PTR-095

Utility of Polyplasdone™ crospovidone as a Tablet Binder

Quyen Schwing, Marvin Davis, Divya Tewari, Thomas Dürig
Ashland Specialty Ingredients, Wilmington, Delaware 19808, USA

Introduction

Superdisintegrants can play a major role in tablet formulations. Their main function is to greatly increase the drug dissolution rate of solid dosage forms. The goal of this study was to evaluate the binding capacity of several superdisintegrants, when used as a binder for roller compaction in immediate-release (IR) and orally disintegrating tablet (ODT) formulations, using ranitidine HCl as a model drug. Superdisintegrants evaluated in this study were as follows:

- Polyplasdone crospovidone
- Competitive crospovidone
- Croscarmellose sodium
- Sodium starch glycolate

Methods

Pure Polymer Characterization and Compaction Comparison of Superdisintegrants. For each superdisintegrant, the Carr loose and packed bulk densities were measured using the Hosokawa powder flow tester. The compressibility was determined by the following formula:

Compressibility (%) = [100 (Packed Density – Loose Density)] / Packed Density

Flowability of each superdisintegrant was determined by using the Carr Cohesion measurement method. Because the physical and chemical properties of the Ultra and XL grades of Polyplasdone™ are the same (the only difference being in the level of impurities) these grades are used interchangeably in this study. The competitive CL and CL-F grades of crospovidone vary only in particle size and are also used interchangeably.

Preparation of 280 mg Pure Superdisintegrant Tablets. Each superdisintegrant was blended with stearic acid (Table 1) and compressed at four different compression forces (5, 10, 15, and 20 kN) using 3/8" flat faced, beveled edge tooling on a Manesty Betapress. However, both croscarmellose sodium and sodium starch glycolate needed higher compression forces to maintain tablet hardness.

Table 1. Pure superdisintegrant tablet formulation

Material	% w/w	Weight (mg)
Superdisintegrant	99	277.2
Stearic acid	1	2.8
Total	100	280

Preparation of 560 mg IR Ranitidine HCl Tablets. The first three ingredients in Table 2 were passed through an 18 mesh screen and blended for 10 minutes.

Table 2. IR Ranitidine HCl tablet formulation

Ingredients	Tablet formulation (%w/w)	Tablet weight (mg)
	Intragranular	
Ranitidine HCl	30	168
Lactose	49	274.4
Superdisintegrant	20	112
	Extragranular	
Magesium stearate	1	5.6
Total	100	560

The blend was compacted into ribbons by a roller compactor with the following parameters:

- Roller speed: 6.0 RPM
- Roll gap: 0.8 mm
- Roll force: 2.2 kN/cm

The ribbons were milled in the FitzMill with a 0.065" screen, knives forward and medium speed. The milled ranitidine granulation was passed through an 18 mesh screen. Magnesium stearate was passed through a 35 mesh screen, added to the screened granulation, and blended for 3 minutes. The final blend was compressed on a Manesty Betapress using 7/16" FFBE tooling, to a tablet weight of 560 mg. Tablet hardness, thickness, friability, and disintegration time were tested.

Dissolution of IR Ranitidine HCl Tablets. Dissolution (n = 6) was conducted in 900 ml deionized (DI) water at 37°C using the USP apparatus II at 50 rpm paddle speed (Distek Dissolution System, Model 5100). The amount of ranitidine dissolved was monitored using a UV spectrophotometer (Agilent 8453) at 220 nm. Samples were taken at 7.5, 15, 30, and 45 minutes.

Results and Discussion

Pure Polymer Characterization and Compaction Comparison of Superdisintegrants. Figure 1 shows that sodium starch glycolate has the highest flowability index but lowest compressibility, due to its spherical morphology. Both croscarmellose sodium and L-HPC have good compressibility but lower flowability due to their fibrous structures. Polyplasdone™ XL crospovidone shows good compressibility and flowability values. Also, in the pure polymer compaction study, Polyplasdone XL crospovidone produced tablets with the highest breaking force (Figure 2). On the basis of this information we concluded that Polyplasdone crospovidone can be used as a binder for ranitidine HCl tablets.

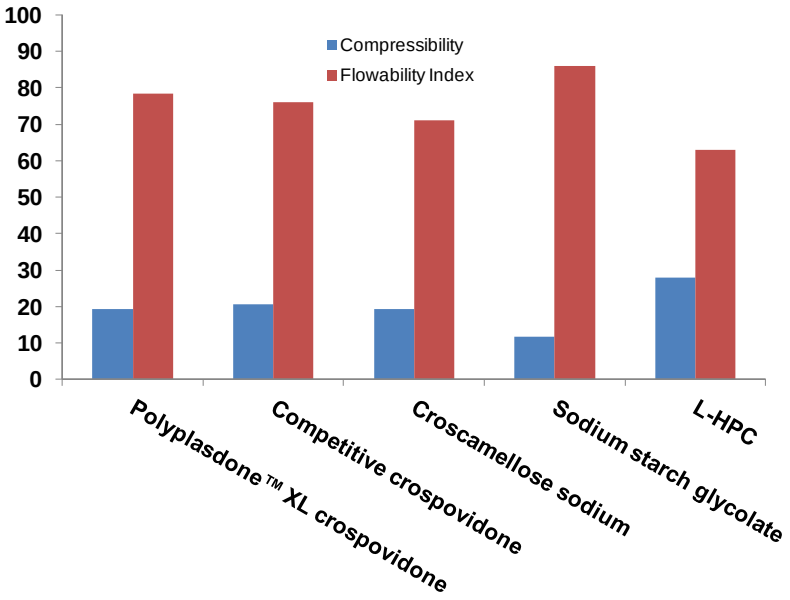

Figure 1. Compressibility and flowability of superdisintegrants

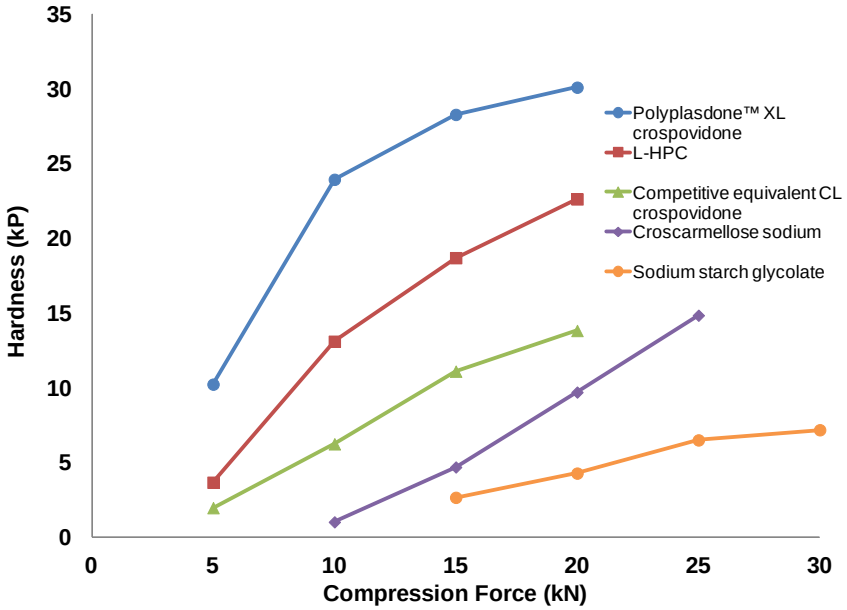

Figure 2. Pure polymer compaction comparison of superdisintegrants

IR Ranitidine HCl Tablets. Microcrystalline cellulose (MCC) is often used as a primary binder for roller compaction. Figure 3 shows the tablets made with MCC or L-HPC yielded harder tablets than tablets made with other polymers. However, the tablets made with Polyplasdone™ Ultra crospovidone had the shortest disintegration times, and somewhat faster drug release than tablets made with other polymers (Figure 4 and 5).

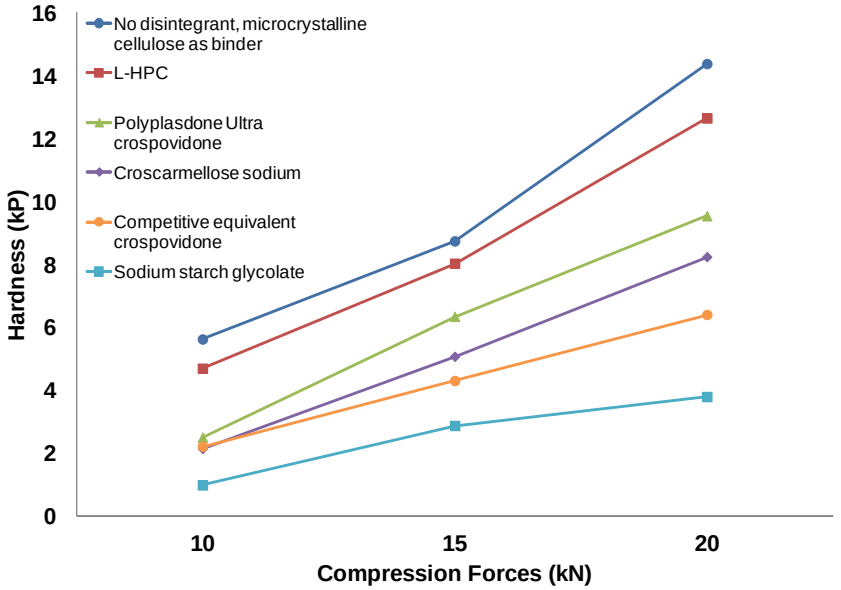

Figure 3. Effect of compression force on hardness of IR ranitidine HCl tablets

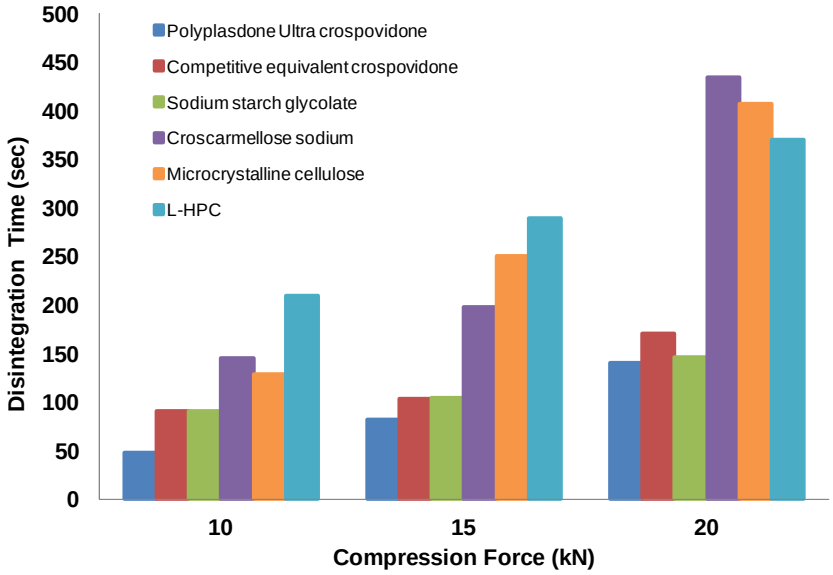

Figure 4. Disintegration time of IR ranitidine HCl tablets

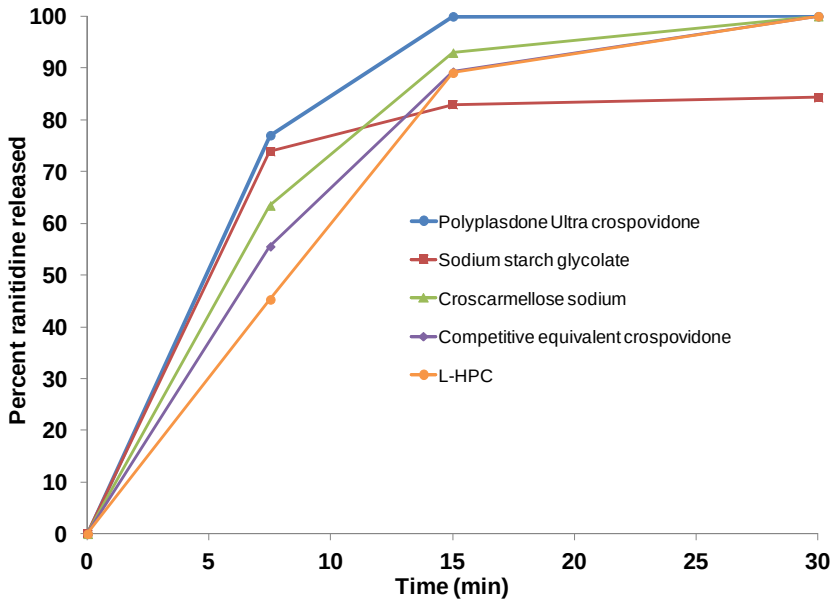

Figure 5. Dissolution of IR ranitidine HCl tablets in DI water

Conclusions

The good flowability, compressibility and high breaking force of the pure Polyplasdone™ XL or Ultra crospovidones tablets demonstrate the binding ability of Polyplasdone XL or Ultra crospovidone. Also, the hardness, disintegration and dissolution results of IR ranitidine HCl tablets show that Polyplasdone crospovidones are not only good binders for dry granulation, but also excellent superdisintegrants for any solid dosage form.