# How to Maximize Three Roll Mill Throughput

Production companies are always looking for high throughput continuous batch machines. A three roll mill satisfies these requirements and is part of the mixing/grinding stage of the process. There are other mixing machines that can achieve higher throughput, but three roll mills can mix a variety of viscosity and mill to small particle sizes. This allows users to achieve uniform and small particle sizes when mixing their products. Three roll mill work by using shear force based on the roller speed and diameter. The product will run through two passes as it goes through the back roller and middle roller, then the middle and front roller. This means that the throughput is governed by the surface area of the rollers, gap setting, and roller speed. By finding a way to maximize the throughput, we can help optimize the process and find out which three roll mill will fight your process.

We recently helped a customer improve throughput working with our T50 ointment mill. What we thought would be a simple task of adjusting the speed or the gap sizes turned out to be a full-scale lab experiment. The ointment pre-mix was so thick that it required an unusual combination of front and back gap settings to make it work. Even so, the hourly output was still significantly lower than other types of creams due to the material property. Here, we want to introduce the scientific method our engineer utilized to maximize throughput, so that customers can make the most out of this award winning lab model ointment mill.

Our engineer first observed the behavior of cream on the roller. The initial setting was 50 microns for both gaps. The cream was slow running into the feeding area and was stuck on the middle roller which meant bad transfer to the fast roller and the hence collection blade. The conclusion was that the gap between the slow and middle roller should be wider, while the gap between the middle and fast roller should be narrower. After a few rough adjustments, our engineer decided to fine-tune the gap settings with a series of experiments.

| Experiment No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Front Gap (mm) | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 |
| Back Gap (mm) | 0.15 | 0.15 | 0.15 | 0.15 | 0.1 | 0.2 | 0.2 | 0.25 |
| Speed (%) | 50 | 75 | 100 | 100 | 100 | 100 | 100 | 100 |
| Weight (g) | 63 | 106 | 78 | 58 | 88 | 72 | 798 | 82 |
| Time (sec) | 54 | 75 | 42 | 36 | 59 | 32 | 395 | 32 |
| Ratio (g/sec) | 1.17 | 1.41 | 1.86 | 1.61 | 1.49 | 2.25 | 2.02 | 2.56 |
| Time for 10 Kg (mins) | 142.86 | 117.92 | 89.74 | 103.45 | 111.74 | 74.07 | 82.50 | 65.04 |