Use of partially pregelatinized corn starch as filler for two pieces hard gelatin capsules

Häusler O.[1], Lefèvre Ph.[1]

[1] **Roquette Frères**, 62080 Lestrem, France

INTRODUCTION

Partially pregelatinized corn starches are free-flowing and self-disintegrating powders. Their physico-chemical properties are well adapted to the use as filler-disintegrant in two-piece hard gelatin capsules [1]. A new product, LYCATAB® C has been recently developed for this application [2]. The following study has been done to compare the performance of LYCATAB® C with the similar excipient Starch 1500® in its recommended application as filler for two-piece hard gelatin capsules. Placebo formulations with the pure excipient were selected for these trials.

MATERIALS & METHODS

POWDER PROPERTIES: Powder characterisation was performed through:

- SEM (Jeoul JSM 5410 LV),
- Laser Particle Size Analyser (Coulter®), Volume distribution,
- EP methods for density and flow,
- Hosokawa® tester for the Carr index.

MACHINABILITY TEST: Size 1 opaque white capsules were filled on a BOSCH GKF 120 Capsule filling machine using a size 2 dosing plate (15 mm plug length). The powder was either used without or with 0.2% Mg Stearate for lubrication. The lubrication was done on 2 kg batches in a Turbula mixer, mixing time 2 min. Statistic on the mean fill weight was done with 20 capsules after 0 and 15 min working time. Disintegration time: Using the EP apparatus without discs, in water at 37° C.

RESULTS & DISCUSSION

Powder Properties

LYCATAB® C and Starch 1500® have similar powder properties, well adapted to the application as capsule filler.

	LYCATAB® C	Starch 1500®
Bulk density	0.64 g/cm³	0.61 g/cm³
Tapped density	0.81 g/cm³	0.80 g/cm³
Carr Index	21.0	23.8
Mean particle size	100 µm	90 µm
Flow time	4 s	infinite
Angle of repose	35°	41°

LYCATAB® C has very low dust content (see **fig. 1**) compared to Starch 1500®. It could be explained as a result of a specific powder structure resulting from a unique production process. The SEM picture shows very compact powder particles. The starch granules are completely embedded in a matrix of precooked starch (see **fig. 2**). It is therefore not likely that single starch particles fall out of the matrix system. Starch 1500® showed a completely different picture in SEM studies. Its more friable structure causes the observed larger particle size distribution (see **fig. 1**), explaining the observed lesser flow properties of Starch 1500®.

Figure 1. Particle size distribution of LYCATAB® C and Starch 1500®.

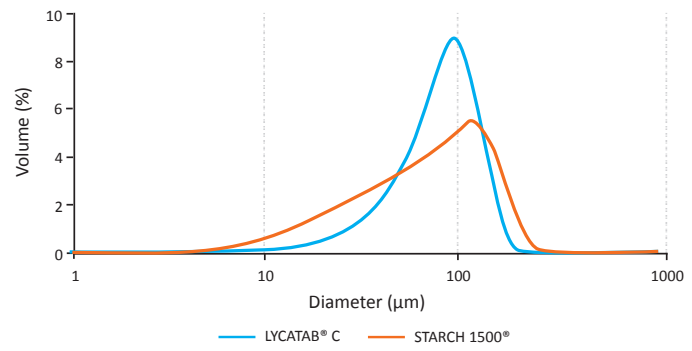
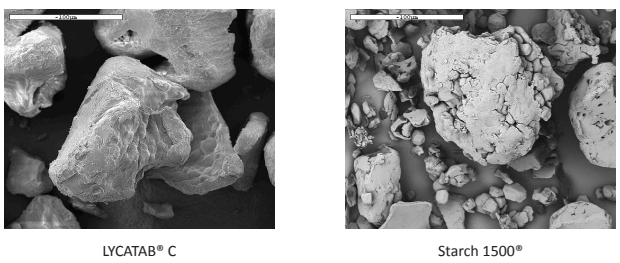


Figure 2. SEM Pictures of LYCATAB® C and Starch 1500® Magnification 350 x each.



LYCATAB® C

Starch 1500®

Machinability test

The machinability test proves that both products could be used for capsule filling without any problems. It is even possible to run without added lubricant ("self lubricating"). The constancy of the mean fill weight as well as the low standard deviation of the fill weight underline the high performance of both products.

Test without Mg-Stearate

	LYCATAB® C	Starch 1500®
0 min	319.6 mg ± 0.60%	325.5 mg ± 0.37%
15 min	319.5 mg ± 0.68%	323.3 mg ± 0.67%

Test with 0.2% Mg-Stearate

	LYCATAB® C	Starch 1500®
0 min	337.5 mg ± 0.34%	344.7 mg ± 0.33%
15 min	340.8 mg ± 0.20%	346.6 mg ± 0.30%

The higher fill weight in presence of Mg stearate indicates that the lubricant assists the flow and the final arrangement of the powder particles during the capsules filling process. The generally lower deviations of the fill weight in presence of Mg stearate underlines the need to work with a certain lubrication level for optimal results.

Capsules Disintegration

The disintegration times of the filled placebo capsules have been measured with:

LYCATAB® C	5 min 00 s
LYCATAB® C + 0.2% Mg st.	3 min 40 s
Starch 1500®	10 min 30 s
Starch 1500® + 0.2% Mg st.	10 min 30 s

Surprisingly the disintegration time of LYCATAB® C filled capsules is significantly shorter in presence of 0.2% Mg stearate. However this could be explained by the observation that the lubricant helps improve the fill of the capsules so that less air remains. The starch particles can act under these conditions more effectively as disintegrants. This mechanism would also explain the longer disintegration time of capsules filled with Starch 1500®. The starch particles in Starch 1500®'s more open structure cannot transmit its swelling power in optimal manner.

CONCLUSION

This study demonstrates that both partially pregelatinized corn starches LYCATAB® C and Starch 1500® are useful filler-disintegrants for hard gelatin capsules. Several differences, both in the powder physical properties and in the disintegration time of capsules were observed. They could be explained as result of dissimilar particle structures caused by two different production technologies. The more compact structure of LYCATAB® C seems to be important for getting optimal results in capsules production.

REFERENCE

1. Newton, J.M., Filling f hard gelatin capsules S.T.P. Pharma 3 (11) 880-885, 1987.
2. Technical Documentation Roquette Frères 9/2001.