

## Sample Preparation & Processing

### Cutting Power for Larger Sample Volumes and Increased Throughput

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Cutting mills are used for sample preparation to subsequent analysis in many different areas and are particularly suitable for homogenising heterogeneous samples. Tough, fibrous and elastic materials – which cannot be pulverised satisfactorily by impact, pressure or friction – are easily homogenised by cutting effects. Typical examples of heterogeneous mixtures are refuse derived fuels or biomass, plastic items which are analysed for hazardous substances, electronic waste which is examined in the context of RoHS and WEEE regulations, or precious metals which are recovered from waste products – the range of applications is huge.

#### Versatile and Effective

Due to the wide range of applications, cutting mills need to be highly flexible and powerful to fulfil all requirements. Until now Retsch had 3 models in its portfolio: the basic model SM 100, the universally suitable standard model SM 200 and the heavy-duty model SM 300. This range, however, did not cover one area of application – the size reduction of large sample pieces and volumes. The maximum feed size of samples was limited to 60 x 80 mm, large sample volumes had to be processed in batches. This prolonged the sample preparation process, even if the actual grinding was carried out rapidly.

Retsch's new SM 400 now covers this gap in the cutting mill range. It has a grinding chamber volume of 7.5 l and accepts sample pieces with a maximum size of 170 mm x 220 mm. Thus, large sample volumes are fed into and fully homogenised by the mill in a very short time. Manual pre-cutting is usually not required. Thanks to the wide hopper, considerable grinding chamber volume and the large 240 mm x 240 mm surface of the bottom sieves, the throughput is much higher than that of smaller models like the SM 300. On top of that, the SM 400 achieves grinding results down to 1 mm with a negligible dust fraction, depending on the sample material.

For grinding heat-sensitive or low-density samples, the use of the cyclone-suction combination is recommended. It substantially improves material discharge from the grinding chamber and the air jet provides a cooling effect. Furthermore, the cyclone is connected to a 30 l receptacle for grinding large sample volumes in one go. Alternatively, the continuous outlet receptacle can be used for grinding large sample quantities. The fold-back hopper and the easy detachable bottom sieves facilitate cleaning.



Figure 1: Cutting Mill SM 400 with cyclone-suction combination.

#### Application Examples

##### Bulky waste/Refuse-derived fuels

600 g bulky waste (mixture of foam material, foil, plastic, wood chips, wool, paper; no metal) with a maximum particle size of 150 mm was ground both in the SM 300 and SM 400, using a 6 mm bottom sieve and a cyclone. In both cases a D90 value of 6 mm was achieved; however, the complete sample amount was processed much faster in the new SM 400, as no manual pre-cutting was required.

##### Model SM 300

Division into 4 part-samples within 1 min -> manual pre-cutting to <80 mm within 2 min -> grinding for 4 min, total processing time: 7 min

##### Model SM 400

Complete sample amount was processed without pre-cutting in one go, total processing time: 1 min



Figure 2: Refuse-derived fuel sample before and after size reduction in the SM 400.

##### Maize kernels for small scale production of chicken feed



Figure 3: Maize kernels before and after size reduction in the SM 400.

The SM 400 is also suitable for use in small scale production, for example of chicken feed. In this application example 4 kg maize kernels with a maximum particle size of 10 mm was pulverised within 30 seconds, using a 12 mm bottom sieve. The fraction <2.5 mm was 35%, 100% of the sample was <6 mm. With this procedure, a fine fraction <1 mm can be largely avoided.

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### Cellulose pressed fibre mat

2 pieces of cellulose pressed fibre mat with a size of 150 mm were processed within 3 minutes with a 2 mm bottom sieve. Major part of the sample was within the desired fraction of 0.5 mm – 2 mm. Thanks to the low speed of the SM 400, the result was virtually dust-free.



Figure 4: Cellulose pressed fibre mat before and after grinding in the SM 400.

### More applications in the SM 400

Sample	Quantity	Feed size	Bottom sieve	Time	Final fineness
Thermoplast	400 g	140 x 40 mm	4 mm	10 sec	<5 mm
Plastic moulded parts	90 g	Up to 150 mm	12 mm	2 min	<20 mm
Ceramic for bone implants	1 kg	20 x 40 mm	4 mm	30 sec	<3 mm
Diallyl phthallate DAP	900 g	bis 100 mm	4 mm	40 sec	<1 mm

### Hemp plants

100 kg dried hemp with a feed size up to 60 mm was milled to a fineness <20 mm within 60 minutes, using a 20 mm bottom sieve. The SM 400 is the only mill to speedily process such an amount of a fibrous material without blockages of the hopper by wedged pieces.



Figure 5: Hemp plants before and after grinding in the SM 400.

### Conclusion

For the size reduction of large sample pieces and high throughput, the available cutting mills have often been the limiting factor, e.g. by making manual pre-cutting necessary. With the new SM 400 it is now possible to feed pieces up to 170 mm x 220 mm directly into the mill and grind large volumes in one step which not only results in improved grinding results but also saves valuable time.