Comparative Study on Natural Gum Used In Treatment of Fecal Impaction

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Abstract:
Fecal impaction is one of the most frequently reported gastrointestinal (GI) disorders that negatively impacts quality of life and is associated with a significant economic burden to the patients and society. Traditional treatments including lifestyle modification and laxatives are often ineffective in the more severe forms of constipation and over the long term. New medications targeting at intestinal chloride channels and colonic serotonin receptors have been demonstrated effective in recent years. Emerging agents focusing on improving intestinal secretion and/or colonic motility have been shown effective in animal models and even in clinical trials. Natural gums like tragacanth, asacia, isabgol are promising biodegradable polymeric materials as the conventional excipients used in the formulation development is evaluated and compared for the following papaments like Swelling index (maximum for Isabgol 6.11 ) it can be used as mucoadhesive polymers, Solubility of gums (all the natural gum were water soluble ), Loss of drying/moisture content (maximum for Isabgol 123 %) it can be used for Cumulative Drug Release, ash value (maximum for Isabgol 0.10) ash is good indicator of either previous extraction of water soluble salts in drugs, density (Tapped density is maximum for tragacanth 0.78 ) Good density can be used for oral solid formulation , Measurement of Compressibility( maximum for tragacanth 34.6). Good compressibility can be successfully handled using a weak binder in the formulation. For Matrix Tablets isabgol is the best base then tragacanth or acacia.

Keywords: tragacanth , isabgol, asacia, laxative, fecal impaction ,constipation

Introduction:
Conventionally the excipients are used for the formulation of drug which fulfill important criteria for a dosage form like weight, defined volume and consistency which is required for the accurate administration of active ingredients. While in the new pharmaceutical dosage form they are playing multiple function like controlled release, sustain release ,delayed release, modify stability and increased bioavailability of active ingredient, patient compliance and easy to manufacture. Modern and modification of excipients continuously done to fulfill the need of advanced drug delivery system or novel drug delivery system. Recently different polymers are identified and they are involved in the formulation of different dosage form like solid, liquid and semisolid and particularly beneficial to create novel drug delivery system. Including synthetic and natural polymers both are involved for the formulation of dosage form. Synthetic polymers have different issue for their use like they are toxic, costly and have environmental related issues. Nevertheless the natural polymers are used into the pharmaceutical formulations because they are cheap, easily available, non-toxic, and biodegradable and have the ability for chemical modification. Today, a huge number of excipients are available which are originated from plants. By doing the different studies researchers identified the usefulness of the pharmaceutical excipients which are originated from different plants. Different modifications of natural gums are done to fulfill the need of drug delivery system and it gives a big competition to the synthetic excipients which are available in the market. The factor which are define the increase in the demand of the excipients which are originated from plants is that they are
renewable and cultivated in a convenient manner and because of which there will be a constant supply of it. They are used as viscosity enhancer, disintegrating agents, emulsifying agent, suspending agent, gelling agent, bio adhesive and binding agent in different dosage form like buccal patch, film coating agent, matrix controlled system, nanoparticle, suspension, emulsion, microsphere. The gum and mucilage which are found naturally contain different constituents in them. In various cases polysaccharides, tannins or resins are present in gum which are responsible to retard the release of active ingredient from dosage forms which is found to be important for sustained release dosage form.

**Evaluation Parameters:**

1. **Swelling index determination:**

Swelling index is defined as the volume of mucilage formed within 24 hours from 1g of mucilage containing material.

Many herbal materials are of specific medicinal utility because of its swelling properties – especially gums and those containing an appreciable amount of mucilage, pectin or hemicellulose.

Swelling characteristics of the separated mucilage powder was determined by using different media such as 0.1N Hydrochloric acid, pH 7.4 phosphate buffer and distilled water.

The swelling index is the volume which is absorb by the 1 g of herbal material under specified environment. Its identification is done by the addition of water or a swelling agent which is specified in the test procedure for each individual herbal material (either whole, cut or pulverized). Using a glass-stoppered measuring cylinder, the material is shaken repeatedly for 1 hour and then allowed to stand for a required period of time. The volume of the mixture (in ml) is then read.

The mixing of whole herbal material with the swelling agent is easy to achieve, but cut or pulverized material requires vigorous shaking at specified intervals to ensure even distribution of the material in the swelling agent.

Swelling index = final volume of drug / initial volume of drug

2. **Solubility of gums:**

It is sparingly soluble in water but swells in contact with it giving a highly viscous solution. Gums are polyuronide consisting of arabinase, galactose and glucoronic acid but rhamnose is present in traces.

Determine the solubility in various solvent such as ethanol, acetone and distilled water and deferent condition either in cold solvent or hot solvent.

3. **Loss of drying/moisture content determination:**

As the inherent moisture in disintegrates may influence the stability of dosage form containing moisture sensitive drugs, moisture content of the separated gum and mucilage was detected by loss on drying methods.

The sample 1g was heated at 105°C until constant weight in a hot air oven and percentage loss of moisture on drying was calculated using the formula.

LOD (%) = Weight of water in sample/ Weight of dry sample X 100

4. **Determination of ash value:**

- **Total ash**

  About 1 g of the powdered drug was accurately weighed in a tared silica crucible. The powdered drug was spread as a fine layer at the bottom of the crucible. The crucible was incinerated at a temperature not exceeding 450°-550°C until free from carbon. The crucible was cooled and weighed. The procedure was repeated till a constant weight was observed. The percentage of the total ash was calculated in triplicate with reference to the air dried drug.

- **Water soluble ash**
The ash obtained as described in the determination of total ash was boiled for 5 min with 25 ml of water. The insoluble matter was collected on an ashless filter paper and washed with hot water. The insoluble ash was transferred into a tarred silica crucible and ignited at a temperature not exceeding 450°C. The procedure was repeated until a constant weight was observed. The weight of the insoluble matter was subtracted from the weight of the total ash. The difference in weight was considered as water-soluble ash. The percentage of water-soluble ash was calculated with reference to air-dried drug.

**Calculation of ash value:**

\[
\% \text{ Total Ash value: } \frac{\text{wt. of drug after incineration}}{\text{wt. of drug before incineration}} \times 100
\]

\[
\% \text{ Water soluble ash: } \frac{\text{wt of water soluble drug}}{\text{total ash}} \times 100
\]

5. Determination of density

a. **Measurement of Bulk density**

The bulk density of a powder is the ratio of the mass of an untapped powder sample and its volume including the contribution of the inter-particulate void volume. Hence, the bulk density depends on both the density of powder particles and the spatial arrangement of particles in the powder bed.

It may be expressed in grams per cubic centimeter (g/cm³) or (g/ml).

The bulking properties of a powder are dependent upon the preparation, treatment and storage of the sample, i.e. how it was handled.

The bulk density of a powder is determined by measuring the volume of a known mass of powder sample that may have been passed through a sieve, into a graduated cylinder, or by measuring the mass of a known volume of powder that has been passed through volumeter into a cup or a measuring vessel.

\[D_b = \frac{M}{V_0}\]

b. **Measurement of Tapped density.**

The tapped density is an increased bulk density attained after mechanically tapping a container containing the powder sample.

The tapped density is obtained by mechanically tapping a graduated measuring cylinder or vessel containing the powder sample. After observing the initial powder volume or mass, the measuring cylinder or vessel is mechanically tapped, and volume or mass readings are taken until little further volume or mass change is observed. The mechanical tapping is achieved by raising the cylinder or vessel and allowing it to drop, under its own mass, a specified distance by either of three methods as described below. Devices that rotate the cylinder or vessel during tapping may be preferred to minimize any possible separation of the mass during tapping down.

\[D_T = \frac{M}{V_T}\]

6. **Measurement of Compressibility**

Measures of Powder Compressibility Because the interparticulate interactions influencing the bulking properties of a powder are also the interactions that interfere with powder flow, a comparison of the bulk and tapped densities can give a measure of the relative importance of these interactions in a given powder. Such a comparison is often used as an index of the ability of the powder to flow, for example the Compressibility Index or the Hausner Ratio.

The Compressibility Index and Hausner Ratio are measures of the propensity of a powder to be compressed as described above. As such, they are measures of the powder ability to settle and they permit an assessment of the relative importance of interparticulate interactions. In a free-flowing powder, such interactions are less significant, and the bulk and tapped densities will be closer in value. For poorer flowing materials, there are...
frequently greater interparticulate interactions, and a greater difference between the bulk and tapped densities will be observed. These differences are reflected in the Compressibility Index and the Hausner Ratio.

Compressibility Index = \(100 \frac{(V_0 - V_f)}{V_0}\)

\(V_0\): unsettled apparent volume

\(V_f\): final tapped volume

Hausner Ratio = \(\frac{V_0}{V_f}\)

Depending on the material, the compressibility index can be determined using \(V_{10}\) instead of \(V_0\). If \(V_{10}\) is used, it is clearly stated in the results.

**Calculations and Results:**

1. **Swelling index determination:**

<table>
<thead>
<tr>
<th>S. no</th>
<th>Drug</th>
<th>Initial volume</th>
<th>Volume after 24 hrs.</th>
<th>Swelling index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Isabgol</td>
<td>1.8ml</td>
<td>11ml</td>
<td>6.11</td>
</tr>
</tbody>
</table>

2. **Solubility:**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Solvents</th>
<th>Acacia</th>
<th>Isabgol</th>
<th>Tregacanth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ethanol</td>
<td>Insoluble</td>
<td>Insoluble</td>
<td>Insoluble</td>
</tr>
<tr>
<td>2.</td>
<td>Acetone</td>
<td>Insoluble</td>
<td>Insoluble</td>
<td>Insoluble</td>
</tr>
<tr>
<td>3.</td>
<td>Dist. water</td>
<td>Soluble</td>
<td>Soluble</td>
<td>Soluble</td>
</tr>
</tbody>
</table>

3. **Loss of drying/ Moisture content:**

\[
\text{LOD} \, \text{(%)} = \frac{\text{Weight of water in sample}}{\text{Weight of dry sample}} \times 100
\]

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Material</th>
<th>Sample wt.</th>
<th>After 1hr.</th>
<th>After 2hr.</th>
<th>%LOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acacia</td>
<td>1g</td>
<td>0.89gm</td>
<td>0.89gm</td>
<td>112</td>
</tr>
<tr>
<td>2.</td>
<td>Isabgol</td>
<td>1g</td>
<td>0.81gm</td>
<td>0.81gm</td>
<td>123</td>
</tr>
<tr>
<td>3.</td>
<td>Tragacanth</td>
<td>1g</td>
<td>0.88gm</td>
<td>0.88gm</td>
<td>114</td>
</tr>
</tbody>
</table>

4. **Ash value determination:**

% Total Ash value: wt. of drug after incineration / wt. of drug before incineration X 100

% Water soluble ash: wt of water soluble drug / total ash X 100

<table>
<thead>
<tr>
<th>S. No</th>
<th>Drugs</th>
<th>Wt. before incinerate</th>
<th>Wt. After incinerate</th>
<th>Total ash</th>
<th>Water soluble ash</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acacia</td>
<td>1g</td>
<td>0.840</td>
<td>0.840</td>
<td>0.02</td>
</tr>
<tr>
<td>2.</td>
<td>Isabgol</td>
<td>1g</td>
<td>0.850</td>
<td>0.850</td>
<td>0.10</td>
</tr>
<tr>
<td>3.</td>
<td>Tragacanth</td>
<td>1g</td>
<td>0.760</td>
<td>0.760</td>
<td>0.02</td>
</tr>
</tbody>
</table>
5. Powder density determination:

Bulk density \( D_b = \frac{M}{V_0} \)

Tapped density \( D_T = \frac{M}{V_T} \)

Compressibility Index = 100 \( \frac{(V_0 - V_f)}{V_0} \)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Powder material</th>
<th>Bulk density</th>
<th>Tapped density</th>
<th>Compressibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Acacia</td>
<td>0.56 g/ml</td>
<td>0.75</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Tregacanth</td>
<td>0.51 g/ml</td>
<td>0.78</td>
<td>34.6</td>
</tr>
<tr>
<td>3.</td>
<td>Isabgol</td>
<td>0.52 g/ml</td>
<td>0.55</td>
<td>6.25</td>
</tr>
</tbody>
</table>

Conclusion:
Natural gums are promising biodegradable polymeric materials. Many studies have been carried out in fields including food technology and pharmaceuticals using gums and mucilages. It is clear that gums and mucilages have many advantages over synthetic materials. Various applications of gums and mucilages have been established in the field of pharmaceuticals. However, there is a need to develop other natural sources as well as with modifying existing natural materials for the formulation of novel drug delivery systems, biotechnological applications and other delivery systems. Therefore, in the years to come, there will be continued interest in natural gums and their modifications aimed at the development of better materials for drug delivery systems.

Reference:
1. Amelia M. Avachat*, Rakesh R. Dash and Shilpa N. Shrotriya Recent Investigations of Plant Based Natural Gums, Mucilages and Resins in Novel Drug Delivery Systems Indian Journal of Pharmaceutical Education and Research Sinhgad College of Pharmacy, 44/1, Vadgaon(Bk.), Pune-411041, Maharashtra, India P.P 86-87