International Journal of Advanced Research and Development
www.advancedjournal.com
ISSN: 2455-4030
Received: 25-11-2022, Accepted: 11-12-2022, Published: 27-12-2022
Volume 7, Issue 6, 2022, Page No. 29-31

Lemon seed mucilage as solubility enhancer in pharmaceutical formulation decelopment

Rohit S Pawar[1], Pratik V Salave[1], Kiran B Virkar[1], Suraj Bagade[2]
[1] Mandesh Institute of Pharmaceutical science and research Center Mhaswad, Maharashtra, India
[2] Gauri Shankar Institute of Pharmaceutical Education and Research Center Limb Satara, Maharashtra, India

Abstract
Mucilage'is a complex heterogeneous polysaccharide. Polysaccharides have emerged as an important class of bioactive natural products and widely used in food, cosmetics, textiles, and pharmaceutical systems for various purposes, such as thickener, stabilizer, emulsifier, excipient and gelling agent. In addition, many studies elucidate that polysaccharides isolated fiom plants have antioxidative activities. Hetero-polysaccharide mucilage was extracted from the seed coats of different citrus rootstocks viz. Rough lemon, Sachtion citmmelo and Yuma citrange for investigating its biochemical and molecular properties. In the proposed research work, soxhlet extraction methodology is to be employed for the extraction of lemon seed mueilage and that extract is to be used for proposed formulation to improve the solubility of less soluble drug.
Seed mucilage of *Lepidium sativum* (Cruciferae) was used to prepare fast disintegrating tablets and formulated. Tablets were compared with tablets prepared using synthetic disintegrant such as soditun starch glycolate, kyron T314 and ac-disol. The results showed that disintegration and mean dissolution time for batch containing 10% mucilage was better than other tablets prepared using different synthetic disintegrating agent.

Keywords: lemon seed, pharmaceutical, mucilage

Introduction

Mucilage

Mucilage'is a complex heterogeneous polysaccharide. Polysaccharides have emerged as an important class of bioactive natural products and widely used in food, cosmetics, textiles, and pharmaceutical systems for various purposes, such as thickener, stabilizer, emulsifier, excipient and gelling agent. In addition, many studies elucidate that polysaccharides isolated fiom plants have antioxidative activities. Mucilage is a thick, gluey substance produced by most plants and some microorganisms. It is a polar glycoprotein and an exopolysaccharide. It occurs in various parts of nearly all classes of plant, usually in relatively small percentages, and is frequently associated with other substances, such as tannims and alkaloids. Mucilage in plants is thought to aid in water storage and seed germination, and to act as a membrane thickener and food reserve. Among the richest sources are cacti (and other succulents) and flax seeds. Mucilage has a unique purpose in some camivorous plants. Exopolysaccharides are the most stabilizing factor for micro aggregates and are widely distributed in soils. Therefore, exopolysaccharide-producing "soil aigae" play a vital role in the ecology of the world's soils. The substance covers the outside oc for example, unicellular or filamentous green algae and cyanobacteria. Amongst the green algae especially, the group volvocales are known to produce exopolysaccharides in a certain part of their life cycle.

Lemon seed mucilage

Hetero-polysaccharide mucilage was extracted from the seed coats of different citrus rootstocks viz. Rough lemon, Sachtion citmmelo and Yuma citrange for investigating its biochemical and molecular properties. Investigations showed that the mucilage contained (mg/g) starch 3. 13-5. 04; maltose 3. 23-4. 31; glucosamine 0. 017- 0. 289; D-xylose 0. 059-0. 107 and total soluble sugars 8. 13-11. 82. Specific enzyme activities were 16. 98-35. 96, 30. 60-98. 45, 42. 00-73. 98, 660. 98-738. 35 and 7. 660-19. 27 IU mg-1 of protein for protease, amylase, catalase, peroxidase and superoxide dismutase, respectively.
Proximate analysis showed 12. 85-13. 94% moisture, 11. 25-14. 06% crude protein, 0. 31- 0. 86% crude lipid, 1. 31-2. 69% crude fibre, 2. 95-3. 45% ash and 81. 48-91. 49 kJ 100 g-'energy.
In the proposed research work, soxhlet extraction methodology is to be employed for the extraction of lemon seed mueilage and that extract is to be used for proposed formulation to improve the solubility of less soluble drug.
Seed mucilage of *Lepidium sativum* (Cruciferae) was used to prepare fast disintegrating tablets and formulated. Tablets were compared with tablets prepared using synthetic disintegrant such as soditun starch glycolate, kyron T314 and ac-disol. The results showed that disintegration and mean dissolution time for batch containing 10% mucilage was better than other tabletsprepared using different synthetic disintegrating agent.

Poorly soluble drug problem

Although the oral route of drug administration is the Most common and preferred method of delivery due to convenience and ease of ingestion, for many drugs it can be a problematic and inefficient mode of delivery for a number of reasons.
Limited drug absorption due to poor solubility of drugs resulting in poor bioavailability is paramount amongst the potential problems that can be encountered when delivering an active agent via the oral route. Therapeutic effectiveness of a drug depends upon the bioavailability and Ultimately upon the solubility of drug molecules. Solubility is one of the important parameter to Achieve desired concentration of drug in systemic circulation for pharmacological response to

be Shown. Currently only 8% of new drug candidates have both high solubility and permeability.

The solubility of a solute is the maximum quantity of solute that can dissolve in a certain quantity of solvent or quantity of solution at a specified temperature. In the other words the solubility can also define as the ability of one substance to form a solution with another Substance. The solubility issues complicating the delivery of these new drugs also affect the Delivery of many existing drugs.

Choice of Topic with Reasoning

Various co-solvent and surfactant widely used to enhance solubility of poorly soluble drugs. The difficulties arise in case of solubility and wettability of poorly aqueous soluble drug and in the design of pharmaceutical fomiulation which leads to adverse effect or side effect, if concentration is beyond limit. For enhancing the solubility of drug, there is need of immerging Out such polymer or compound that will enhance the solubility with minimum concentration and Without any adverse effect.

Thus, we want to isolate and construct natural polymer or mucilage to overcome these Difficulties of solubility of poorly soluble drugs. So, in this case, we isolate lemon seed mucilage to improve solubility of poorly soluble drug as immerging green approaches.

Objective

1. To isolate and extract lemon seed mucilage.
2. To study the eftect of isolated mucilage and solubility of selected drug or drugs.

Literature Review

Kumar, R. *et. al.* (2009) [9]: They extracted mucilage from the seeds of fenugreek, *Trigonella foenum-graceum L* (family Leguminosae). used as mouth dissolving tablet formulations containing metformin hydrochloride. Mucilage extracted from fenugreek seeds were subjected to toxicity studies, it showed that extracted mucilage is devoid of toxicity. Fast disintegrating tablet of metformin HCl was formulated using different concentration (2, 4, 6 8 and 10% w/w) of natural disintegrant viz; isolated mucilage of fenugreek seed and synthetic superdisintegrant like croscarmellose sodium and were compared. Disintegration time and drug release were taken as the basis to optimize the rapidly disintegrating tablet.

Saeedi M. *et. al.* (2010) [6]: Mucilage extracted from *Plantago psyllium* seeds was evaluated for inertness and safety parameters. The suitability of psyllium mucilage for a pharmaceutical binder was assessed in paracetamol tablets. Properties of the granules prepared using different concentrations of psyllium mucilage were compared with PVP and tragacanth. Psyllium mucilage at 5 % (*m*/*m*) was found to be comparable with 3 % (*m*/*m*) of PVP. Investigated paracetamol tablets indicated that psyllium mucilage can retard the drug release.

Naqvi, S.A. *et.al.* (2011)*:* Hetero-polysaccharide mucilage was extracted from the seed coats of different citrus rootstocks viz. Rough lemon, Sachtion citrumelo and Yuma citrange for investigating its biochemical and molecular properties. Investigations showed that the mucilage contained (mg/g) starch 3.13–5.04; maltose 3.23–4.31; glucosamine 0.017–0.289; d-xylose 0.059–0.107 and total soluble sugars 8.13–11.82. Specific enzyme activities were 16.98–35.96, 30.60–98.45, 42.00–73.98, 660.98–738.35 and 7.660–19.27 IUmg−1 of protein for protease, amylase, catalase, peroxidase and superoxide dismutase, respectively. Proximate analysis showed 12.85–13.94% moisture, 11.25–14.06% crude protein, 0.31–0.86% crude lipid, 1.31–2.69% crude fibre, 2.95–3.45% ash and 81.48–91.49 kJ 100 g−1 energy. The comparative characterization of the extractable proteins was profiled by SDS-PAGE and quantified using Bradford assay. Structural properties of samples were analyzed and compared using Fourier transformation infrared (FT-IR) spectroscopy.

Malviya R. *et.al*. (2011) [11]: In the present review Malviya R. *et.al*.they have discussed mucilage, as a potent candidate to be used in various pharmaceutical formulations. They have also compiled the various sources which may lead to significant mucilage production and also the extraction procedure. The various properties have been dealt in detail, which makes it a potential candidate to be used as pharmaceutical excipient.

Methodology/ Laboratory Work

1. Collection of samples.
2. Isolation and extraction of mucilage.
3. Selection of Active Pharmaceutical Ingredient.
4. Effect of mucilage on the solubility of selected API
5. Preformulation studies.
6. Formulation development.
7. Evaluation and stability studies.

1. Collection of samples

Collection, authentication and processing will be done based on scientific methods available. Investigation of existing literature relating to a species of interest, including taxonomic literature, pharmacopoeial monographs and other literature, and herbal or ethnobotanical literature, will be done. Wendy L. Applequist (2012) [14]]

2. Isolation and extraction of mucilage

Aqueous extraction and solvent extraction techniques will be used for isolation and extraction of mucilage. [Prajapati, V. D., *et. al.* (2014) [8]]

3. Selection of Active Pharmaceutical Ingredient

Selection of poorly soluble drugs will be based on Biopharmaceutical Classification System.The BCS is a scientific schematic proposed by Amidon and co-workers in 1995, which allowed the classification of drugs based on solubility and intestinal permeability parameters in four classes. [Amidon et.al. (1995)]

4. Effect of mucilage on the solubility of selected API

Excess amount of drug (approx.100mg) will be added tovials containing aqueous solutions of increasing concentrations of mucilage and shaken at 25±0.5°C. In order to establish the optimal mixing time, vials were shaken for 24-72 hours respectively. [Nicolescu, C., Arama et. al. (2010)]

5. Preformulation study

The evaluation of preformulation will be carried out using various studies like solubility, melting point, λ_{max}, IR spectra, and Physicochemical tests such as

Rheological Measurements, Water Binding Capacity, Chromatography, and micromeritical studies such as bulk density, tap density, Hausner's ratio, angle of repose, Carr's index are to be studied. [Ricky W. Fedeniuk *et.al*. (1994)] [10]. incompatibility studies of mucilage will also be extended with selected drugs.

6. Formulation development

Suitable dosage form will be prepared upon the results which will obtain during Preformulation stidies.

7. Evaluation

Formulation developed during investigation will be evaluated for its safety, effectivity and stability.

Table 1: Outline of the Proposed Research Work

Sr. No.	Research Work	Tentative Time (Months)
1.	Literature Survey	1
2.	Selection of API	1
3.	Effect of mucilage on the solubility of selected API	2
4.	Preformulation study	2
5.	Formulation development	2
6.	Evaluation and stability studies	2
7.	Data compilation and Thesis writing	2

Methods of Data Collection

The methods used for the data collection are two types:

a. Primary data collection
b. Secondary data collection and
c. Experimental work.

a. Primary data collection: The primary data collection method includes the data obtained from the observations and experimental work it includes or refers to an investigation in which a factor or variable under test is isolated and its effect(s) measured. In the experimental work the researcher or investigator measures the effects of an experiment which he conducts specifically.

b. Secondary data collection

Secondary data is known as the data which is already available i.e., which is collected and analyzed by someone else. The researchers use the secondary data then he has to look onto the sources from where he can collect these data. These used secondary data will be either published or unpublished data.

c. Experimental work

The data obtained from the experimental work includes the effect of different variables or factors on to the drugs solubility, dissolution rate and bioavailability *in-vitro*.

Methods of Data Analysis

The obtained data will be analyzed statistically using Excel and Statistical softwares.

References

1. Arrunategui LB, Silva-Barcellos<NM, Bellavinha KR, Ev LDS, Souza JD. Biopharmaceutics classification system: importance and inclusion in biowaiver guidance. Brazilian Journal of Pharmaceutical Sciences,2015:51(1),143-154.
2. Charles AL, Huang TC, Lai PY, Chen CC, Lee PP, Chang YH. Study of wheat of flour-cassava starch composite mix and the function of cassava mucilage in Chinese noodles. Food Hydrocolloid,2007:21:368–378.
3. Charles AL, Huang TC, Chang YH. Structural analysis and characterization of mucopolysaccharide isolated from roots of cassava (Manihot esculenta Crantz L.). Food Hydrocolloid,2008:22:184–191.
4. Jennifer Le. Drug Bioavaibility.MSD Manual professional, 2017. Available from:https://www.msdmanuals.com/professional/clinicalpharmacology/pharmacokinetics/drug-bioavaibility.
5. Hariprasanna RC, Upendra Kulkarni, Basawaraj S Patil, Vipul Karkar, Parikh Bhavik. Formulation and development of fast disintegrating felodipine tablets: functionality of superdisintegrants IJPSR, 2010:1(8)(Suppl.)
6. Majid Saeedi *et al.* Evaluation of binding properties of *Plantago psyllium* seed mucilage *Acta Pharm*,2010:60:339–348.
7. Nicolescu C, Aroma CORINA, Nedelcua, Monciu CM. Phase solubility studies of the inclusion compexes of repaglinide with β-cyclodextrin and β-cyclodextrin derivatives. Farmacia,2010:58(5),620-628.
8. Prajapati VD, Maheriya PM, Jani GK, Patil PD, Patel, BN. Lepidium sativum Linn.: A current addition to the family of mucilage and its applications, International Journal of Biological Macromolecules,2014:65:72-80.
9. Ravi Kumar et al. isolation and evaluation of Disintegrant Properties of fenugreek seed mucilage International Journal of PharmTech Research,2009:(1)4:982-996. ISSN: 0974-4304.
10. Ricky W Fedeniuk, Costas G Biliaderis'. Composition and Physicochemical Properties of Linseed (Linum usitatissimum L.) Mucilage J. Agric. Food Chem,1994:42:240-247.
11. Rishabha Malviya *et al.* Applications of Mucilages in Drug Delivery - A Review, Advances in Biological Research,2011:5(1):01-07. ISSN 1992-0067.
12. Simranjit Kaur,Prabakaran Lakshmanan. Hibiscus Rosa-sinesis leaves polysaccharide as solubility enhancing agent for poorly soluble drug, Pharmacy & Pharmacology International Journal, 2015, 2(6).
13. Summar A Naqvi et al. Biochemical profiling of mucilage extracted from seeds of different citrus rootstocks, Carbohydrate Polymers,2010:83(2011).
14. Wendy L. Applequist et al. Selection and authentication of botanical materials for the development of analytical methods Anal Bioanal Chem, 2012. DOI 10.1007/s00216-012-6595-1.