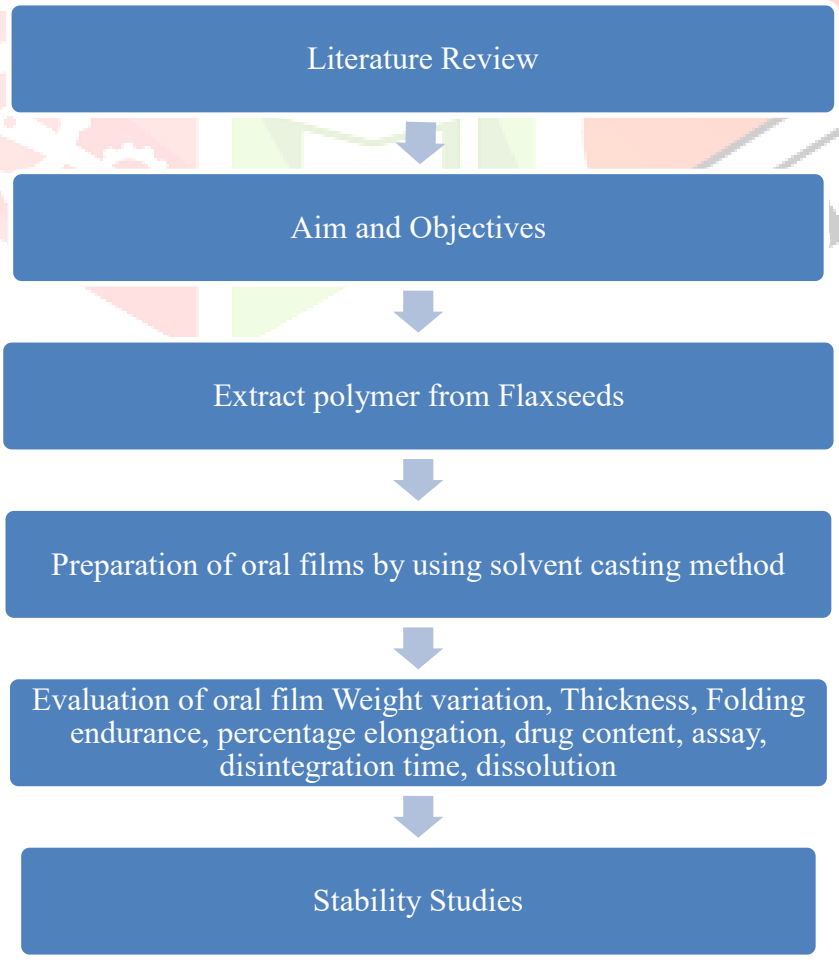
consideration the aforementioned factors. Using this procedure, an aqueous solution was created by dissolving HPMC in 25 milliliters of distilled water, and it was left for an hour to eliminate any trapped air bubbles. Afterwards, the mixed solution was placed on a petri dish and allowed to dry for a whole day at room temperature. Once the film had dried, it was carefully taken out of the petri dish, sliced into 2x2 sq cm strips, and stored in a desiccator. A innovative strategy to increasing consumer acceptance is the use of oral thin films of domperidone, which have several advantages such as quick disintegration, water-free self-administration, a high percentage of the drug, and a long mucoadhesion time.

OBJECTIVES -:

1. The objective of present research work was to formulate and evaluate mouth-dissolving films of flaxseed by solvent casting method using hydroxypropyl methyl cellulose as polymer for rapid release of drug.
2. To create a metformin film that dissolves quickly by employing a naturally occurring polymer that is taken from flaxseeds.
3. To increase adherence from patients.
4. To alleviate hyperglycemia symptoms with a rapid beginning of action.
5. to provide better bioavailability of drug, to have improved permeability, quick onset of action as well as improve patient compliance.

Keywords: Mouth dissolving film, Permeability, Bioavailability, Salivary fluid, Solvent casting method, HPMC

PLAN OF WORK:-



LITERATURE REVIEW

Sr. No.	Author	Tittle	Name of journal	Year	Abstract
1.	Barbary, O. M., S.A. Al-Sohaimy, M.A. El-Saadani A.M.A. Zeitoun	Extraction ,Composition and physicochemical properties of flaxseeds .	Research gate	2009	The mucilage was precipitated from the extract with 80% -ethanol in water (1:4 v/v). The proximate composition,sugarcompositi on, and functional properties
2.	Pradeep puligundla and seokwon Lim	A Review of Extraction Techniques and food application of flaxseed mucilage	MDPI	2022	Flaxseed mucilage is used as gelling agent/gelstrengthening agent, structure-forming agent, stabilizing agent, fat replacer, anti-retrogradation agent, prebiotic, encapsulating agent, edible coatings and films/food packaging material, and emulsifier/emulsion stabilizer were included.

3.	Alaa Balla Sulimain Abuelrakha, Elnazeer I. Hamedelniel	Extraction and Evaluation of Linseed Mucilage as Binding Agent in Prednisolone Tablet 20 mg	Pharmaceutical and Biosciences Journal	2019	The Linseed mucilage was extracted and evaluated for physicochemical properties using official procedures. Tablet was prepared by wet granulation. Granules evaluation revealed satisfactory results.

4.	Mayur Inamdar 1,Pooja Abhang 1	Isolation and evaluation of fenugreek ,flaxseed mucilages and its use as a pharmaceutical binder.	International journal of pharmacy and technology	2012	Fenugreek seeds and flax seeds produce high viscosity mucilage at low concentration levels. The binding properties of the mucilage isolated were investigated using lactose granules with different binder concentrations levels of 3%w/v, 5% w/v, 7%w/v and 10% w/v. The results were compared with regularly used binders such as starch paste, PVP and 1:1 concentration of both FXM and FNM.

5.	John Edward O mullane , Ian Peter Hayter.	Linseed mucilage	PCT	1993	Compositions of matter comprising linseed mucilage and purified forms thereof having therapeutic and cosmetic utility for topical applications to the skin and/or mucous membranes of the body. Linseed mucilage compositions have mucoadherent properties; they may be used as an artificial mucus or lubricant and may be combined with active treating substances.

6.	Yee Bond Tee* Jiafei Wong, Mei Ching Tan, and Rosnita A. Talib	Development of Edible Film from Flaxseed Mucilage	Research gate Peer reviewed article	2016	A flaxseed mucilage-based edible film was developed with the addition of glycerol as a plasticizer. Various concentrations of glycerol were blended into the extracted mucilage, and the developed films were studied in terms of physical, mechanical, and morphological properties
7	Yogyata S. Pathare*, Vishakha S. Hastak, Amruta N. Bajaj	Polymer used for fast disintegrating oral film: A Review	International journal of pharmaceutical Science	2013	er. Fast dissolving Film systemic circulation polymers achieve rapid disintegration, good mouth feel and mechanical properties to the films. Fast- dissolving oral thin film offer fast, accurate dosing in a safe, efficacious format that is convenient and portable, without the need for water or measuring devices.

8.	Murilo Santos Pacheco et al. Int J Biol Macromol.	A review on orally disintegrating films (ODFs) made from natural polymers such as pullulan, maltodextrin, starch, and others	National laboratory of Medicine	2021	ODFs can easily be applied into the mouth and quickly disintegrate, releasing the drug with no need of water ingestion and enabling absorption through the oral mucosa. The ODFs matrices are typically composed of hydrophilic polymers, in which the natural polymers are highlighted since they are polymers extracted from natural sources,

					non-toxic, biocompatible, biodegradable, and have favourable properties for application.
10.	Tingting Li,Fansong meng,Wenrui chi, Shiyu xu and Lijua n wang	An Edible and Quick-Dissolving Film from Cassia Gum and Ethyl Cellulose with Improved Moisture Barrier for Packaging Dried Vegetables	National Laboratory of medicine	2022	A quick-dissolving edible film was made from cassia gum (CG) incorporated with ethyl cellulose (EC). Mechanical results show that addition of 5% EC based on CG gave rise to the highest tensile strength (TS) of the composite film. Scanning electron microscopy revealed that

						excess addition of EC slightly decreased the homogeneousness of films
9.	Kaur Mandeep*,A.C. Rana, Seth Nimrata	Fast Dissolving Films: An Innovative Drug Delivery System	International journal of pharmaceutical research and allied science		2013	This review describes about the formulation methodology, evaluation parameters and the future aspects of fast dissolving films.

11.	Rajni Bala et al. Int J Pharm Investig	Orally dissolving strips: A new approach to oral drug deliver y system	Nation o al laborat ory f medici ne	20 13
12.	Shaikh Ershadulha que and AngapanSh eela	Development of polymer-bound Fast dissolving metformin buccal film with disintegrant	National laboratory of science	201 5
13.	Anna ziolkovsk a	Laws of flaxseed mucilage extraction	Research gate	2011

INTRODUCTION:

The environment has been severely impacted by the large-scale disposal of synthetic polymers including polypropylene, polystyrene, and polyvinyl chloride. In order to decrease the amount of waste generated, biodegradable polymers have been created to partially or completely replace synthetic polymers (Janjarasskul and Krochta 2010). Recently, there has been an increase in the use of biodegradable polymers, including cellulose, pullulan, maltodextrin, and starch. One of the most significant crops in human history is flax (Linum usitatissimum L.), which may be utilized almost entirely for the production of durable consumer items on a commercial basis. For instance, flaxseed is frequently used as a medium to make premium oil paintings due to its well-known oil content (MacFadyen, 2018). Due to the high concentration of lignans, fiber, and α-linolenic acid (ALA, omega-3 fatty acid), it is often referred to as a modern functional food (Goyal et al., 2014). While yellow and brown are the two primary hues of flax seeds, there are some noticeable differences between the two varieties. Historically, dark seeds have been found to contain more linolenic acid (Mittapalli, Rowland, 2003), stearic acid, and tocopherols than yellow seeds. They also have a greater antioxidant capacity and stability (Barroso et al., 2014). Recent research has shown that the buccal delivery of medications is a safe and effective substitute for more traditional methods of drug administration. When a drug is administered bucally, it is readily released into the buccal cavity for systemic or localized effects. This method of delivery works particularly well for pediatric and geriatric patients, who frequently have difficulty swallowing conventional oral solid dosage forms. Additionally, the buccal route is particularly useful for medications that irritate the gastrointestinal tract, pharmaceuticals that are inactivated in the stomach environment, and during episodes of nausea and vomiting [14-20]. Nowadays, a range of buccal dosage forms are offered in the market, such as hydrogels, quick dissolving films, mucoadhesive films and tablets, and oral disintegrating tablets. The most advanced oral solid dose form is mouth dissolving film because it is more flexible and comfortable [15]. Because the mucosa in the mouth is permeable, mouth-dissolving films allow for instant bioavailability and rapid absorption of medications. For children with diarrhea, elderly people who are emetic, etc., mouth dissolving films are helpful. For cold sores, toothaches, and mouth ulcers, it is also primarily helpful as a local anesthetic. Because patients were complying with the new medicine administration technique better, mouth dissolving films began to gain acceptability and appeal. Oral films are more commonly used for people with schizophrenia and dysphasia and have a greater advantage over the main disadvantages of fast disintegrating pills, which are connected to choking and fear of friability [16]. Different polymers, such as hydroxypropylmethylcellulose (HPMC), methylcellulose, polyethylene glycol (PEG), pullulan, polyvinylpyrrolidone (PVP), gelatin, and maltodextrin, have been successfully used in the preparation of mouth dissolving films [14, 23, 24]. Flax, a plant from the Linum genus in the Linaceae family, is best known as a plant from the Linum genus in the Linaceae family that is cultivated in cooler regions of the world for industrial purposes. Flaxseeds are a good source of dietary fibers and omega-3 fatty acids, including alpha-linolenic acid. Flaxseeds also contain phytoestrogens called lignan. While the cellulosic portion is crystalline, responsible for the majority of the material's characteristics, and gives it strength, the non-cellulosic portion is amorphous[25]. Fast-dissolving systems utilizing polymers are necessary for their effective role as drug carriers because the pace of drug absorption is also dependent on a number of parameters, including the drug's

composition, formulation, and interaction under in vivo circumstances. Because they are more patient-friendly than the current standard oral dose forms, such as tablets, capsules, and syrups, fast-dissolving drug delivery methods are thought to be beneficial. One such mechanism, buccal films, circumvents hepatic first-pass metabolism to enable systemic medication administration at the intended site of action. Based on its pharmacological effect and physicochemical characteristics, metformin was selected as the model medication. This systemic drug delivery approach effectively addresses the primary drawbacks of metformin in terms of therapeutic effectiveness, including its low bioavailability (between 50% and 60%), short biological half-life (5 hours), primary site of absorption being the proximal small intestine, and difficulty maintaining adequate plasma levels of the drug. Because of its mucoadhesive quality, biocompatibility, and biodegradability, the polysaccharide chitosan was selected. Super-disintegrants, such as starch, sodium starch glycolate (SSG), and microcrystalline cellulose (MCC), can be added in various ratios to enhance the bioavailability and disintegration qualities of OTFs in saliva. Therapeutic applications can be achieved quickly and effectively with the help of these innovative drug-delivery systems[12].

Metformin is a biguanide antihyperglycemic agent and first-line pharmacotherapy used in the management of type II diabetes. Metformin is considered an antihyperglycemic drug because it lowers blood glucose concentrations in type II diabetes without causing hypoglycemia. It is commonly described as an "insulin sensitizer", leading to a decrease in insulin resistance and a clinically significant reduction of plasma fasting insulin levels.metformin is a complex drug with multiple sites of action and multiple molecular mechanisms.

Metformin functions physiologically by decreasing glucose synthesis in the liver either directly or indirectly. It also increases glucose utilisation, increases GLP-1, and modifies the microbiome in the gut. Metformin works at the molecular level to inhibit the liver's mitochondrial respiratory chain, which activates AMPK and improves insulin sensitivity by affecting fat metabolism. It also lowers cAMP, which in turn decreases the production of gluconeogenic enzymes. Metformin also affects the liver in ways that are not dependent on AMPK, which may involve inhibiting the activity of fructose-1,6-bisphosphatase by AMP. We propose that the best way to validate the physiological relevance of metformin's effects in cells is to conduct in vivo studies, preferably involving humans who are administered metformin orally, since cell and tissue responses are dependent not only on dosage but also on treatment duration and model employed. To provide a more thorough understanding of the primary mechanisms that are active in long-term metformin treatment in humans, further pharmacogenetic studies in humans and careful physiological validation of cell-based metformin research, focusing on intestinal, hepatic, and renal effects, are necessary.[26]

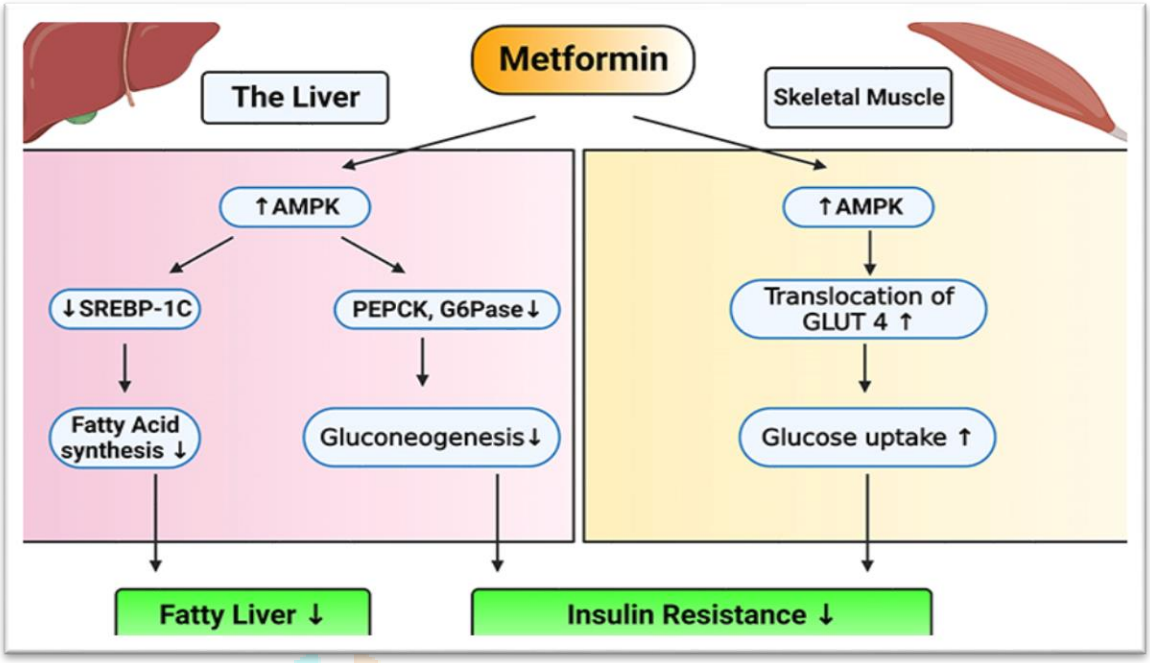


Fig.1. MOA of Metformin [26]

Uses of Flaxseeds-

1. **They help protect against blocked or narrowed arteries**

   Animal studies have shown that the anti-inflammatory effect of flaxseeds appears to have a beneficial impact on cholesterol and may help in reducing atherosclerosis (the build-up of fats and cholesterol on artery walls, which can reduce blood flow).

2. **They help maintain healthy blood pressure**

   Human and animal studies have demonstrated that flaxseed helps to decrease both systolic and diastolic blood pressure, by improving lipid metabolism and offering anti-inflammatory benefits.

3. **They help support healthy blood sugar management**

   Flaxseeds have been found to help reduce blood glucose in both those with diabetes and prediabetes.

4. **They help support a healthy microbiome**

   Consuming flaxseeds have been shown to help support a healthy microbiome, and therefore have the potential to support overall health. Flaxseeds are a good source of fibre, including soluble fibre, which acts as a prebiotic thereby feeding the good bacteria in our large intestine.

DIABETES-Taking flaxseed by mouth might slightly improve blood sugar control in people with type 2 diabetes. Benefits seem to be greatest with whole or ground flaxseed and when used for at least 12 week

CONSTIPATION- Flaxseed is a good source of dietary fibre. Eating flaxseed in muffins or other foods seems to increase Bowel movements in young adults and people with diabetes.

OBESITY- Taking flaxseed by mouth may help reduce body weight, body mass index (BMI), and waist size in adults who are overweight or obese[27].

IDEAL CHARACTERISTICS FOR MDF'S

The ideal characteristics of MDFs are as follows [29-32]:

- It should be thin, flexible, and easy to handle
- The films should be transportable, not sticky and keep a plane form without rolling up
- It should be easy to administer
- The film should offer agreeable taste and a satisfying mouth-feel
- The disintegration time should be as rapid as possible
- Film surface should be smooth and uniform
- It should remain physically and chemically stable during its shelf life
- It should be cost effective and ease of commercial production
- It should have low sensitivity to environmental/atmospheric conditions such as humidity and temp

ADVANTAGES OF MDF'S -

Advantages are as follows [29-32]:

- It can be taken without water
- It disintegrate/dissolve quickly in mouth
- Flexible and light in weight
- It is appropriate to all age group
- Cost effective.[21]

DISADVANTAGES OF MDF'S -

Disadvantages are as follows [28-32]:

- Drug(s) which requires to take in high doses cannot be incorporated into films.
- Maintaining dosage uniformity is challenging task for the films.
- Moisture sensitivity.
- Require special packaging.
- API's which are unstable at pH of the saliva cannot be designed in the form of film.

EXPERIMENTAL WORK -:

Material and methods-:

1.Flaxseeds

2.Metformine Tablet 500 mg

3.HPMC-K100

4.Sodium Starch Glycolate(SSG)

5.Microcrystalline Cellulose MCC)

6.Sucrose

7.Citric acid

8.Glycerol

9.Water

Methods of Preparation of mouth dissolving films:-

Anyone of the following or a combination of one or more methods can be followed for making film formulation.

Solvent casting method

Films can be prepared using this method, the ingredients which are water-soluble are taken inaccurate quantity and are mixed well in beaker to make a clear solution. In other beaker containing suitable

solvent add accurately weighed API and other ingredients. Then, both beakers containing formulation ingredients are mixed with stirring and finally cast into the Petri plate then allow it to dry for some period and cut the film into the appropriate size [33-34].

Hot melt extrusion

In this method, all substances required to make films are taken together into its solid powder form. Then, this mixture is melted using extruder which having heaters into it and the melt is shaped into film. It is then cooled, cut, and packaged. This method has some advantages over the other methods such as minimum product wastage and better content uniformity [34].

Semisolid casting method

If films formulation contains some acid insoluble polymers, then this technique is appropriate [35]. The examples of such polymers are cellulose acetate butyrate cellulose acetate phthalate. In general, film former and acid insol. polymer used in ratio of 04:01 [36-37].

Rolling method

API containing suspension or solution is taken on a carrier and allowed to move onto it. Then keep to drying for some period and finally cut in appropriate dimensions [38].

Solid dispersion extrusion

When some immiscible substances are extruded with API in this methodology is followed. Solid dispersions are prepared, and then these are designed into thin films using dies [38].

1 Solvent Casting Method-:

Drugs and water-soluble substances are dissolved in water while using the solvent casting procedure. Excipients are dissolved in an appropriate solvent, followed by the mixing and agitation of both solutions before being poured into a petri dish and allowed to Drug[39].

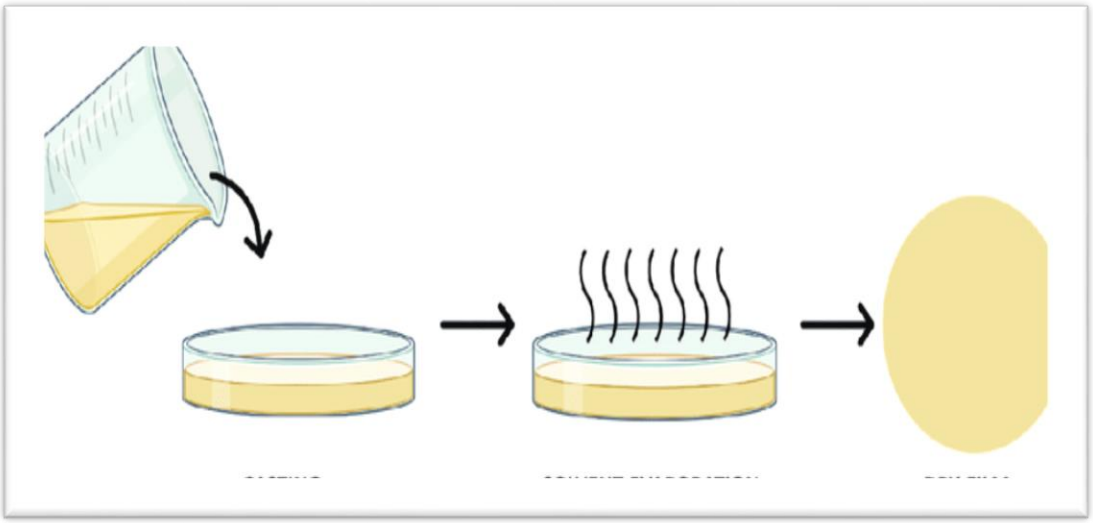


Fig : Solvent Casting Method-

Pre-formulation study:

The phase of drug development known as preformulation is when a drug substance's physicochemical and biologic characteristics are determined. It is a crucial step in the creation of new medications. In later stages of development, the drug development-related data gathered during this period is utilized to inform important choices. In order to construct formulations rationally, a wide range of information must be generated. A crucial first step in the preformulation stage of product development is characterizing the medicine and flaxseeds. This is followed by an analysis of the excipients' qualities and their compatibility.

Collection of seeds-: The Brown color flaxseed were collected from the from the local market in Indapur.

Fig 3: Flax seeds

Preparation of Extract-:

In Indapur, India, a local market provided the flaxseeds (Linum Usitatissimum) used in the study. High grade purity was employed in the acetone and absolute alcohol used. The experiment was conducted using freshly

made double distilled water. Our lab devised a technique for isolating the mucilage from flax seeds (FXM).A 500 ml double distilled water batch containing 10 g of crushed fenugreek seeds was allowed to soak for 4 hours at 80°C in a in waterbath, stirring occasionally, until a thick mass was achieved. It was left overnight below 20°C after being left at room temperature for four hours with sporadic stirring.

A muslin cloth was used to separate the hydrated mucilage. Next, 50 milliliters of pure alcohol were added to the mucilage to cause it to precipitate. Vacuum filtration was employed to filter the precipitated mucilage. After that, 40 milliliters of acetone were used to dehydrate the separated mucilage. Any extracted oil that may have been present in the hydrated mucilage is likewise eliminated by this process. Following filtering, the precipitated mass was dried for 12 hours at 50°C in a hot air oven. After being dried, the mucilage was ground into a powder using a mortar and pestle and then put through sieve #60. It was time to make the flaxseed mucilage powder[40].

Fig.4 flaxseed soaked in water

Fig.5 Heating flaxseeds with water

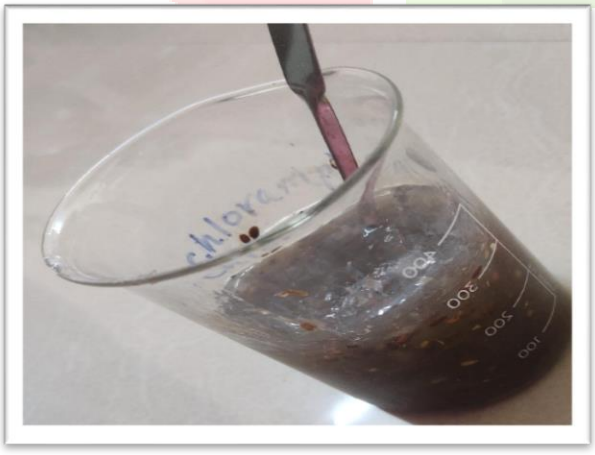


Fig.6 soaked After 12hrs

Fig.7 Separation of mucilage by Muslin cloth

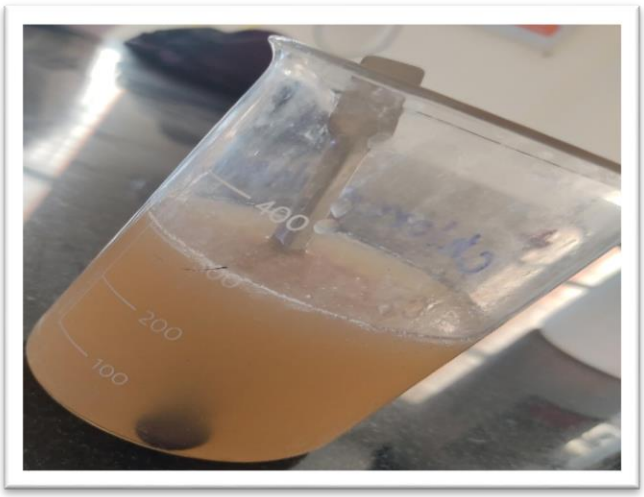


Fig.7 separation of mucilage

Fig.8 Precipitated mucilage with alcohol

Fig. 9 Acetone use for dehydrate the mucilage

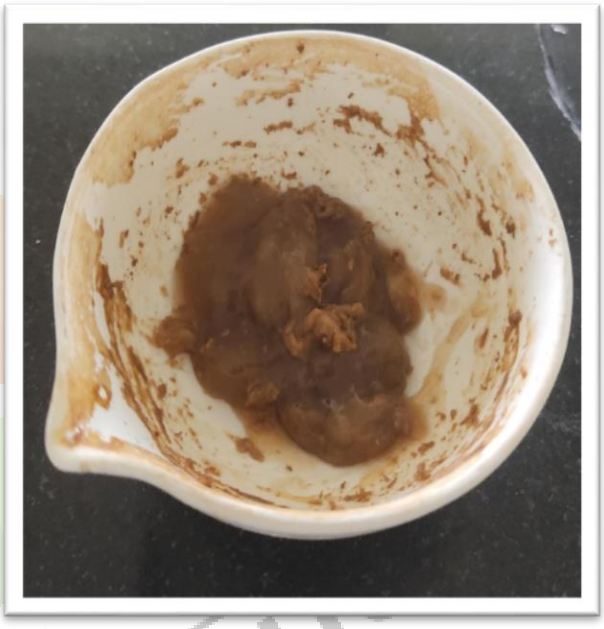


fig. 10 drying Of mucilage

fig.11 Mass was dried for 12 hrs at 50°c in Hot air oven

fig.12 mass grinding using mortar pestle

Fig.13 Powder pass through sieve #60

fig.14 Powder form of flax seed

METHOD OF PREPARATION OF MOUTH DISSOLVING FILM:-

Different formulations of metformin fast-dissolving films were prepared from metformin, chitosan, various disintegrants, sucrose, citric acid, and glycerol by the solvent- casting technique.HPMC-K100 was dissolved in water and stirred until a clear solution formed. To this, a calculated amount of metformin (500 mg), disintegrating agents – sucrose, citric acid, and glycerol – were added and diluted to 20 mL using double-distilled water. The solution was stirred continuously to obtain a clear bubble-free viscous solution, transferred into a clean petri dish and kept at room temperature for approximately 24 hours. The prepared films were then cut into a size of 2×2 cm2, packed in aluminum foil[12].

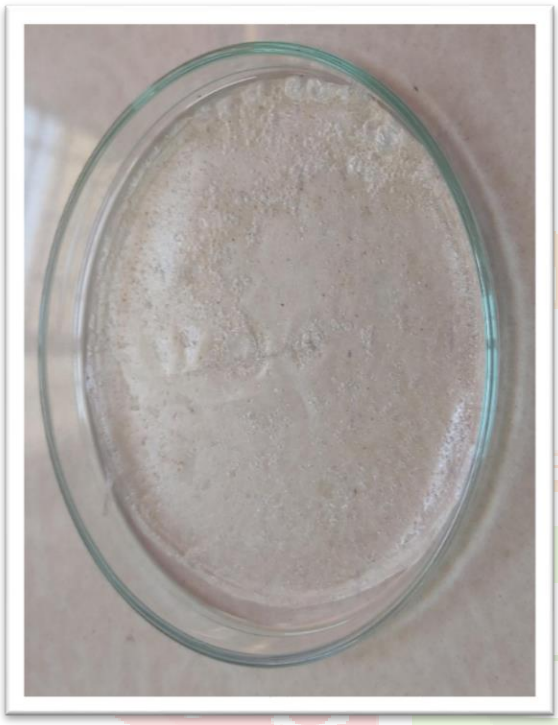


Fig. 15 Formulation

Fig.16 Film cut into2×2 cm

FORMULATION OF FAST MOUTH DISSOLVING FILM -:

Formulation	Metformin	HPMC-k100	F.extract	SSG	MCC	Sucrose	Citri -c acid	Glycerol	Water
F1	500	200	150	44	22	64	34	5	20
F2	500	200	100	22	-	64	34	4	20
F3	500	200	50	-	22	64	34	3	20

Table 1: Composition of ingredients

Ingredients	Roles
HPMC K-100	Film forming agent
MCC	Bulking agent
SSG	Disintegrant agent
Sucrose	Sweetening agent
Citric acid	Saliva stimulating agent
Glycerol	Plasticizer
Flax seed	Natural polymer

Table 2: Excipients and their roles

EVALUATION PARAMETERS:-

Organoleptic evaluation

Color, odor and taste were assessed as an organoleptic property.

Physical appearance and surface texture

Corporeal form was tested by optical scrutiny and outward smoothness was evaluated by way of touch or responsiveness of the film.

Thickness

A micrometer screw gauge was used to measure the film thickness.In order to obtain uniformity of film, thickness is measured at 5 different locations. The thickness of the film should be less than 5 %[39].

Weight variation

A random selection of thin films was made, and their average weight was determined. Every film was weighed and compared to the deviation's average weight.[12]

Tensile strength

It is nothing but the maximum stress applied to the point at which the strip specimen disrupts.

$$Tensilestrength = \frac{\text{Loadat failure} \times 100}{Stripthickness \times Stripwidth}$$

Folding endurance

A film is sliced and rapidly folded in the same spot until it breaks to test folding endurance. The value of folding endurance is determined by the number of times the film could be folded in the same way without breaking. Film has a topical folding endurance of 160–250 [13].

Morphology study

the scanning electron microscopic at fixed magnification is used to check morphology of prepared film.

Moisture content

Films of 4 cm² region were cut and properly weighed and stored in a desiccator containing fused anhydrous calcium chloride. After 24 hours, the films were removed and weighed again. The moisture content of the film is calculated by the following formula.

% Moisture content = (Initial weight – Final weight)/Initial weight x 100

In-vitro disintegration Petri dish method:

The oral film was applied to the surface of 2 milliliters of distilled water in a petri dish, and the duration of the film's dissolution was timed.All formulations' in vitro quick dissolving film disintegration times are listed in Table 3 [8].

Surface pH

The film to be tested was placed in a petridish and was moistened with 0.5 ml of distilled water and kept for 1hr. The pH was noted after bringing the electrode of the pH meter in contact with the surface of the formulation and kept for 1 min to allow equilibrium condition[13].

Disintegration time

disintegration time of MDFs carried out using U.S.P. disintegration apparatus. The disintegration time should be about 30 s or less for mouth dissolving strips. Disintegration time will vary depending on the formulation ingredients but typically the disintegration range from 5 to 30 s. Although there is no official guidance available for mouth disintegrating films [41].

Young's modulus (YM) [42].

YM = (Force at corresponding strain/cross section area)×1/(corresponding strain)

Stability studies

it is to be conducted as per the International Conference on Harmonization guidelines [42].

Drug content and assay Drug content-:

1. This test was performed by dissolving a 4 cm² area of film in 50 ml of
2. 0.1 N HCL with stirring. This solution was filtered using a whatmann filter paper, and the filtrate was diluted to 100 ml with the same buffer in a volumetric flask. This solution was analysed using UV spectrometer[12].

7.2 ASSAY-:

This test was performed by dissolving a 4 cm area of thin film in 50 ml of pH 6.8 phosphate buffer with stirring. This solution was filtered using a Whatmann filter paper, and the filtrate was diluted to 100 ml with the same buffer in a volumetric flask. This solution was analyzed using UV spectrophotometer[12].

RESULT AND DISCUSSION:-

In relation to this project, research has been done by looking through the existing references about the use and efficacy of flaxseed mucilage extract in fast-dissolving films. Solvent casting was used to create mouth dissolving films.

Weight variation-:

Weight variation was measured when five one-square-inch films from casted films were cut at five separate locations. There is a weight variation of 69 to 68.2 mg. Table 3 displays the outcomes of weight fluctuations.

Formulations	Weight variation (mg)
F1	69
F2	68
F3	68.2

Table. 3 Weight variation

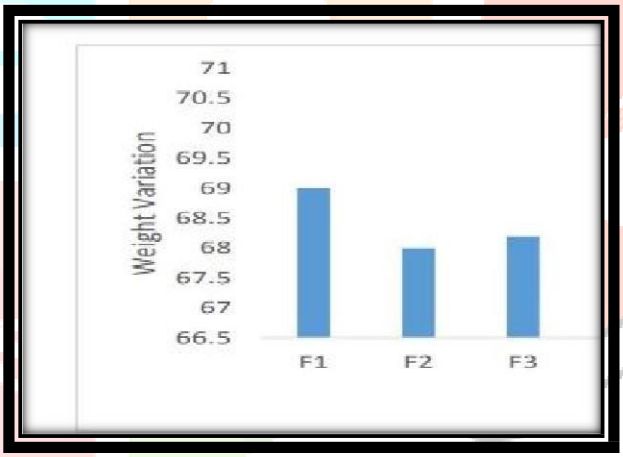


Fig. 17 Bar chart of weight variation

Thickness

The thickness of the drug loaded films were measured with the help of micrometer screw gauge. The result were reported in table 4.

Fig.18 micrometer screw gauge

Folding endurance-:

For the research, a 3 inch by 10 mm film was captured.Manual measurement was used to gauge the folding endurance.Cut to 4 cm^2, the film strip was tested for folding durability until it broke at the same location. Table 4 listed how many times the film folded before breaking.

In- vitro disintegration Test-:

In petri dishes, in vitro disintegration tests are conducted. One film was placed on the water's surface in a Petri dish containing two milliliters of distilled water, and the duration of time was recorded until the oral film had fully dissolved. Table 4. listed the report's findings

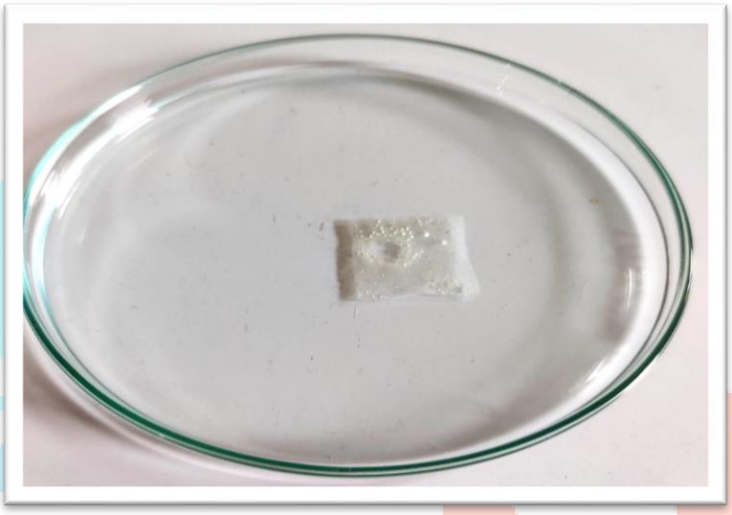


Fig.19 In vitro Disintegration Test

Time Surface pH-:

The film to be tested was placed in a Petri dish and was moistened with 0.5 ml of distilled water and kept for 1hr. The pH was noted after bringing the electrode of the pH meter in contact with the surface of the formulation and kept for 1 min to allow equilibrium.

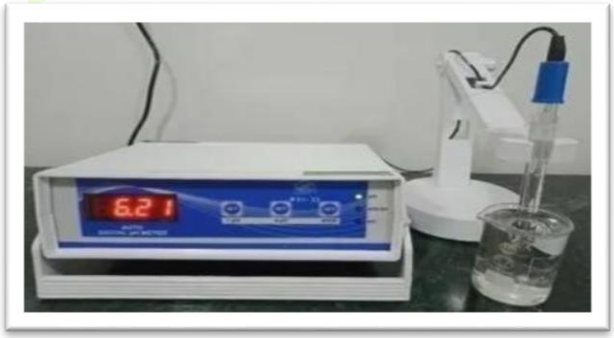


Fig.20 PH meter

Formulations Thickness	Thickness (mm)	Folding endurance	In-vitro disintegration time(sec)	Surface PH range
F1	0.17	198	28	6-7
F2	0.18	220	25	6.5-7
F3	0.19	231	20	6-7

Table No. 4

Moisture content-:

Four centimetre area films were cut, weighed accurately, and kept in a desiccator with fused anhydrous calcium chloride. The films were taken out and weighed once more after a 24-hour period. This formula is used to determine the film's moisture content.

% Moisture content = (Initial weight – Final weight)/Initial weight x 100

= 0.070-0.060×100

= 0.010×100

= 1%

Drug Content-:

The prepared film formulations were analyzed for drug content and it was observed that all the formulation found to contain almost uniform quantity of drug as per content uniformity studies indicating reproducible technique. The data is reported in table 4

Formulation	Drug Content (mg)	Assay (%)
F1	24.86	97.25
F2	23.25	98.14
F3	22.91	98.34

Table 5: Drug content and assay

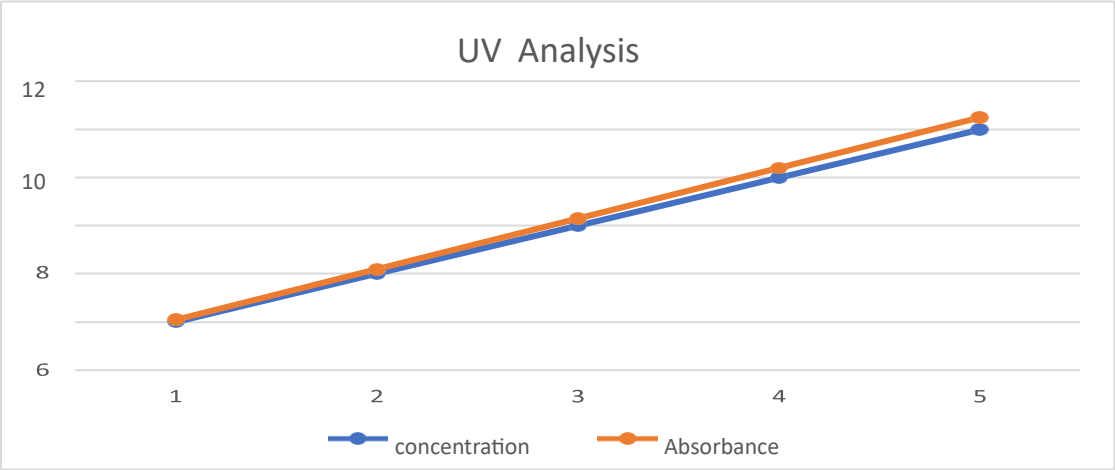


Fig. 21: UV analysis graph

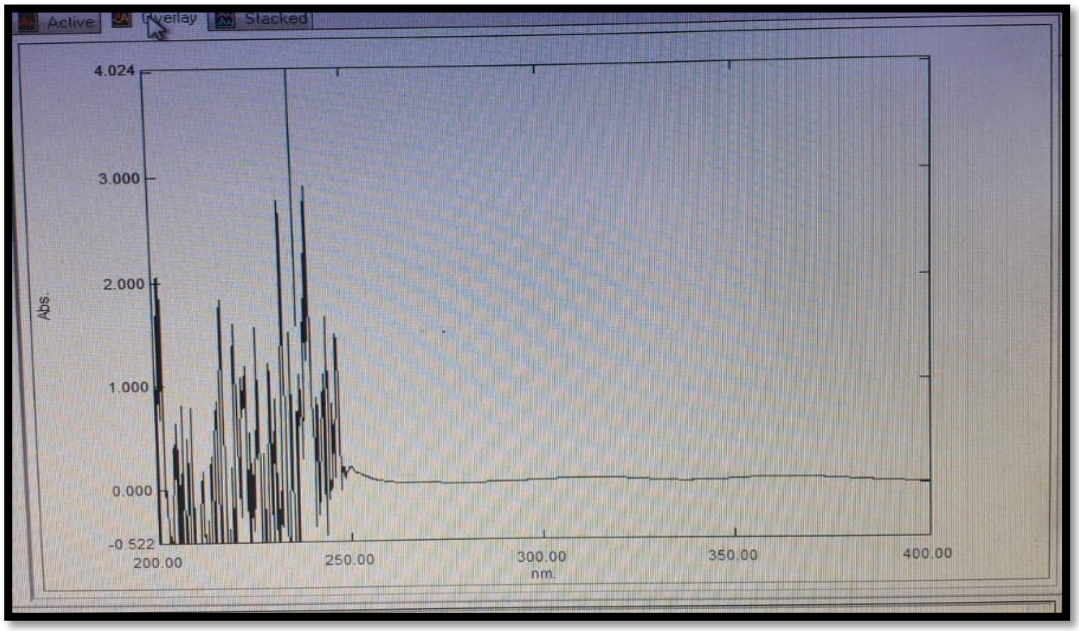


Fig :. 13 Absorbance of Metformin

Calculation:

Y= mx +C

0.34=2x+0.25

x= 0.34- 0.25\2

x= 0.34-0.125

x=0.21 µg/ml

Result: Therefore each film contain 25 mg of drug.

DISCUSSION -:

A natural polymer with exceptional film-forming capabilities, flaxseed mucilage extract was utilized in the creation of metformin's fast-dissolving films. The films had a thickness of around 0.1885 mm and ranged in weight from 67 to 68.2 mg. We did not find that the addition of disintegrants resulted in a significant increase in thickness relative to weight variations. Nevertheless, we did see that, in comparison to formulation F3, without disintegrants, the thickness of formulations F1 and F2 exhibited a modest increase in thickness. Through manual folding of the FDF until it broke, the folding endurance was determined. There was a consensus that the breaking moment marked the end. As can be seen in Table 3, the films' folding endurance fell between 198 and 231.

It was discovered that F3 had the greatest folding endurance whereas F1 had the lowest. Because of the long chain polymer network in flaxseed, it was discovered that the mucilage extract had an impact on the folding endurance of the FDF. The folding endurance values of the FDF were proven to be optimal, indicating that the FDFs possess favorable mechanical and physical qualities.

F1 were conducted using 150 mg of flaxseed mucilage extract, SSG, sucrose, microcrystalline cellulose, citric acid, glycerol, and 200 mg of HPMC-K100 . The film was opaque, and the thickness varied.In comparison to the other two batches, the thickness is higher. Because of HPMC-K100 and the naturally occurring polymer found in flaxseeds, the disintegration time is also longer.

F2 was treated with 200 mg HPMC-E15, 100 mg flaxseed mucilage extract, microcrystalline cellulose, sodium starch glycolate, citric acid, and glycerol. The hue of the film was whitish, and its thickness was homogeneous. The movie has a nice appearance. In comparison to formulation F1, the disintegration time is shorter.

The following were used in F3: 50 mg of flaxseed mucilage extract, 200 mg of HPMC-E15, sucrose microcrystalline cellulose, citric acid, glycerol, etc.They had a uniform thickness and were translucent and clear. It is thinner than the previous two batches.In comparison to F1 and F2, the disintegration time is shorter. The movies have good mechanical qualities. Because sodium starch glycolate was absent, flexibility was good.

Conclusion -

The principal aim of this study was to create a mouth-dispersing film containing metformin hydrochloride and basic components such as polymers, plasticizers, sweeteners, and saliva-stimulating agents.

Solvent casting was used to create the films. HPMC K-100 has demonstrated good adaptability.

The plasticizer glycerol was able to give the film flexibility and folding endurance, whereas the bulking agent microcrystalline cellulose was unable to do so.

Although the plasticizer glycerol was able to give the film flexibility and folding endurance, the bulking agent microcrystalline cellulose was unable to do so. Good mouth feel, folding durability, immediate drug release, and good mechanical qualities were demonstrated by the improved formulation (F3).

The F3 exhibited a 20-second disintegration time and 99% drug release in 3 minutes, compared to an hour for the commercial version.

As a result, fast drug release was accomplished for an instantaneous commencement of action, which is advantageous over traditional tablet dosage forms.

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