Stability study of orally disintegrating tablets (ODT)

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Purpose

Orally disintegrating tablets formulated for direct compression are an attractive way to combine benefits such as easier swallowing, fast efficacy and efficient production. Several suitable ready-to-use excipients with different fillers and disintegrants are available, all with intended tablet disintegration times of <30 s. When selecting the optimal excipient, it is crucial to consider its performance not just at time zero but also over its shelf life. This study aims to characterize available ODT excipients with respect to their compressibility and potential for quick disintegration. A tablet hardness of 100 N is the goal, as this ensures easy handling and means conventional packaging can be used. The stability of these ODT formulations will be evaluated, with characteristic parameters such as tablet hardness, disintegration time, and discoloration being studied over a 1-year period under accelerated storage conditions.

Methods

Placebo formulations containing the ODT excipient mixed with 1% magnesium stearate (Parteck® LUB MST excipient, MilliporeSigma, USA) were processed using a single punch press (EK0, Korsch, Germany). Tablets weighing 300 mg with a diameter of 11 mm and a hardness of ~100 N were produced at compression forces between 13–30 kN. The ODT excipients used are listed in Table 1. The tablets were stored in closed containers under accelerated conditions (40 °C, 75% r. H.) for 26 weeks and analyzed after 1 day, 1 week, 2, 4, 8, 12 and 26 weeks. Tablet hardness was analyzed using an Erweka Multicheck® 5.1 (Erweka, Germany, n = 20). The disintegration time of six tablets for each ODT product was measured using a disi4 (Biomation, Germany). Possible discoloration of the tablets (n = 5) was recorded with a Konica Minolta CM 700-d spectrophotometer (Konica Minolta, Germany).

Product	Composition
Parteck® ODT excipient	Mannitol, croscarmellose sodium
Product A	MCC, SiO2, mannitol, fructose, crospovidone
Product B	Mannitol, PVP
Product C	Lactose, maize starch
Product D	Mannitol, xylitol, MCC, crospovidone
Product E	Mannitol, starch

Table 1: ODT excipients used

Setup:

Mixing
ODT excipient + 1% lubricant

→ **Direct compression**
Hardness >100 N (compression force adjusted)

Storage of tablets
40 °C/75% r.H. over 26 weeks, closed containers

→ **Evaluation of**
- Disintegration time
- Discoloration

Results

Compressibility

The desired tablet hardness of >100 N was achieved for all the directly compressible excipients tested (Fig. 1). However, compression forces between 13–30 kN were required. Parteck® ODT excipient reaches its highest tablet hardness (172 N) at the lowest compression force (13 kN). These tablets also have the shortest disintegration time, just 21 s. Three of the other ODT excipients have disintegration times between 39–46 s, while two only disintegrate within 120 and 250 s respectively.

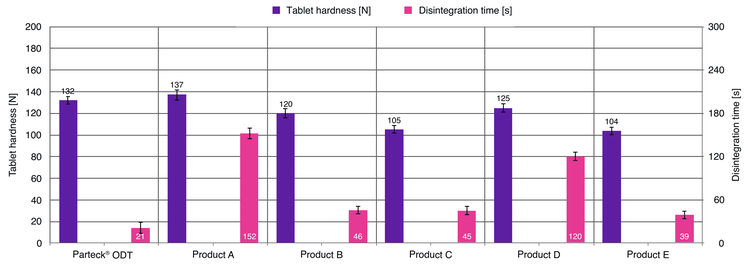

Figure 1: Tablet hardness and disintegration time (second x-axis) of OD tablets (n = 20). Different compression forces were applied with the aim of achieving a tablet hardness of >100 N

Stability

The results of the stability study are different for the different ODT excipients. Fig. 2 demonstrates that there is a strong increase in disintegration time (DT) during storage for two products (Product A and B). Product D does not show a significant increase, but the DT is generally slightly higher. Parteck® ODT excipient and Product C and D show good stability over 26 weeks under accelerated conditions.

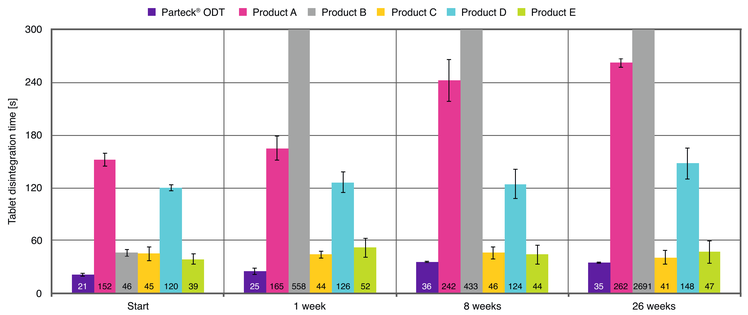

Figure 2: Disintegration time of tablets stored at 40 °C/75% r.H. over 26 weeks (n = 6)

Product A clearly shows discoloration during storage under accelerated conditions. The delta value (Fig. 3) is significantly increased after just 1 week of storage. After 26 weeks, a strong discoloration occurs, which is visible to the naked eye and also demonstrated by the delta value (Fig. 4, upper tablet). The other products show acceptable stability and no visual changes are found.

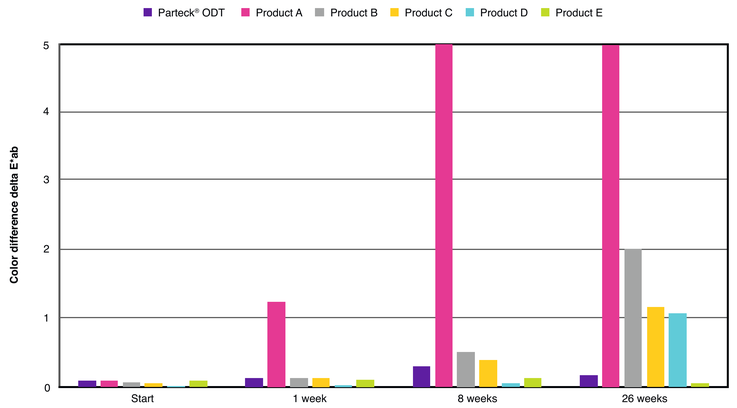

Figure 3: Colour measurement of tablets stored at 40 °C/75% r.H. over 26 weeks (n = 5)

Figure 4: Colour of "Product A" tablets (upper tablet) vs. Parteck® ODT tablet after 26 weeks storage at 40 °C/75% r.H.

Conclusion

A variety of ODT excipients differing in compressibility, hardness and storage stability are available for direct compression. The study clearly shows the importance of evaluating performance not only at time zero but after a certain period of storage.

Parteck® ODT excipient combines excellent compressibility with a short disintegration time and stable performance under accelerated storage conditions.

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