

# IMPACT OF DIFFERENT ROLL SIZES ON ROLLER COMPACTOR GRANULATIONS

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## PURPOSE

To determine if constant linear roll face speed and compaction force/unit length (across roll width) would yield similar granulations from two different sized roller compactor rolls.

## METHODS

Formulation used in this study is listed in Table 1. The lactose and microcrystalline cellulose (MCC) was blended in a V-blender for 3 minutes; the magnesium stearate was added to the mixer and blended for an additional 3 minutes.

Resulting blend was then compacted on two different roller compactors (TF-156 and TFC-220). Rolls used are shown in Equipment section. Compaction force was tested at two levels: 7.0 and 14.0 kilonewton/cm. Compacts were generated with four different roll speeds (188.5; 377.0; 565.5; and 754.0 cm/min) and a constant screw to roll rpm ratio of 3:1.

Ribbon thickness was measured. Compacted ribbons were milled through a 14 mesh screen in a rotary granulator. After milling, the granulations were sieved to determine arithmetic mean diameter ( $D_{50}$ ) and measured for bulk density.

## EQUIPMENT

### Roll Comparison

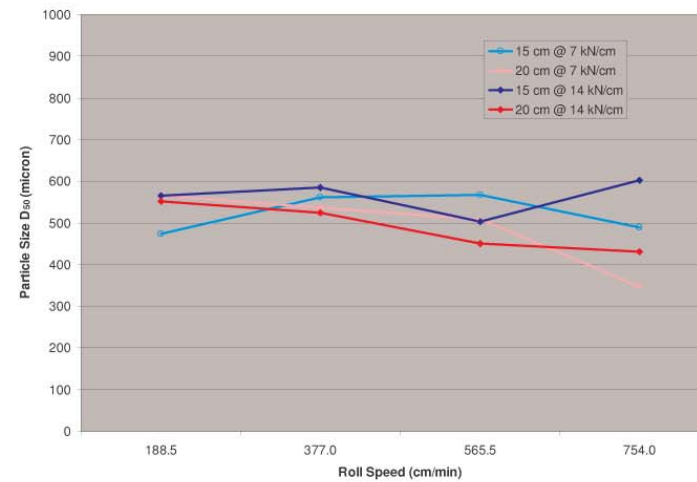


### Screw Comparison

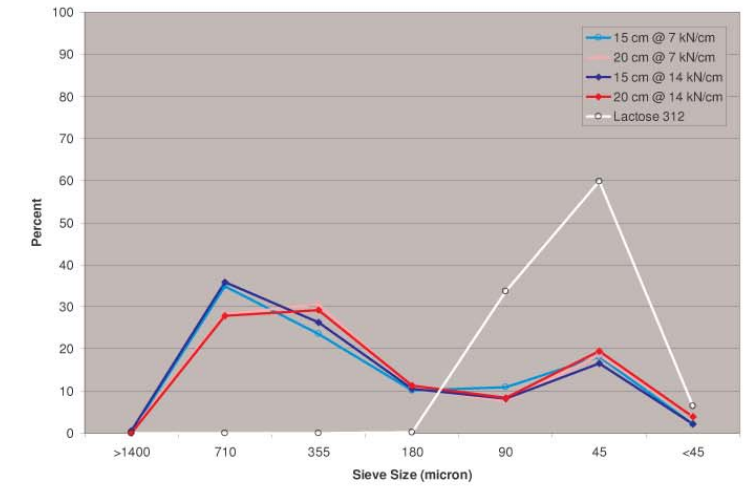


## RESULTS

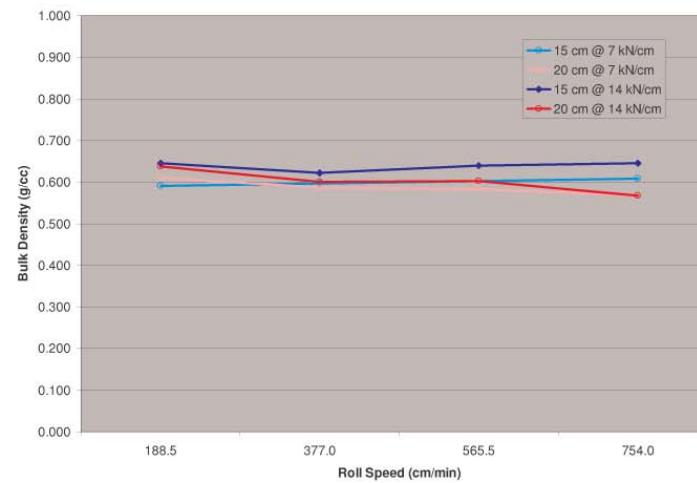
### Mean Particle Size at Various Roll Speeds



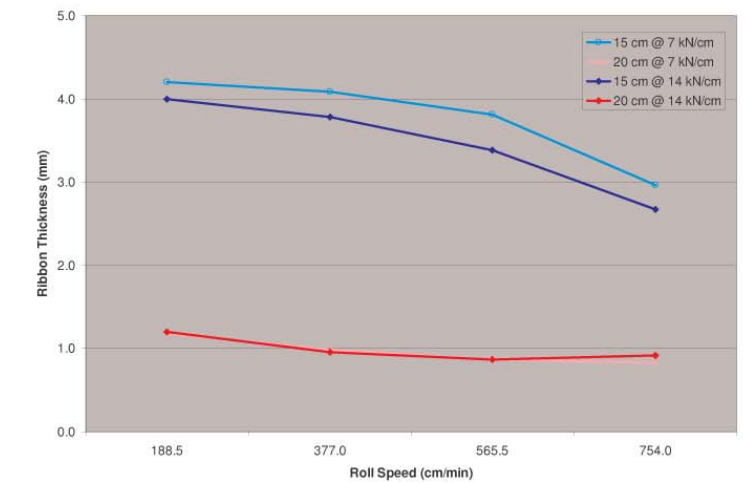
### Particle Size Distribution at 377 cm/min



### Bulk Density at Various Roll Speeds



### Ribbon Thickness at Various Roll Speeds



## CONCLUSIONS

For low to mid-range roll speeds, constant linear roll face speed and constant compaction force/unit length appears to yield similar granulations in terms of mean particle size ( $D_{50}$ ) and bulk density. Increasing the speed of the rolls (reducing the dwell time) in this range appears to cause a downward shift in the ribbon thickness,  $D_{50}$ , and bulk density. The reduction in  $D_{50}$  and bulk density is probably a result of less time being allowed for bonds to form between particles. Thickness of the ribbon does not seem to impact the characteristics of the granulation for a constant roll speed and compaction force/unit length.

The difference in roll and screw design between the two machines do appear to cause a shift in granulation characteristics at high roll speeds. This is thought to be a result of a change in slippage of the powder at the roll face and a corresponding change in the pre-compression applied by the screw.

Table 1 – Formulation Characteristics

Ingredients/Characteristic	Value
MCC, PH-101	20.0%
Lactose, 312	79.3%
Magnesium Stearate	0.3%
Mean Particle Size, $D_{50}$ ( $\mu$ m)	92.0
Bulk Density (g/cc)	0.470

Table 2 – Compaction Process Parameters

Process Parameters	TFC-220	TF-156
<b>Unit Roll Force</b>		
7.0 kN/cm	3000 pounds	3.5 tons
14.0 kN/cm	6000 pounds	6.9 tons
<b>Roll Speeds</b>		
188.5 cm/min	3 rpm	4 rpm
377.0 cm/min	6 rpm	8 rpm
565.5 cm/min	9 rpm	12 rpm
754.0 cm/min	12 rpm	16 rpm
<b>Screw to Roll RPM Ratio</b>	3:1	3:1