### Task:

**Application field:** Environment  
**Material:** Toys, Barbie doll  
**Feed size:** 20 - 200 mm  
**Feed quantity:** 50 g (for the plastic body)  
**Material specification(s):** elastic, fibrous  
**Customer requirement(s):** < 200 µm, separate analysis of body, clothes and hair, determination of heavy metals like lead and cadmium  
**Subsequent analysis:** ICP Inductively Coupled Plasma

### Solution:

**Selected instrument(s):** Heavy-Duty Cutting Mill SM 2000  
Ultra Centrifugal Mill ZM 200

**Configuration(s):**  
SM 2000: Bottom sieve square holes 6 mm,  
ZM 200: Push-fit rotor, 12 teeth, stainless steel;  
MM 400: Grinding jar stainless steel 25 ml, screw top  
Ring sieve trapezoid holes 0.75 mm, stainless steel;  
6 grinding balls stainless steel ø 10 mm for the hair  
2 grinding balls tungsten carbide ø 12 mm for the clothes

**Parameter(s):**  
SM 2000 = 695 rpm  
ZM 200 = 18000 rpm  
Frequency MM 400 = 25/s

**Time:** 5 min. (per sample)

**Achieved result(s):** predominantly < 200 µm

**Remark(s):** The Barbie doll was first separated in single parts. The plastic body was pre-cut in the Cutting Mill SM 2000, and finally ground in the Ultra Centrifugal Mill ZM 200 under pre-cooling conditions using liquid nitrogen. Synthetic hair and clothes have been prepared in the Mixer.

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Mill MM 400.
The filled screwed jars have been first cooled in liquid nitrogen for 2 - 3 min. and than fixed in the Mixer Mill MM 400 for the grinding action.

**Recommendation:** For sample preparation of different children toys for the following determination of heavy metals, the above mentioned workflow is recommended.

**Pictures of the sample**

*Fig. 1:* Original sample “Barbie”  
*Fig. 2:* Pre-cutted plastic body  
*Fig. 3:* Finely ground in ZM 200  
*Fig. 4:* Synthetic hair
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