MOARĂ MIXER MM 400

O moară mutifuncțională

The Mixer Mill MM 400 is a true multipurpose mill designed for dry, wet and cryogenic grinding of small volumes up to 2 x 20 ml. It mixes and homogenizes powders and suspensions with a frequency of 30 Hz within seconds – unbeatably fast and easy to operate.

The compact benchtop unit is suitable for classic homogenization processes, as well as for biological cell disruption for DNA/RNA and protein extraction. Long processing times up to 99 hours make the MM 400 ideally suited for research applications, for example in mechanochemistry.

With regard to performance and flexibility of this mill, there is no equivalent technology available in the market.

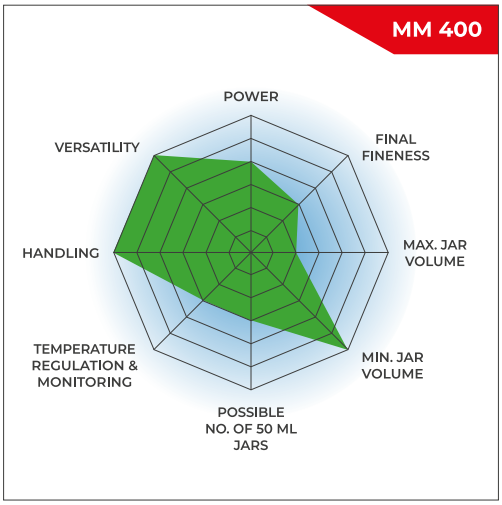
You may also be interested in the mixer mill models MM 500 nano and MM 500 vario which operate with the same functional principle at a frequency of 35 Hz but provide substantially higher performance. For applications which require cooling or heating the sample, the Mixer Mill MM 500 control is the perfect choice. Each RETSCH mixer mill has a specific application focus.

Click pentru video

Video Produs

THE MOST VERSATILE ALL-ROUNDER OF BALL MILLS

- Max. speed 30 Hz
- Horizontal oscillation causes strong impact effects for effective sample processing
- Up to 8 mm feed size and 5 µm final fineness
- 2 grinding stations for jars of min 2 ml and max 50 ml, adapter for 10 x 2 ml single use vials and 4 x 50 ml conical centrifugation tubes
- Steel jars can be precooled manually in liquid nitrogen
- Calibrated speed and time, small benchtop model, storable SOPs and cycle programs, 7 different jar materials



PERFORMANȚĂ ȘI DESIGN

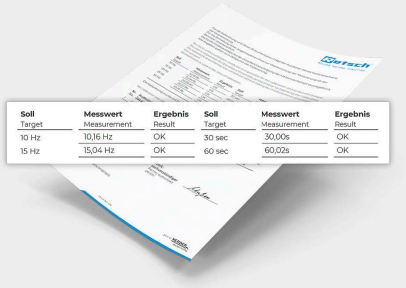
- Pulverizare și omogenizaare prin impact impact și frecare, cu o frecvență de 30 Hz
- Echipată cu 2 posturi de măcinare pentru până la 20 de probe odată
- Memory for 12 Standard Operating Procedures (SOP) and 6 program cycles
- Convenient touch display, significant noise reduction

VERSATILITATE DE NEEGALAT

- 3 moduri de măcinare: uscată, umedă și criogenică
- Mixarea pulberilor cu liant, în incinte de plastic înainte de comprimare (peletizare) pentru analiza XRF
- Potrivită pentru aplicații de cercetare, cum ar fi mecanochimia sau pentru lizarea celulelor biologice
- Extraction of pesticides (QuEChERS) and herbal ingredients

MOARĂ MIXER MM 400

CALIBRATION ENSURES REPRODUCIBLE RESULTS



Reproducibility is paramount in the process chain from sampling to analysis. Lab equipment which can be calibrated guarantees reproducible results with minimum standard deviation every time. This is particularly useful when comparing results produced at different locations.

The MM 400 is the first laboratory mill which can be calibrated. RETSCH initially calibrates time and frequency of the mill and offers a regular calibration service to ensure reproducible milling processes.

This functionality is particularly suitable for

- Testing labs with different locations
- Accredited labs applying ISO/IEC 17025 or ISO 9000ff
- Pharmaceutical products

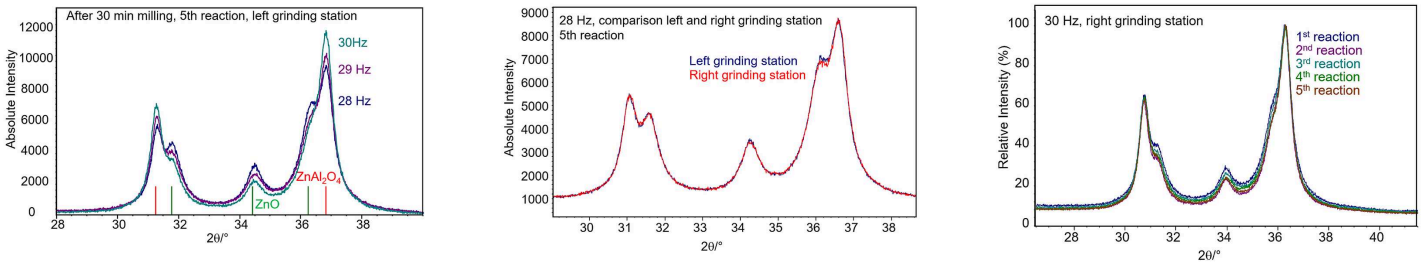
MOARĂ MIXER MM 400

REPRODUCIBILITY OF MECHANOCHEMICAL REACTIONS IN THE MIXER MILL MM 400

Reproducibility is a fundamental principle of scientific research and is essential for ensuring the credibility and reliability of scientific findings. The Mixer Mill MM 400 was tested regarding the reproducibility within a mechanochemical reaction, and it could be proven that it provides excellent reproducibility during several repetitions, for both clamping positions, and also between different devices. [1]

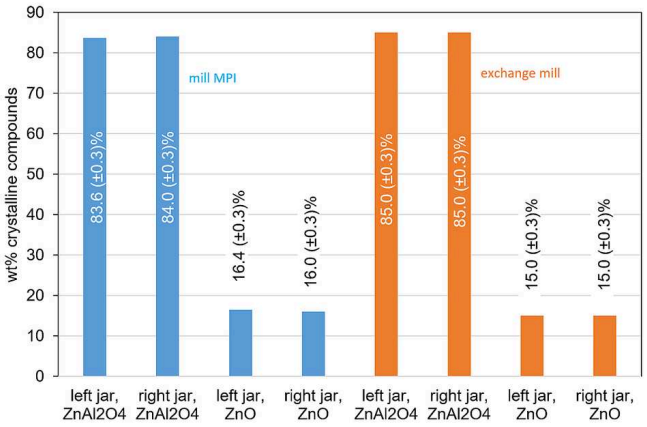
Minor variations of the frequency from 30 Hz to 29 Hz or 28 Hz have an influence on the yield of the reaction. It is of fundamental interest that the mixer mill maintains a set value, e.g. 30 Hz, and does not deviate from it. A premise which is fulfilled by the MM 400 which comes with a calibration certificate.

The mechanochemical reaction γ-Al_2O_3 + ZnO -> $ZnAl_2O_4$ was conducted for 30 min using 25 ml grinding jars, 2 x 15 mm grinding balls, 1 g educts, at 28 Hz, 29 Hz and 30 Hz five times in a row. The comparison between left and right clamping station showed highly reproducible results, also the comparison between the 5 trials.



XRD patterns after the mechanochemical reaction γ-Al_2O_3 + ZnO -> $ZnAl_2O_4$: Left: Grinding at 28 Hz, 29 Hz and 30 Hz, results after 5th reaction. Middle: Comparison left and right grinding station at 28 Hz 5th reaction each. Right: Reaction 1 to 5 at 30 Hz, right grinding station. Results presented by the group of Claudia Weidenthaler. [8]

The experiments were repeated using another MM 400 device to compare the results between the two mills. Again, the excellent reproducibility was verified for the 5 tests conducted at 30 Hz, for both, left and right grinding station.



Almost identical results (weight % of educts and product) and reproducibility are obtained with a different MM 400 device. Results presented by the group of Claudia Weidenthaler. [1]

MOARĂ MIXER MM 400

SOLUȚII PENTRU APLICAȚII APLICAȚII BIOLOGICE ȘI DISTRUGERE (LIZARE) CELUALARĂ

Mixer mills are frequently used for homogenizing biological samples. The so-called bead beating with small glass beads is an established method for cell disruption of yeasts, microalgae or bacteria. The sample is only moderately warmed in the process which can be reduced to a minimum by pre-cooling.

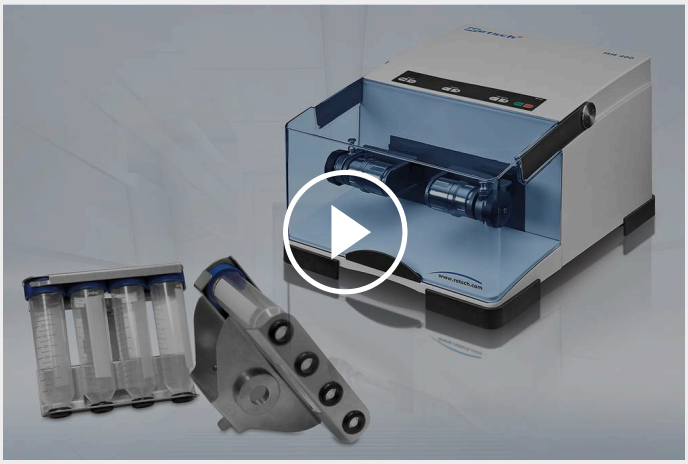
The MM 400 allows for efficient cell disruption of up to 240 ml cell suspension for DNA/RNA and protein

extraction. For accurate diagnosis of infections, it is possible to isolate intact bacteria from tissue in 8 x 30 ml bottles or 10 x 5 ml vials by using adapters.

The MM 400 can be operated with a range of adapters for single-use vials with the following capacities:

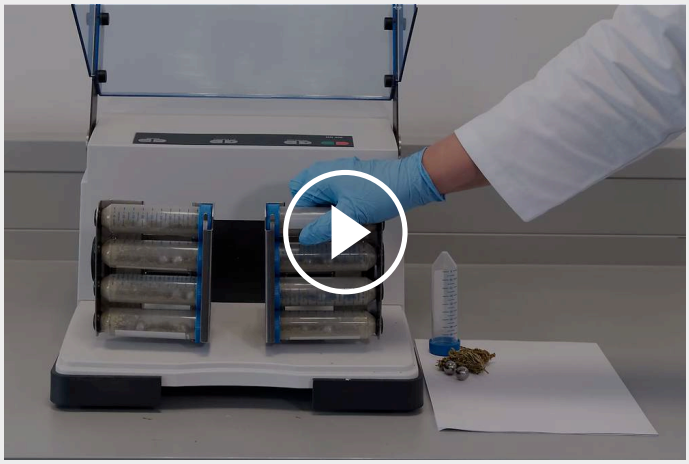
20 x 0.2 ml / 20 x 1.5 or 2 ml / 10 x 5 ml / 8 x 30 ml / 8 x 50 ml

For the pulverization of 25 to 30 g plant material, such as cannabis flower, conical centrifuge tubes are best suited. Up to 8 tissue samples, like fresh liver in buffer solution, can also be homogenized in these 50 ml tubes using steel or zirconium oxide balls. To keep the mechanical stress on the vials as low as possible, a reduced frequency and a high filling level, e. g. with buffer and sample, are recommended.



Click pentru video

Moara Mixer MM 400 - Lizarea celulei de drojdie*



Click pentru video

Moară mixer MM 400 - Homogenization of cannabis*

*The video shows the previous model with identical functional principle.

SOLUTIONS FOR CRYOGENIC GRINDING

The CryoKit is a cost-effective solution for cryogenic sample processing with the Mixer Mill MM 400. The set consists of two insulated containers, two tongs and safety glasses.

The sample to be embrittled and the grinding ball are filled into the stainless-steel grinding jar which is tightly screwed. Indirect embrittlement is effected by pre-cooling the jar in a liquid nitrogen bath. After approximately 2 minutes, the sample is sufficiently cooled for cryogenic processing.

If direct contact with liquid nitrogen is to be avoided, the CryoMill or Mixer Mill MM 500 control are suitable options. Both mills can be operated with jars made of other materials than steel for cryogenic grinding.

Click pentru video

Moara Mixer MM 400 - Măcinare Criogenică*

APPLICATIONS IN MECHANOCHEMISTRY

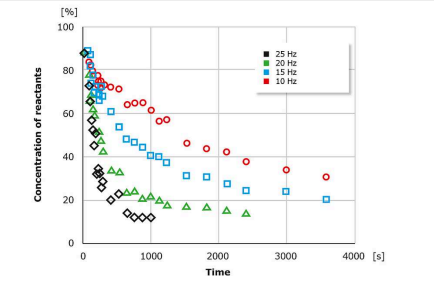
Mechanochemistry enables fast reactions of substances in a solvent-free environment. Some chemical reactions require the frictional forces of a planetary ball mill, while other reaction types need energy input through impact – that is where the Mixer Mill MM 400 comes into play.

The sample volumes available for research applications are often very low. This makes small grinding jar sizes of up to 50 ml, like they are available for the MM 400, beneficial. Due to the frequently long reaction times, the possibility to program process times of several hours is another important aspect.

Mixer mills offer a unique advantage over planetary ball mills in mechanochemical applications: the use of transparent jars in combination with the typical horizontal jar movement enables in-situ RAMAN spectroscopy. This permits real-time monitoring of the reaction process to identify the optimal time for maximum yield and avoid prolonged processing.

The MM 400 offers many advantages for mechanochemical applications:

- Process times of up to 99 h
- Various grinding jar sizes and materials
- Transparent PMMA grinding jars enable in-situ RAMAN spectroscopy
- Programmable frequency and break times
- Adapter for 4 x 5 ml stainless-steel grinding jars permits up to 8 simultaneous reactions



Time course of the Knoevenagel reaction between vanillin and barbituric acid under mechanochemical conditions using 2x10mm zirconium oxide grinding balls in 19 ml PMMA grinding jar at 30 Hz. Reaction running over 30 minutes with visible progress indicated by color change.

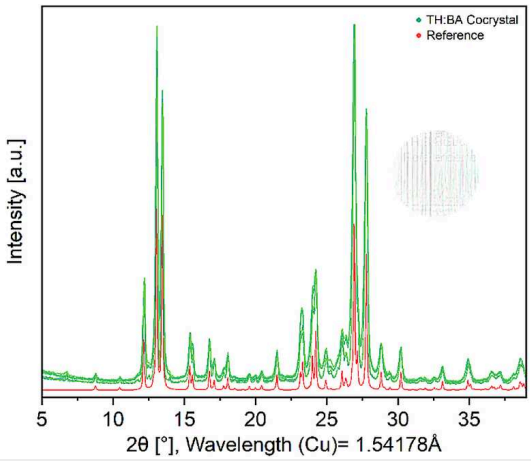
Courtesy of Dr. Sven Grätz, Ruhr-University Bochum, Faculty of Chemistry and Biochemistry, AG Prof. Borchardt.

CO-CRYSTAL SCREENING WITH THE MM 400

Co-crystal screening can be effectively performed in Mixer Mills. In a study [9] using the MM 400, 2 ml steel tubes and the corresponding PTFE adapter were employed to co-crystallize theophylline and benzamide in a 1:1 ratio under the following conditions:

- 60 min milling time
- 30 Hz frequency
- One 6 mm steel ball per tube
- Four experiments without solvent and four with 20 µL ethanol

X-ray powder diffraction patterns of the eight resulting samples (shown in green) align closely with the simulated reference pattern of the target co-crystal. All observed signals correspond to the desired product, with no significant additional signals, indicating successful and reproducible co-crystal formation. The MM 400 with 2 ml steel tubes delivers consistent results, and this compatibility extends to the MM 500 series, which can also accommodate 2 ml steel tubes.



XRD patterns after the co-crystal formation of theophylline and benzamide after 60 min milling time in the MM 400 against a simulated reference. Results presented by experiments of Dominik Al-Sabbagh. [2]

CHEMISTRY IN THE MILL: TEFLON RECYCLING (PTFE) USING MECHANICAL ENERGY

MECHANOCHEMICAL RECYCLING OF PTFE (TEFLON)

Mechanochemical reactions can also be carried out particularly efficiently using the MM 400. Recent research shows how PTFE (Teflon) can be broken down in the MM 400 through a reaction with sodium, using mechanical energy. The intense movement of the grinding balls provides the energy needed to break the stable carbon-fluorine bonds – without any additional heat or pressure. In this way, large portions of the material can be converted into sodium fluoride and carbon – a promising approach for future recycling processes.

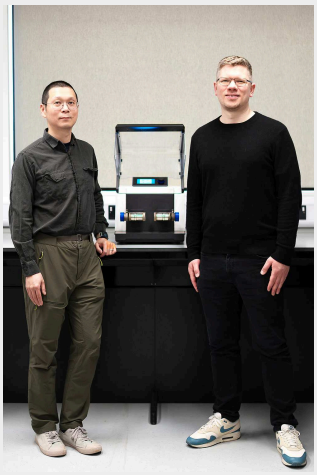


Image on the right: Dr. Erli Lu and Dr. Dominik Kubicki with the Mixer Mill MM 400, which was used to decompose PFAs. [4]

The process using MM 400 was part of the renowned science program “Forschung aktuell” on Deutschlandfunk. Give it a listen!

The radio segment is available only in German.

FUNCTIONALIZING BIOMASS FOR PHARMA APPLICATIONS VIA MECHANOCHEMISTRY

Mechanochemistry is transforming how functional biomaterials are made, and cationic cellulose is a prime example. Using a solvent-free process, cotton fibers are combined with a catalytic base and a minimal additive, then milled together with the cationic reagent to activate the reaction using the Mixer Mill MM 400. This solid-state approach eliminates water and bulk solvents, dramatically reducing chemical use and waste compared to conventional methods. After milling, a short aging step completes the reaction, delivering highly charged cellulose fibers with exceptional performance. [3]

Optimal reaction conditions: Cotton fibers were milled in a 50 ml stainless steel jar with 3 x 10 mm balls for 5 min at 25 Hz, then EPTMAC was added, and the mixture was milled for additional 30 min. The subsequent aging of the reaction mixture at 50 °C for 24 h, followed by Soxhlet extraction (48 h) and freeze drying, resulted in the isolation of pure cCF material.

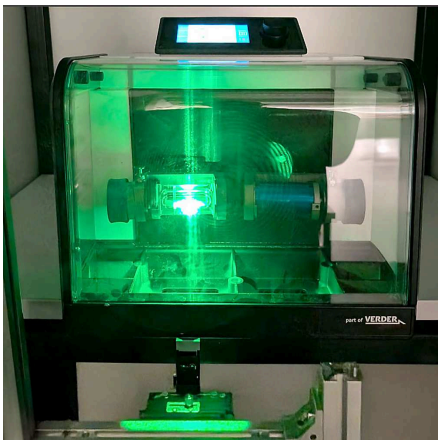
Why is this exciting for pharma?
These cationic fibers show strong electrostatic binding to viruses, enabling efficient removal of pathogens from water and process streams—critical for sterile manufacturing and clean water applications. Beyond filtration, the material offers potential in drug delivery, antimicrobial surfaces, and bioprocessing aids. The process achieves outstanding sustainability metrics aligning with green chemistry principles and industry goals. It also allows precise control over charge density for tailored performance.

This innovation demonstrates how mechanochemistry can deliver high-value, eco-friendly solutions for pharmaceutical production—combining safety, efficiency, and sustainability in one breakthrough approach.

MOARĂ MIXER MM 400

IN-SITU RAMAN SPECTROSCOPY

In-situ Raman spectroscopy is a powerful analytical technique that allows for the monitoring and analysis of materials in their natural or process environment. This method utilizes Raman scattering, a phenomenon where light interacts with molecular vibrations, leading to shifts in the wavelength of the scattered light. These shifts provide a unique spectral fingerprint for the material being analyzed, offering insights into its chemical composition or molecular structure.



The "*in-situ*" aspect refers to the ability to observe and measure these characteristics directly during an ongoing process. This can include observing changes in the presence of various chemical reactions, also the so called mechanochemistry. Mechanochemistry involves the use of impact, shearing, or friction actions to induce chemical changes in solids. This approach is increasingly popular for its ability to bypass the need for solvents, potentially offering a more environmentally friendly and energy-efficient pathway for chemical synthesis. The Raman spectroscopy can provide invaluable insights into the reaction mechanism, phase transformations, reaction kinetics or for optimization of reaction conditions.

The MM 400 is “Raman-ready”, allowing easy removal of the bottom plate inlay. The bottom plate has openings for the Raman probe to consistently measure at the bottom of the jars by placing the Raman probe underneath the mill and thus underneath the jars, where particle interaction is most intense, ensuring accurate data. The Retsch PMMA grinding jars, with their transparency and chemical resistance, enhance spectral data without contamination. The plane outer shapes of the jars further enhance the spectroscopic data. These design adjustments streamline the experimental workflow. Researchers can now perform *in-situ* Raman spectroscopy with greater ease and precision, opening new possibilities for in-depth material analysis.

PENTRU PROCESE DE MĂCINARE SIGURE ȘI EFICIENTE

ACCESORII MOARĂ MIXER MM 400

GRINDING JARS IN 7 DIFFERENT MATERIALS

Volumul nominal al incintelor cu filet variază între 1,5 și 50 mL și pot fi fabricate din oțel durificat, oțel inoxidabil, agat, carbură de wolfram, oxid de zirconiu sau PTFE, fiind posibilă și măcinarea fără contaminare cu metale grele.

Transparent PMMA grinding jars are used for in-situ RAMAN spectroscopy but also enable applications with photochemical reactions. Moreover, these are resistant to a variety of chemicals. The jars can be used with the predecessor of the MM 400 just like older jar models are compatible with the latest mixer mill model.

2 ML TUBES FOR CRYOGENIC GRINDING

Small 2 ml steel tubes are used for cryogenic applications. Up to 20 of these tubes can be clamped into the MM 400 using an adapter. The advantage: they can withstand low temperatures and mechanical stress and do not break like disposable vessels. Ideal for the smallest sample quantities in the cryogenic range.

ADAPTOARE PENTRU FIOLE DE UNICĂ FOLOSINȚĂ

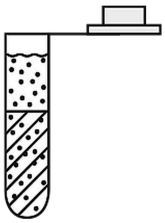
Pe moara MM 400 pot fi montate adaptoare pentru fiole de unică folosință de 0.5 / 1.5 / 2 / 5 ml. Pentru cantități mai mari de probă, ca de exemplu, extracția proteinelor, sunt disponibile adaptoarele pentru fiole de 50 mL sau pentru recipente cu gură largă, de 30 mL.

ADAPTERS FOR INCREASED SAMPLE THROUGHPUT

The MM 400 can be equipped with adapters that accommodate four 5 ml stainless-steel grinding jars, allowing for simultaneous pulverization of a maximum of 8 samples. This increased throughput is particularly beneficial for mechanochemical applications.

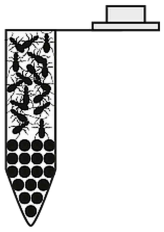
VIALS, BOTTLES AND TUBES AVAILABLE FOR MM 400

1.5 or 2 ml
Safe-lock
single-use vials
2 x 10 vials max.



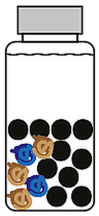
- Cell disruption for DNA/RNA proteins/ metabolites
- Cryogenic grinding of soft sample (tissue, plants, cell pellets, insects)
- Dry or wet homogenization of soft samples (tissue, insects)

5 ml
Safe-lock
single-use vials
2 x 5 vials max.



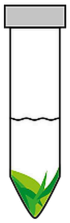
- Cell disruption for DNA/RNA proteins/ metabolites
- Cryogenic grinding of soft sample (tissue, plants, cell pellets, insects)
- Dry or wet homogenization of soft samples (tissue, insects)

30 ml
disposable wide
mouth bottles
2 x 4 bottles max.



- Cell disruption for DNA/RNA proteins/ metabolites
- Dry or wet homogenization of soft samples (tissue, insects)
- Dry milling of hard samples (quartz sand)

50 ml
disposable conical
centrifugation tubes
2 x 4 tubes max.



- Cell disruption for DNA/RNA proteins/ metabolites
- Dry or wet homogenization of soft samples (tissue, insects)
- Extraction of pesticides from food/ plants (QuEChERS)
- Mixing of powder and wax to press pellets for XRF

RECOMANDARE PENTRU UMPLEREA INCINTELOR

The jar size should be adapted to the sample volume to ensure optimum results. Ideally, the grinding balls are 3 times the size of the largest sample piece. The numbers and sizes of balls given in the table below follow this rule of thumb. To pulverize, for example, 20 ml of a sample consisting of 8-mm sized particles, the use of a 50 ml jar and 25 mm balls is recommended. According to the table, one grinding ball is required. 20 ml of a sample with 5-mm particles, however, can be homogenized with four 15 mm balls.

Volum nominal incintă de măcinare	Volum probă	Dimensiune max. probă	Încărcătura de bile recomandată (bucăți)						
			Ø 5 mm	Ø 7 mm	Ø 10 mm	Ø 12 mm	Ø 15 mm	Ø 20 mm	Ø 25 mm
1.5 ml	0.2 – 0.5 ml	1 mm	1 – 2	-	-	-	-	-	-
5 ml	0.5 – 2 ml	2 mm	-	1 – 2	-	-	-	-	-
10 ml	2 – 4 ml	4 mm	-	5 – 7	1 – 2	1 – 2	-	-	-
25 ml	4 – 10 ml	6 mm	-	-	5 – 6	2 – 4	1 – 2	-	-
35 ml	6 – 15 ml	6 mm	-	-	6 – 9	4 – 6	2 – 3	1	-
50 ml	8 – 20 ml	8 mm	-	-	12 – 14	6 – 8	3 – 4	1	1

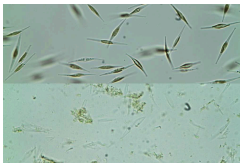
Tabelul prezintă încărcătura recomandată (în bucăți) de bile de măcinare de diferite dimensiuni în raport cu volumul borcanului de măcinare, cantitatea de probă și dimensiunea maximă de alimentare.

PROBE TIPICE

Morile mixer RETSCH sunt foarte versatile. Omogenizează, spre exemplu, aliaje, hrană pentru animale, oase, ceramice, cereale, produse chimice, cărbuni, cocs, droguri, deșeuri electronice, sticlă, boabe, păr, minerale, semințe uleioase, minereuri, hârtie, materiale vegetale, materiale plastice, nămol, soluri, paie, tablete, textile, țesuturi, tabac, probe deșeuri, lemn, lână, etc.

FIBROUS: HAIR

30 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
2 min at 30 Hz

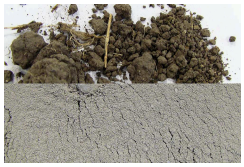


CELL DISRUPTION: MICROALGAE

30 ml cell suspension
8 x 50 ml conical centrifuge tubes (adapter)
with 25 ml glass beads each;
0,5-0,75 mm
30 s at 30 Hz

ELASTIC-LIQUID: CAPSULES WITH LIQUID

15 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement in LN_2 for 3 min
4 x 2 min at 30 Hz
with intermediate cooling



MEDIUM-HARD/ FIBROUS: SOIL

20 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
1 min at 30 Hz

Click pentru video

PARSLEY

TOUGH-FIBROUS: WOOD

5 ml sample
10 ml zirconium oxide jar
2 x 12 mm zirconium oxide balls
3 min at 30 Hz

ELASTIC-TOUGH: POLYURETHANE PELLETS

20 ml sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement in LN_2 for 3 min
4 x 2 min at 30 Hz
with intermediate cooling

FIBROUS: CANNABIS

3 g sample
50 ml stainless steel jar
1 x 25 mm stainless steel ball
embrittlement with LN_2 for 2 min
90 s at 30 Hz

HARD-BRITTLE: CONCRETE

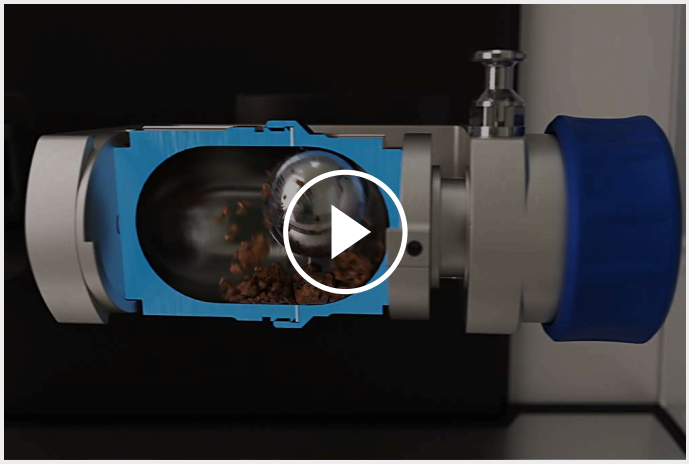
10 ml sample
25 ml zirconium oxide jar
2 x 15 mm zirconium oxide balls
2 min at 30 Hz

MOARĂ MIXER MM 400

PRINCIPIU DE FUNCŢIONARE

Incintele de măcinare MM 400 execută mișcări de oscilație radială în poziție orizontală. Inerția bilelor de măcinare determină pulverizarea probei la capetele rounjite ale incintelor. De asemenea, mișcarea incintelor combinată cu mișcarea bilelor are ca rezultat mixarea intensivă a probei.

Gradul de mixare poate crește mai mult prin utilizarea mai multor bile mici. Astfel, folosind bile de sticlă, de exemplu, se poate efectua distrugerea (lizarea) celulelor biologice. Efectul impactului de frecare dintre aceste bile asigură lizarea eficientă a celulelor.



Click pentru video

DATE TEHNICE

Aplicabilitate	size reduction, mixing, homogenization, cell disruption, cryogenic grinding, mechanochemistry
Domenii in care se utilizeaza	agricultură, alimente, biologie, chimie/plastic, geologie/ metalurgie, inginerie/electronică, materiale de construcții, medicină/produse farmaceutice , mediu/reciclare, sticlă/ ceramică
Material probă	cu duritate mica/medie/mare, fragil, elastic, fibros
Principiul de reducere a dimensiunii	impact, frecare
Dimens. max. probă*	<= 8 mm
Finețe finală*	~ 5 µm
Volum/masă probă admisă*	max. 2 x 20 ml
Posturi de macinare	2
Vibrational frequency	3 - 30 Hz (180 - 1800 min-1)
Media duratei de măcinare	30 s - 2 min
Max. grindig time	99 h
Macinare uscată	da
Măcinare umedă	da
Măcinare criogenică	da
Liză celulară în fiole de analiză	da, până la 20 x 2,0 ml
Dispozitiv de fixare cu centrare automată	da
Tipul incintelor de măcinare	design superior cu șurub
Material de constructie a elementelor de macinare	oţel călit, oţel inoxidabil, carbura de wolfram, agat, oxid de zirconiu, PTFE, PMMA
Dimensiuni recipiente de macinare	1.5 ml / 5 ml / 10 ml / 25 ml / 35 ml / 50ml
Setarea timpului de macinare	digital, 10 s - 8 h
POS-uri stocabile	12
Programe de cicluri stocabile	6
Alimentare electrica	100-240 V, 50/60 Hz
Conectare sursă de alimentare	monofazic
Grad de protecție	IP 30
Putere instalata	165W
W x H x D (închis)	385 x 350 x 470 mm

Masa netă:	~ 27,5 kg
Standard	CE

* în funcție de materialul probei și configurația/setările instrumentului

REFERENCES

[1] Reaction scheme and performance of the experiments: Prof. Dr. Claudia Weidenthaler, Research Group Leader Heterogeneous Catalysis Powder Diffraction and Surface Spectroscopy, Max-Planck Institut für Kohlenforschung, Mülheim an der Ruhr.

[2] Reaction scheme and performance of the experiments: Dominik Al-Sabbagh, Chemistry Laboratory Technician, Division 6.3 – Structure Analysis, Federal Institute for Materials Research and Testing (BAM), Berlin.

[3] Tatsiana Nikonovich, Yao Yu, Mikko Korkiakoski, Chengji Yang, Iris Seitz, Daniel Langerreiter, Mauri A. Kostiainen, Eduardo Anaya-Plaza, and Sandra Kaabel; Solid-State Synthesis of Cationic Cellulose Fibers from Low-Processed Cotton for Efficient Virus Capture; ACS Sustainable Chemistry & Engineering 2025 13 (42), DOI: 10.1021/acssuschemeng.5c07884

[4] With permission of Dr Erli Lu, Associate Professor in Mechanochemistry & Sustainable Synthesis School of Chemistry, University of Birmingham

www.retsch.ro/mm400

INFORMAŢII DESPRE COMANDĂ

MIXER MILL MM 400

Mixer Mill MM 400 with quick release clamp
(please order grinding jars and balls separately)

20.715.0001		MM 400	100–240 V, 50/60 Hz

GRINDING JARS MM 400, SCREW TOP DESIGN

HARDENED STEEL

01.462.0237		25 ml

STAINLESS STEEL

01.462.0230		1.5 ml
01.462.0231		5 ml
01.462.0290		5 ml (for use with adapter 02.706.0351)
01.462.0236		10 ml
01.462.0213		25 ml
01.462.0214		35 ml
01.462.0216		50 ml

TUNGSTEN CARBIDE

01.462.0235		10 ml

01.462.0217		25 ml

AGATE

01.462.0232		5 ml
01.462.0233		10 ml

ZIRCONIUM OXIDE

01.462.0234		10 ml
01.462.0201		25 ml
01.462.0215		35 ml

PTFE

01.462.0238		25 ml
01.462.0244		35 ml
22.041.0004		Mixing beakers of polystyrene, 56 ml, 100 pcs.

PMMA, TRANSPARENT JARS FOR MECHANOSYNTHESES

01.462.0539		10 ml, 10 pieces
02.462.0539		10 ml, 2 pieces

ACCESSORIES FOR AERATION AND INCREASED PRESSURE

01.462.0548	Jar set incl. aeration jar 28 ml stainless steel, filter 10 µm, sealings and fittings 2 x 1/

		8“ for hose diameter 3 mm and 0.65 mm wall thickness (2x3 m hose included)
22.050.0005		Conversion kit including 2 connectors for the hoses on grinding arm, bottom plate for leading hoses out of the housing, counterweight

ACCESSORIES FOR GRINDING JARS MM 400

22.486.0005		Opening aid for grinding jars, 2 pcs.
02.706.0351		Adapter for use of 2/4 grinding jars 5 ml (01.462.0550)
22.085.0007		Gasket for grinding jar 1.5 ml, 10 pcs.
22.085.0008		Gasket for grinding jar 5 ml, 10 pcs. (for grinding jar 01.462.0231)
22.111.0001		Gasket for grinding jar 5 ml, 10 pcs. (for grinding jar 01.462.0550)
22.085.0009		Gasket for grinding jar 10 ml, 10 pcs.
22.085.0006		Gasket for grinding jar 25 ml hardened steel and stainless steel, 10 pcs.
22.085.0003		Gasket for grinding jar 25 ml zirconium oxide and tungsten carbide, 10 pcs.
22.085.0005		Gasket for grinding jar 35 ml stainless steel, 10 pcs.
22.085.0004		Gasket for grinding jar 35 ml zirconium oxide, 10 pcs.
22.085.0002		Gasket for grinding jar 50 ml stainless steel, 10 pcs.

ACCESSORIES FOR MIXING AND CELL DISRUPTION MM 400

22.001.0020		Adapter for 4 conical centrifuge tubes (e.g. Falcon® Tubes), 2 pieces, incl. 20 tubes
05.026.0001		Conical centrifuge tubes, 50 ml, 20 pieces
22.001.0021		Adapter for 4 wide mouth bottles, 2 pieces, incl. 12 wide mouth bottles, 30 ml

ACCESSORIES FOR COLD GRINDING MM 400

22.354.0001		Cryo kit for cooling the grinding jars with liquid nitrogen (incl. 2 insulated containers (1 and 4 liter), 2 pairs of grinding jar tongs, 1 pair of safety glasses)

ACCESSORIES MM 400

99.200.0043		IQ/OQ Documentation for MM 400

ACCESSORIES FOR CELL AND TISSUE DISRUPTION

22.008.0010		Adapter for 5 reaction vials 5.0 ml, made of PTFE
22.008.0014		Adapter for 10 reaction vials 1.5 and 2.0 ml, made of PTFE or stainless steel
22.008.0005		Adapter for 5 reaction vials 1.5 and 2.0 ml, made of PTFE or stainless steel
22.008.0006		Adapter for 10 reaction vials 0.2 ml, made of PTFE
22.749.0006		Safe-lock reaction vials 5.0 ml, 200 pcs.
22.749.0001		Safe-lock reaction vials 2.0 ml, 1000 pcs.
22.749.0002		Safe-lock reaction vials 1.5 ml, 1000 pcs.
22.749.0004		Safe-lock reaction vials 0.2 ml, 1000 pcs.
22.749.0008		Reaction vials made of stainless steel 316L, 2.0 ml, 10 pcs. (for use with adapter 22.008.0014)

GRINDING BALLS

HARDENED STEEL

05.368.0029		5 mm Ø

05.368.0030		7 mm Ø
05.368.0059		10 mm Ø
05.368.0032		12 mm Ø
05.368.0108		15 mm Ø

STAINLESS STEEL		
22.455.0010		2 mm Ø, 500 g (approx. 110 ml)
22.455.0011		3 mm Ø, 500 g (approx. 120 ml)
22.455.0002		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0001		4 mm Ø, 200 pieces (approx. 14 ml)
22.455.0003		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0034		5 mm Ø
05.368.0035		7 mm Ø
05.368.0063		10 mm Ø
05.368.0037		12 mm Ø
05.368.0109		15 mm Ø
05.368.0062		20 mm Ø

05.368.0105		25 mm Ø

TUNGSTEN CARBIDE

22.455.0006		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0005		4 mm Ø, 200 pieces (approx. 14 ml)
22.455.0004		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0038		5 mm Ø
05.368.0039		7 mm Ø
05.368.0071		10 mm Ø
05.368.0041		12 mm Ø
05.368.0110		15 mm Ø

AGATE

05.368.0024		5 mm Ø
05.368.0025		7 mm Ø
05.368.0067		10 mm Ø
05.368.0027		12 mm Ø

ZIRCONIUM OXIDE

05.368.0089		2 mm Ø, 0.5 kg (approx. 135 ml)
05.368.0090		3 mm Ø, 0.5 kg (approx. 140 ml)
22.455.0007		3 mm Ø, 200 pieces (approx. 6 ml)
22.455.0009		5 mm Ø, 200 pieces (approx. 25 ml)
05.368.0146		7 mm Ø
05.368.0094		10 mm Ø
05.368.0096		12 mm Ø
05.368.0113		15 mm Ø
05.368.0093		20 mm Ø
05.368.0106		25 mm Ø

PTFE WITH STEEL CORE

05.368.0045		10 mm Ø
05.368.0046		12 mm Ø
05.368.0114		15 mm Ø
05.368.0047		20 mm Ø

POLYAMIDE FOR MIXING BEAKERS

05.368.0042		5 mm Ø

05.368.0043		7 mm Ø
05.368.0044		9 mm Ø
05.368.0003		12 mm Ø

GLASS BEADS		
22.222.0001		0.10 – 0.25 mm Ø, 500 g (approx. 320 ml)
22.222.0002		0.25 – 0.50 mm Ø, 500 g (approx. 320 ml)
22.222.0003		0.50 – 0.75 mm Ø, 500 g (approx. 320 ml)
22.222.0004		0.75 – 1.00 mm Ø, 500 g (approx. 320 ml)
22.222.0005		1.00 – 1.50 mm Ø, 500 g (approx. 320 ml)