Evaluation of Different Concentration of Binders on the Dissolution Profile of Paracetamol Tablets

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Abstract:
Aim and objective: The aim of this research is to study the effect of different concentrations of binder (2, 4, 6%) on the dissolution profile of prepared Paracetamol tablets. Materials and methods: Paracetamol, Lactose, Microcrystalline cellulose, Starch and Magnesium stearate were purchased from Central Drug House (P) Ltd., New Delhi. All the chemicals were supplied as “required no purification before use”. Results revealed that the three batches (F1-F3) of Paracetamol granules and tablets prepared with different concentrations of binder 2, 4, 6% respectively using wet granulation technique showed varying dissolution profile. Bulk density of all the batches was in range from 0.45±0.02-0.73±0.03 gm/ml and tapped density in range from 0.73±0.01-0.86±0.02 gm/ml respectively. Flow property of all the batches was found to be good. % Friability of the prepared batches was in range from 33-76%. F2 batch was the least friable amongst all the other batches. % drug release of all the batches after 60 mins. was in range from 42.61-91.18%.

Key words: Pharmaceutical Excipients • Binders • Granules • Wet Granulation • In-Vitro Dissolution

INTRODUCTION

Pharmaceutical excipients are the agents other than the pharmacologically active drug or the API included in the manufacturing process [1, 2]. Binders are the excipients used to impart cohesive properties to the granules which help to ensure the intactness of the tablet after compression [3-5]. These ensure that the granules and tablets are formed with the required mechanical strength [2]. Acacia, Gelatin, Povidone, Starch, Sugars, Cellulose derivatives like microcrystalline cellulose (MCC), hydroxypropyl cellulose (HPMC) etc. are the commonly used binders in the pharmaceutical preparations [2, 3]. These provide plasticity to the tablet formulation and also increase the interparticulate bonding strength in the tablet formulations [5]. Natural polymers like gums and mucilages such as Tragacanth, gum karaya, acacia, Tamarind seed polysaccharide etc. are also used as binding agents and provide advantages over the synthetic excipients because of their inertness, bio-compatibility, low cost and easy availability [6, 7].

MATERIALS AND METHODS

Paracetamol, Lactose, Microcrystalline cellulose, Starch and Magnesium stearate were purchased from Central Drug House (P) Ltd., New Delhi. All the chemicals were supplied as “required no purification before use”.

Preparation of Granules and Tablets: Paracetamol tablets were prepared by wet granulation method as per the formulation chart in Table 1. All the ingredients were accurately weighed. Paracetamol, Lactose and Microcrystalline cellulose (MCC) were mixed properly in a mortar pestle. Different concentrations of Starch paste (2, 4, 6%) was separately prepared and these solutions were used in the granulation process to form granules to prepare F1-F3 batches respectively. Further Magnesium stearate was added to the granules. These granules batches were then compressed to form tablets [3, 8-10].

Preparation of Calibration Curve of Paracetamol: 100 mg of Paracetamol powder was accurately weighed and transferred to 100 ml volumetric flask. 10 ml of Phosphate buffer (pH 7.4) was added to it and shaken for...
few minutes. Further the volume was made up to 100 ml using phosphate buffer to prepare Stock solution. This stock solution was then filtered and different concentrations were prepared from it. The absorbances of prepared solutions were measured at 247 nm using UV spectrophotometer [11, 12].

**The Granules and Tablets Prepared Were Evaluated for the Following Parameters:**

**Bulk Density:** Bulk density is the density of the bulk mass. For determination of bulk density accurately weighed quantity of 5 g was introduced into a graduated measuring cylinder and the cylinder was fixed on the bulk density apparatus. The volume occupied by the granules was noted down [13-17]. Bulk density was calculated using equation 1 given below:

$$\text{Bulk density} = \frac{\text{weight of powder blend}}{\text{bulk volume}}$$  \hspace{1cm} (1)

**Tapped Density:** Tapped density is the density of the tapped mass after tapping 50 times from a fixed height. It was calculated by tapping powder in a bulk density apparatus until constant volume was obtained. The final volume was noted [13-17]. Tapped density was calculated using equation 2 given below:

$$\text{Tapped density} = \frac{\text{weight of granules}}{\text{tapped volume}}$$  \hspace{1cm} (2)

**Powder Flow Property:** Flow property of granules was calculated by measuring angle of repose. Using the formula, angle of repose was calculated thrice [13-17]. Angle of repose was calculated using equation 3 given below:

$$\tan(\theta) = \frac{h}{r}$$  \hspace{1cm} (3)

**Friability:** Friability of the prepared tablets was evaluated using Roche friabilator. 10 tablets were subjected to abrasion at 25 rpm for four minutes. The weight of the tablets before and after friabilation was observed. The percentage weight loss was calculated from which percentage friability was determined [9, 17-19].

**Dissolution:** Dissolution of Paracetamol tablets was carried out in Phosphate buffer (pH 7.4, 37±0.5°C) with a bath volume 900 ml. At appropriate time intervals, 5 ml sample was withdrawn, filtered and was replenished with the same volume of fresh medium. The filtered samples were suitably diluted and analyzed using UV Spectrophotometer at 247 nm [11, 12].

**RESULTS AND DISCUSSION**

Paracetamol granules and tablets were prepared by Wet granulation method and were further characterized. Calibration curve of Paracetamol was prepared in phosphate buffer (pH 7.4) as shown in figure 1. The R² value was found to be 0.998.

Results obtained after physical characterization of granules and tablets batches are described here. The Bulk density of F1-F3 batches prepared by varying the concentration of binder solution was found to be 0.45±0.02, 0.73±0.03, 0.46±0.02 g/ml respectively.
Table 2: Physical characterization of prepared granules and tablets

<table>
<thead>
<tr>
<th>Batches</th>
<th>Binder Concentration (%)</th>
<th>Bulk density (g/ml)</th>
<th>Tapped density (g/ml)</th>
<th>Angle of repose (°)</th>
<th>Friability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>2</td>
<td>0.45±0.02</td>
<td>0.73±0.01</td>
<td>28.35±0.32</td>
<td>61</td>
</tr>
<tr>
<td>F2</td>
<td>4</td>
<td>0.73±0.03</td>
<td>0.86±0.02</td>
<td>24.29±0.40</td>
<td>33</td>
</tr>
<tr>
<td>F3</td>
<td>6</td>
<td>0.46±0.02</td>
<td>0.73±0.03</td>
<td>17.78±0.22</td>
<td>76</td>
</tr>
</tbody>
</table>

Fig 2: % Drug release of Paracetamol tablets prepared from different granulating agents

Table 3: % Drug release of Paracetamol tablets prepared from varying concentration of Binders

<table>
<thead>
<tr>
<th>Time (mins)</th>
<th>% Drug Release</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F1</td>
</tr>
<tr>
<td>0</td>
<td>6.11</td>
</tr>
<tr>
<td>30</td>
<td>18.29</td>
</tr>
<tr>
<td>45</td>
<td>37.06</td>
</tr>
<tr>
<td>60</td>
<td>91.18</td>
</tr>
</tbody>
</table>

Tapped density of F1-F3 batches was 0.73±0.01, 0.86±0.02, 0.73±0.03 gm/ml respectively. Flow property of all the batches was found to be good. Batch F3 was found to have excellent flow property with angle of repose of 17.78±0.22. % Friability of the prepared batches was in range from 33-76%. Table 2 summarizes the Physical characterization of batches of granules and tablets prepared.

The results of dissolution study suggest that % drug release of all the batches after 60 mins. was in range from 42.61-91.18%. % drug release of F1 batch (91.18%) after 60 mins. was found to be maximum while that with batch F3 (42.61%) was minimum among all the 3 batches. Figure 2 and Table 3 summarize the % drug release from all the batches of Paracetamol tablets.

CONCLUSION

It is concluded from the research work that varying the concentration of binder used for wet granulation of Paracetamol tablets shows difference in the release characteristics. Also the variation in concentration of binder showed a remarkable effect in the physical characterization of granules. Bulk density of all the batches was in range from 0.45±0.02-0.73±0.03 g/ml and tapped density in range from 0.73±0.01-0.86±0.02 g/ml respectively. Flow property of all the batches was found to be good. Batch F3 with angle of repose of 17.78±0.22 was found to have excellent flow property. % Friability of the prepared batches was in range from 33-76%. F2 batch was the least friable amongst all the other batches. % drug release of all the batches after 60 mins. was in range from 42.61-91.18%. % drug release of F1 batch (91.18%) after 60 mins. was found to be maximum while that with batch F3 (42.61%) was minimum among all the 3 batches.

Conflict of Interest: Authors have no conflict of interest.

ACKNOWLEDGEMENT

Authors would like to thanks Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Greater Noida for providing laboratory facilities.

REFERENCES