

Lubricant comparison study on tablet press.

Lubricants are important excipients during tableting, as they reduce the friction between the die walls and the punches. This prevents early machine erosion and excessive heat generation during tableting. Magnesium stearate is the most widely used lubricant due to its excellent lubricating effect. However, there are applications where magnesium stearate cannot be used. For example, some tableting blends tend to e.g. over-lubricate, resulting in tablet hardness outside specification limits. Too high concentrations can also negatively affect tablet disintegration time and dissolution of API. A comparative study was therefore carried out with alternative lubricants, to find a substitute for magnesium stearate that does not have any of its disadvantages.

Common issues with magnesium stearate

- ❑ Prolonged disintegration time and dissolution of active pharmaceutical ingredients, especially with high concentrations
- ❑ Reduced tablet hardness due to inhibition of the formation of interparticle bonds
- ❑ Possible overmixing effects if mixing is too long and intensive
- ❑ Batch variability regarding particle size distribution and crystallinity

Study 1: Test description	Evaluating the influence of mixing time & concentration
Tablet press	Single Punch FlexiTab XL
Tablet shape	Round 9.5 mm
Depth of fill	8.0 mm
Compaction pressure	150 MPa
Dwell time	1000 ms
Mixing time	0.5 min 5 min @25 rpm
Concentration	0.5 % w/w 2.0% w/w
Formulation	45% MCC 45% Calciumphosphat 10% Maize starch

Overview of tested lubricants	
Lubricant	Substance
CompactCel F 905.01	Lecithin, acacia gum
CompactCel F 290.02 clear	Rice extract, MCC, refined sunflower oil
CompactCel F 305.19	Rice extract, acacia gum, refined sunflower oil
Compritrol HD 5 ATO	Beheonyl polyoxyl-8 glycerides
Compritrol 888 ATO	Glycerides, C16-22 mono-di-tri
Precirol ATO 5	Glycerides, C16-18, mono, di
Pruv	Sodium stearyl fumarate
Lubritab	Hydrogenated cotton seed oil
Kolliphor p 407	Oxirane, 2-methyl-, polymer with oxirane
Kolliwax S	Stearic acid
Kolliwax HCO	Hydrogenated castor oil
NutriMag ST-v	Magnesium stearate Reference

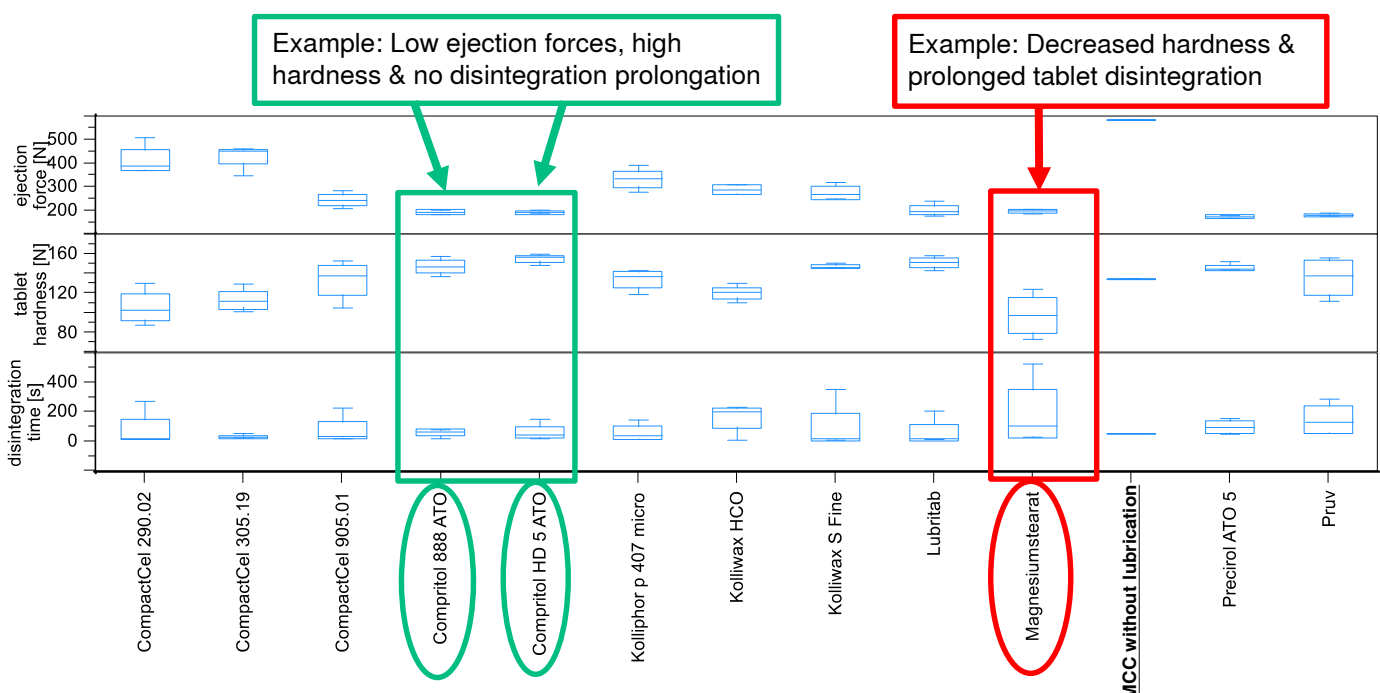


Fig. 1: Box plots for comparison of the effects of different lubricants on ejection forces, tablet hardness and disintegration time

Study 2: Test description	Evaluating the influence of the turret speed
Tablet press	Rotary press TPR200
Tablet shape	Round 8.0 mm
Depth of fill	9.5 mm
Fill cam	10 mm
Compaction pressure	200 MPa
Feeder speed	15 rpm
Turret speed	50 & 75 rpm
Lubricant concentration	1% w/w
Formulation	45% MCC 45% Calcium phosphate 10% Maize starch

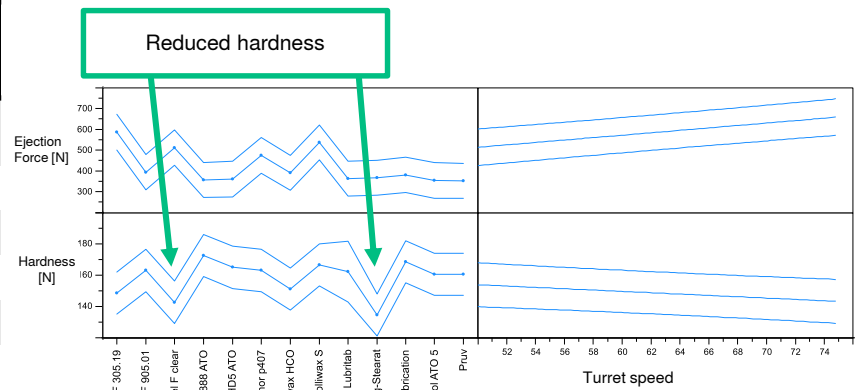


Fig. 2: Predicted response graph of ejection forces and tablet hardness with different lubricants and turret speeds

Results

- Ejection forces resulting > 500 Newton without the use of any lubricant
- Pronounced reduction of the ejection forces with all investigated lubricants
- In comparison to magnesium stearate Compritol® shows consistently high tablet hardness & no prolonged tablet disintegration
- Mixing time & concentration are critical process parameters for most of the investigated lubricants
- Mixing process parameters need to be selected by properties of the lubricants



Fig. 3: Rhönräder mixer (5.3 l)

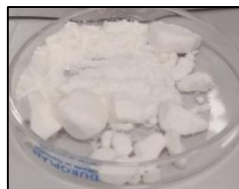


Fig. 4: Lubritab

Summary of evaluated effects of different lubricants

Substance	Disintegration time	Hardness
Magnesium stearate	↑↑	↓↓
CompactCel F 905.01	↑	↓
CompactCel F clear 290.02	No effect	↓
CompactCel F 305.19	No effect	↓
Compritol HD 5 ATO	↑	No effect
Compritol 888 ATO	↑	No effect
Precirol ATO 5	↑↑	No effect
Pruv (JRS)	↑	No effect
Lubritab	↑	No effect
Kolliphor p 407 (BASF)	↑	No effect
Kolliwax S fine	↑	No effect
Kolliwax HCO	No effect	↓

Conclusion

- Magnesium stearate can be replaced by all of the investigated substances
- Selection of the lubricant depends on the formulation and tablet properties (solubility, retardation, porosity)
- Mixing process parameters must be adapted to the properties of the lubricants (water content, particle size distribution, consistency) in order to achieve a sufficiently homogenous mixture with a short mixing time (to avoid overmixing)

Your need is our passion!

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Please contact us. Our "Engineering Pharmaceutical Service" team will be available with all our experience of over 50 years:

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