INTRODUCTION

Drug products designed to reduce the frequency of dosing by modifying the rate of drug absorption have been available for many years. Regular research is going on for the use of natural occurring biocompatible polymeric material in designing of dosage form for oral controlled release administration. Natural gums are biodegradable and non-toxic, which hydrate and swell on contact with aqueous media, so these have been used for the preparation of oral controlled release matrix tablets. Tamarind gum was xyloglycon present in tamarind seed. It is a hydrophilic polymer and had been limited for use as gelling, thickening, suspending and emulsifying agents. It possesses properties like high viscosity, broad pH tolerance and adhesivity. In addition to these other important properties of TSP have been identified recently. They include non-carcinogenicity, mucoadhesivity, biocompatibility, high drug holding capacity and high thermal stability. This led to its application as excipient in hydrophilic drug delivery system. Tamarind gum was used as matrix forming material, while microcrystalline cellulose was used as filler to maintain the tablet weight. All prepared matrix tablets were evaluated for weight variation as per USP XXIV monograph. Twenty tablets of each batch were used to evaluate weight variation among tablets and standard deviation was calculated.

Preparation of SR matrix tablets

According to Table 1 sustained release matrix tablets of Diclofenac sodium were prepared by using different drug: polymer ratios viz. 1:1, 1:1.5, 1:2, 1:2.5, 1:3, and 1:3.5 for various batches Batch A, Batch B, Batch C, Batch D, Batch E and Batch F respectively. Tamarind gum was used as matrix forming material, while microcrystalline cellulose was used as filler to maintain the tablet weight. All ingredients were passed through a # 20 sieve, weighed and blended. The granules (which were obtained after wet granulation) were compressed by a direct compression technique, using KBr press, with the help of 8mm flat faced punches.

Evaluation of fabricated matrix tablets

Weight variation

All prepared matrix tablets were evaluated for weight variation as per USP XXIV monograph. Twenty tablets of each batch were used to evaluate weight variation among tablets and standard deviation was calculated.

Friability
Table 1: Formulation composition of tamarind gum matrix tablets

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Formulations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Batch A</td>
</tr>
<tr>
<td>Diclofenac sodium</td>
<td>50mg</td>
</tr>
<tr>
<td>Tamarind gum</td>
<td>50mg</td>
</tr>
<tr>
<td>Microcrystalline cellulose</td>
<td>200mg</td>
</tr>
<tr>
<td>Total weight</td>
<td>300mg</td>
</tr>
</tbody>
</table>

Table 2: Various evaluation parameters for fabricated tamarind gum tablets

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Tamarind Gum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Batch A</td>
</tr>
<tr>
<td>Weight variation(gm)</td>
<td>0.299±0.01</td>
</tr>
<tr>
<td>Friability (%)</td>
<td>0.05±0.01</td>
</tr>
<tr>
<td>Hardness (N)</td>
<td>20.24±0.12</td>
</tr>
<tr>
<td>Thickness(mm)</td>
<td>3.623±0.01</td>
</tr>
</tbody>
</table>
Tablets of all batches were used to evaluate friability as per USP XXIV monograph. Friability testing was done by Roche friability with triplicate readings\(^\text{19, 20}\).

**Hardness**

Hardness of all batches was determined using Digital Force Gauge (Model:EL=500N, Electrolab). The test was carried out in triplicate for all batches as per USP XXIV monograph for uncoated tablets\(^\text{19, 20}\).

**Thickness**

Thickness was measured by vernier caliper as per USP XXIV monograph. The readings were carried out in triplicate and average value was noted\(^\text{19, 20}\).

**Drug content**

The tablets were powdered, and 50 mg equivalent weight of Diclofenac sodium in tablet powder was accurately weighed and transferred into a 100 ml volumetric flask. Initially, 10 ml of phosphate buffer (pH 6.6) was added and shaken for 10 min. then, the volume was made up to 100 ml with buffer. Subsequently, the solution in volumetric flask was filtered, and 1 ml of the filtrate is diluted and analyzed at 276 nm using UV-visible spectrophotometer (Shimadzu UV-2450, Japan). The drug content of the each sample was estimated from their standard curve \(^\text{21, 22}\).

**Swelling behavior of sustained release matrix tablets**

The extent of swelling was measured in terms of % weight gain by the tablet. The swelling behavior of all formulation was studied. One tablet from each formulation was kept in a petridish containing pH 7.4 phosphate buffer. At the end of 0.5 h and 1 h, the tablet was withdrawn, soaked with tissue paper, and weighed. Then for every 1 h, weights of the tablet were noted, and the process was continued till the end of 8 h. Percentage weight gain by the tablet was calculated by formula;

\[
SI = \left( \frac{(M_t - M_o)}{M_o} \right) \times 100,
\]

Where, \(SI\) = swelling index, \(M_o\) = weight of tablet at time \(t\) (h) and \(M_t\) = weight of tablet at zero time \(^\text{23, 24}\).

**In vitro drug release study**

**In vitro** drug release was studied using Lab India Dissolution Apparatus, with 900 ml of dissolution medium (phosphate buffer pH 7.4) maintained at 37±1°C for 24 h, at 50 rpm. 5ml of sample was withdrawn after every hour, and was replaced by an equal volume of fresh dissolution medium of same pH (phosphate buffer pH 7.4). Collected samples were analyzed spectrophotometrically at measured wavelength of 276nm, and cumulative percent drug release was calculated\(^\text{25, 26}\).

The data obtained in the in-vitro dissolution study is grouped according to two modes of data treatment as follows:

1. Percentage drug released Vs time (h).
2. Cumulative percentage drug released Vs time (h)

In these two methods, drug release profile can be better studied using cumulative percentage drug release Vs time (h) plot.

**RESULTS AND DISCUSSION**

Infrared spectra of drug and polymers were used to study the compatibility between them. No change in peak shows that there was no interaction between drug and polymers. As per the Table 2, the formulated matrix tablets met the Pharmacopoeial requirement of uniformity of weight. All the tablets confirmed to the requirement of assay, as per USP. Hardness, percentage friability and thickness were all within acceptable limits\(^\text{23, 24}\).

Sustained drug release was displayed by all formulations in phosphate buffer (pH 7.4). Figure 4 showed the swelling characteristics of tamarind gum. The swelling index was calculated with respect to time (Figure 4). As time increases, the swelling index was increased, because weight gain by tablet was increased proportionally with rate of hydration up to certain limit (Figure 5). Later on, it decreases gradually due to dissolution of outermost gelled layer of tablet into dissolution medium. The direct relationship was observed between swelling index and polymer concentration, and as polymer concentration increases, swelling index was increased\(^\text{23, 24}\).

It has been observed that the cumulative percent drug release decreases with increasing concentration of polymer and swelling index. The reason attributed to this fact is slow erosion of the gelled layer from the tablets containing higher amount of natural polymer. This slow release is because of the formation of a thick gel structure that delays drug release from tablet matrix \(^\text{25, 26, 27, 28}\).

The in vitro release of Diclofenac sodium from tamarind gum was shown in Figure 6. From the findings, obtained so far it can be concluded that Batch F of tamarind gum in the concentration ratio of 1:2.5 was promising concentration for oral sustained release tablet of Diclofenac sodium.

**CONCLUSIONS**

Natural polymers when used as release retardent exhibits uniform release over longer period of time. Hence it can be concluded that, the tamarind gum which is a natural polymer can be used as a promising drug release retardent in a particular concentration range.

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**REFERENCES**


