



Guidelines for bead beating

Recommendations for efficient sample disruption to facilitate nucleic acid extraction using MACHEREY-NAGEL Bead Tubes on mixer mills.



Introduction

Optimal sample preparation of biological materials is essential for successful analysis. In some cases, biological samples differ fundamentally from each other in terms of shape and consistency.

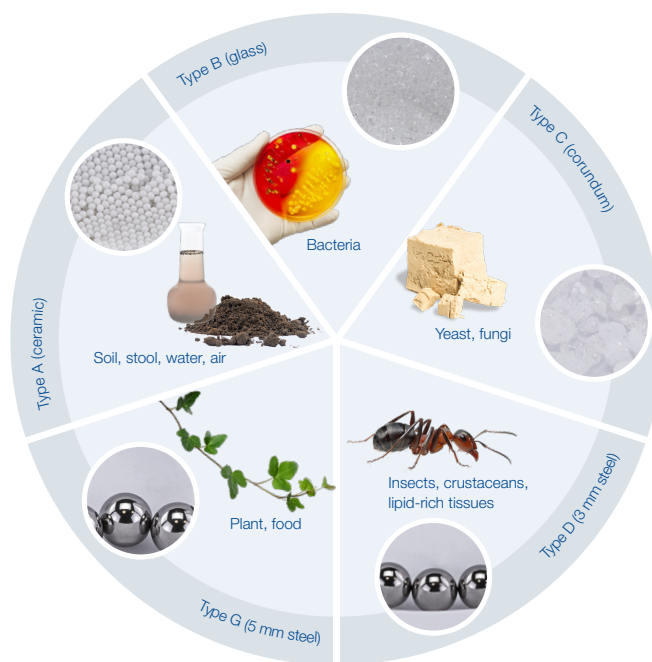
The aim of any sample preparation is to convert the starting material into a form that is accessible to the respective analytical method. Depending on the sample, different digestion techniques are initially used. Samples of any kind must first be homogenized and pulverized.

Bead beating is a very efficient way to disrupt diverse biological sample materials. Small beads within reaction vessels are useful to break up a wide range of biological samples. Cell disruption and homogenization can be performed using laboratory mills.

Mixer mills are ideally suited for cell disruption using our MN Bead Tubes. We explain how a Retsch® mixer mill ideally support you in the sample preparation process.

The following pages show established combinations of MN products with lysis parameters for different starting materials for nucleic acid purification.






MN Bead Tubes



MN Bead Tubes are 2 mL screw cap plastic tubes containing different types of beads (glass, ceramic, steel, or corundum) with a defined size range. They are intended for the disruption of biological sample material and subsequent nucleic acid purification.

While beads with a small diameter are used for the disruption of bacteria or yeast, larger beads are more suitable for homogenization of plant and animal tissues.

For detailed information on the compatibility of our MN Bead Tubes with various disruption devices, please see the table of selected references on the last page.

MN Bead Tubes	REF	Recommended for	In conjunction with
 <p>Type A · ceramic (0.6–0.8 mm)</p>	740786.50	Soil, sediment, stool, air, water	MN Bead Tube Holder (REF740469) on Vortex-Genie 2 or with a mixer mill (e.g. Retsch®)
 <p>Type B · glass (40–400 µm)</p>	740812.50	Bacteria	MN Bead Tube Holder (REF740469) on Vortex-Genie 2 or with a mixer mill (e.g. Retsch®)
 <p>Type C · corundum (1–3 mm)</p>	740813.50	Yeast, fungi	MN Bead Tube Holder (REF740469) on Vortex-Genie 2 or with a mixer mill (e.g. Retsch®)
 <p>Type D · steel (3 mm)</p>	740814.50	Insects, crustaceans, lipid-rich tissue	MN Bead Tube Holder (REF740469) on Vortex-Genie 2 or with a mixer mill (e.g. Retsch®)
 <p>Type G · steel (5 mm)</p>	740817.50	Plant, food	MN Bead Tube Holder (REF740469) on Vortex-Genie 2 or with a mixer mill (e.g. Retsch®)

Microbiome samples – Soil, stool, water, air

The microbiome comprises the genetic material of a microbial community inside or outside the human body. Environmental changes or health condition can be tracked and studied via the microbiome. Although microbiome analysis is a very popular field of modern research sample complexity and diversity is a major challenge to overcome. Using MN Bead Tubes Type A ensures effective sample lysis of microbial samples.

Recommended MN Bead Tubes



Type A · Ceramic



Recommendation for sample processing

Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Soil (sediments or sludge), stool (human and animal, e.g., mouse, rat, chicken), biofilm (plague, swabs)	MN Bead Tubes Type A	0.6–0.8 mm ceramic beads	1–2 min at 30 Hz	< 200 mg sample + 700 µL M1 (Optional: 150 µL Enhancer SX, 2.5 µL RNase A)	NucleoMag® DNA Microbiome
Soil (sediments or sludge), stool (human and animal, e.g., mouse, rat, chicken), biofilm (plague, swabs)	MN 96 Bead Plate Type A	0.6–0.8 mm ceramic beads	2 x 3 min at 30 Hz	< 200 mg sample + 700 µL M1 (Optional: 150 µL Enhancer SX, 2.5 µL RNase A)	NucleoMag® DNA Microbiome

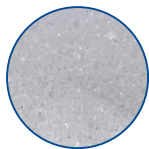
Ordering information

Product	Preps	REF
MN Bead Tubes Type A	50	740786.50
MN 96 Bead Plate Type A	1 / 4 / 24 Set(s)	740850.1 / 4 / 24
NucleoMag® DNA Microbiome	96 / 384	744330.1 / 4

Bacteria

Bacteria are microscopic, single-celled organisms and the oldest living thing on earth. They occur in numerous different species and are found everywhere in the world – in the air, water and soil, as well as in the human body where a few species of bacteria can also cause diseases.

Recommended MN Bead Tubes



Type B · Glass

Recommendation for sample processing



Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Gram-negative bacteria. E.g., <i>Escherichia coli</i> , <i>Vibrio fischeri</i>	MN Bead Tubes Type B	40–400 µm glass beads	4–6 min at 30 Hz	< 40 mg microbial pellet + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoSpin® Microbial DNA
				< 40 mg microbial pellet + 140 µL IME + 10 µL Proteinase K + 2.5 µL RNase A	NucleoMag® DNA Bacteria
Gram-negative bacteria. E.g., <i>Escherichia coli</i> , <i>Vibrio fischeri</i>	MN 96 Bead Plate Type B	40–400 µm glass beads	2 x 4 min at 30 Hz	< 40 mg microbial pellet + 140 µL IME, 10 µL Proteinase K, 2.5 µL RNase A	NucleoMag® DNA Bacteria
Gram-positive bacteria. E.g., <i>Bacillus subtilis</i> , <i>Corynebacterium glutamicum</i>	MN Bead Tubes Type B	40–400 µm glass beads	6–12 min at 30 Hz	< 40 mg microbial pellet + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoSpin® Microbial DNA
				< 40 mg microbial pellet + 140 µL IME + 10 µL Proteinase K + 2.5 µL RNase A	NucleoMag® DNA Bacteria
Gram-positive bacteria. E.g., <i>Bacillus subtilis</i> , <i>Corynebacterium glutamicum</i>	MN 96 Bead Plate Type B	40–400 µm glass beads	2 x 4 min at 30 Hz	< 40 mg microbial pellet + 140 µL IME, 10 µL Proteinase K, 2.5 µL RNase A	NucleoMag® DNA Bacteria

Ordering information

Product	Preps	REF
MN Bead Tubes Type B	50	740812.50
MN 96 Bead Plate Type B	1 / 4 / 24 Set(s)	740851.1 / 4 / 24
NucleoMag® DNA Bacteria	96 / 384	744310.1 / 4
NucleoSpin® Microbial DNA	10 / 50	740235.10 / 50

Yeast and Fungi

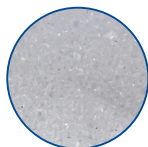
Yeast and fungi both belong to the kingdom of fungi and belong to the group of eukaryotic microorganisms. The kingdom of fungi comprises more than 80,000 different organisms varying in size and shape. The main difference between them is that yeast are single-cell, oval-shaped organisms, and fungi are multicellular organisms with filamentous hyphae. Due to the rigid cell wall structure of the fungi kingdom a thorough and type specific lysis is essential.



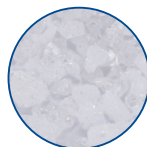
Recommended MN Bead Tubes



Type A · Ceramic



Type B · Glass



Type C · Corundum



Type D · 3 mm steel

Recommendation for sample processing

Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Yeast. E.g., <i>Saccharomyces cerevisiae</i> , <i>Pichia pastoris</i>	MN Bead Tubes Type C	1–3 mm corundum	5 min at 30 Hz	< 100 mg yeast pellet (wet weight) + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoSpin® DNA Yeast
Yeast. E.g., <i>Saccharomyces cerevisiae</i>	MN Bead Tubes Type A	0.6–0.8 mm ceramic beads	7 min at 30 Hz	< 40mg microbial pellet + 140 µL IME, 10 µL PK 2.5 µL RNase A	NucleoMag® DNA Bacteria
Yeast. E.g., <i>Saccharomyces cerevisiae</i>	MN 96 Bead Plate Type B	40–400 µm glass beads	2 x 4 min at 30 Hz	< 40 mg microbial pellet + 140 µL IME, 10 µL PK 2.5 µL RNase A	NucleoMag® DNA Bacteria
Filamentous fungi. E.g., <i>Aspergillus spec.</i> , <i>Rhizopus spec.</i>	MN Bead Tubes Type C	1–3 mm corundum	12 min at 30 Hz	< 40 mg microbial pellet + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoSpin® Microbial DNA
Filamentous fungi. E.g., <i>Aspergillus nidulans</i> , melon mold, citrus mold, potato mold	MN Bead Tubes Type D	3 mm steel beads	1–2 min at 25 Hz	< 40 mg microbial pellet + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoMag® DNA Bacteria
Filamentous fungi. E.g., <i>Aspergillus nidulans</i> , melon mold, citrus mold, potato mold	MN 96 Bead Plate Type D	3 mm steel beads	2 x 1 min at 20 Hz	< 40 mg microbial pellet + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoMag® DNA Bacteria

Ordering information

Product	Preps	REF
MN Bead Tubes Type A	50	740786.50
MN Bead Tubes Type C	50	740813.50
MN Bead Tubes Type D	50	740814.50
MN 96 Bead Plate Type B	1 / 4 / 24 Set(s)	740851.1 / 4 / 24
MN 96 Bead Plate Type D	1 / 4 / 24 Set(s)	740853.1 / 4 / 24
MN Beads Type A (bulk)	400 g	740786.B.250
MN Beads Type B1 (bulk)	750 g	740809.B.5000
MN Beads Type B2 (bulk)	750 g	740812.B.1000
MN Beads Type C (bulk)	200 g	740813.B.250
MN Beads Type D (bulk)	500 g	740814.B.1000
NucleoMag® DNA Bacteria	96 / 384	744310.1 / 4
NucleoSpin® DNA Yeast	10 / 50	740236.10 / 50
NucleoSpin® Microbial DNA	10 / 50	740235.10 / 50

Insects

Insects are the largest group within the phylum of arthropoda. Characteristics of insects are next to the three-part body and three pairs of jointed legs, the chitinous exoskeleton. The protective exoskeleton consisting of the aminopolysaccharide chitin needs an increased lysis effort.



Recommended MN Bead Tubes



Type D · 3 mm steel

Recommendation for sample processing

Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Fresh, frozen, dried, and ethanol preserved insects. E.g., <i>Drosophila melanogaster</i> , crustaceans, lipid rich tissue	MN Bead Tubes Type D	3 mm steel beads	0.5–10 min at 30 Hz	Insect + 100 µL BE + 40 µL MG + 10 µL Proteinase K	NucleoSpin® DNA Insect

Ordering information

Product	Preps	REF
MN Bead Tubes Type D	50	740814.50
NucleoSpin® DNA Insect	10/50	740470.10/50

Animal and human tissue

Cells in complex multicellular organisms are organized into different tissues, which are clusters of similar cells having a specific function. Depending on the nature of a tissue, sample disruption may differ notably. Lipid rich tissues, such as brain or liver for example need more vigorous handling.



Recommended MN Bead Tubes



Type D · 3 mm steel

Recommendation for sample processing

Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Soft tissue. E.g., brain, liver, adipose or fatty fish tissue	MN Bead Tubes Type D	3 mm steel beads	1 min at 10 Hz followed by 10 s at 20 Hz	< 40 mg tissue + 40 µL LBP + 100 µL IME + 10 µL Prot K + 2,5 µL RNase A	NucleoMag® DNA Bacteria
Soft tissue. E.g., brain, liver, adipose or fatty fish tissue	MN 96 Bead Plate Type D	3 mm steel beads	1 min at 10 Hz followed by 10 s at 20 Hz	< 40 mg tissue + 40 µL LBP + 100 µL IME + 10 µL Prot K + 2,5 µL RNase A	NucleoMag® DNA Bacteria

Ordering information

Product	Preps	REF
MN Bead Tubes Type D	50	740814.50
MN 96 Bead Plate Type D	1 / 4 / 24 Set(s)	740853.1 / 4 / 24
NucleoMag® DNA Bacteria	96 / 384	744310.1 / 4

Plant samples

Plants are one of the most important living organisms and a valuable resource. So far, almost 400.000 plant species have been found on the planet. Thus, it is not surprising that plants differ in a variety of ways including shape, cell wall composition, and biochemical compounds. Because of this wide range of plant samples, preparing different sample types for nucleic acid purification can be a challenge. Our MN Bead Tubes Type G are a promising option for the homogenization of plant samples.

Recommended MN Bead Tubes



Type G · 5 mm steel



Recommendation for sample processing

Sample types	Bead Tubes	Bead size & material	Processing time & speed	Buffer and Volume	Recommended kit
Plant material	MN Bead Tubes Type G	5 mm steel beads	60–90 s at 30 Hz	frozen: without buffer fresh: up to 500 µL MC1/C1 (depending on amount of sample material)	NucleoSpin® Plant II NucleoMag® Plant

Ordering information

Product	Preps	REF
MN Bead Tubes Type G	50	740817.50
NucleoSpin® Plant II	10 / 50 / 250	740770.10 / 50 / 250
NucleoMag® Plant	96 / 384 / 2304	744400.1 / 4 / 24

Selected References

Our MN Bead Tubes are compatible with a variety of different mixer mills. Therefore, we have summarized in the following table some publications that cite our MN Bead Tubes in combination with mixer mills. In addition, this table provides information on which MN Bead Tubes were used for which kind of sample material.

Mixer Mill	MN Bead Tube	Sample material	Article	PubMed ID
Retsch® MM400 Mixer Mill	Type A	Brine and olive	Deciphering Microbial Community Dynamics and Biochemical Changes During Nyons Black Olive Natural Fermentations	33133054
Precellys® Evolution	Type A	Colon	The Microbial Metabolite Butyrate Induces Expression of Th1-Associated Factors in CD4 ⁺ T Cells	28894447
Precellys® 24	Type A	Sediment	Sulfate Alters the Competition Among Microbiome Members of Sediments Chronically Exposed to Asphalt	33133031
Precellys® 24	Type B	Bacteria	Cytometry meets next-generation sequencing – RNA-Seq of sorted subpopulations reveals regional replication and iron-triggered prophage induction in <i>Corynebacterium glutamicum</i>	30291266
TissueLyser II	Type A	Soil	Soil microbial sensitivity to temperature remains unchanged despite community compositional shifts along geothermal gradients	34585498
TissueLyser II	Type A	Caecum	Enantioseparation and selective detection of D-amino acids by ultra-high-performance liquid chromatography/mass spectrometry in analysis of complex biological samples	24315356
FastPrep-24™	Type E	Corals	Molecular Mechanisms of Coral Persistence Within Highly Urbanized Locations in the Port of Miami, Florida	https://doi.org/10.3389/fmars.2021.695236
SpeedMill P12	Type A	Larva	New codon 198 β -tubulin polymorphisms in highly benzimidazole resistant <i>Haemonchus contortus</i> from goats in three different states in Sudan	32122383
Mini-BeadBeater-16	Type A	Soil	Metagenomic Analysis for Evaluating Change in Bacterial Diversity in TPH-Contaminated Soil after Soil Remediation	34941754
Bullet Blender® Blue homogenizer	Type B	Bacteria	Characterization of vaginal microbiota in Thai women	30498641
taco™Prep Bead Beater	Type A	Stool	Differences in microbiome and virome between cattle and horses in the same farm	32054207
Vortex	Type A	Stool	Distribution of <i>Giardia duodenalis</i> (Assemblages A and B) and <i>Cryptosporidium parvum</i> amongst migrant workers in Peninsular Malaysia	29501402
Vortex	Type A	Soil	High-Throughput DNA Sequence-Based Analysis of AMF Communities	32415599
Vortex	Type A	Stool	Entamoeba infections and associated risk factors among migrant workers in Peninsular Malaysia	33597471