

PerkinElmer chemagen Technologie GmbH



UNIQUE
TECHNOLOGY
FOR DNA/RNA
ISOLATION

Nucleic Acid Purification: A New Perspective

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June 2, 2014

- ▶ Who is chemagen?
- ▶ What can we do for Public Health Laboratories?
 - chemagen
 - Synergy within PKI
- ▶ Core Competence (M-PVA Beads)
- ▶ Chemistry and Automation
- ▶ Summary

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Who is chemagen?





- ▶ Any instance where Nucleic Acid Extraction is needed
 - Pathogen testing from clinical samples
 - Bacterial and Viral DNA/RNA isolation
 - Genomic DNA and Total RNA isolation
 - Waterborne pathogen testing
 - Extraction of pathogen DNA/RNA from filters
 - Food Testing
 - Extraction of DNA/RNA from plants/food/livestock
- ▶ Together with our Life Sciences and Technology Division
 - An entire workflow of nucleic acid extraction, quantification, NGS, PCR and WGA can be completely provided to Public Health Laboratories
- ▶ Diagnostics Business (Newborn screening, Laboratory Services)

▶ Routinely Detected Pathogens

- HAV, HBV, HCV, HGV, HIV, pB19, CMV, VZV, HPV, HSV (I + II), EBV
- Noroviruses, Influenza, Adenoviruses
- *Chlamydia*, MRSA, FSME, EHEC, *Legionella*, *Listeria*, *Borrelia*, *N. Gonorrhoeae*, *Ureoplasma*, *Mycoplasma*, *Chlostridium*
- *Cryptosporidium* and *Giardia*

▶ From sources

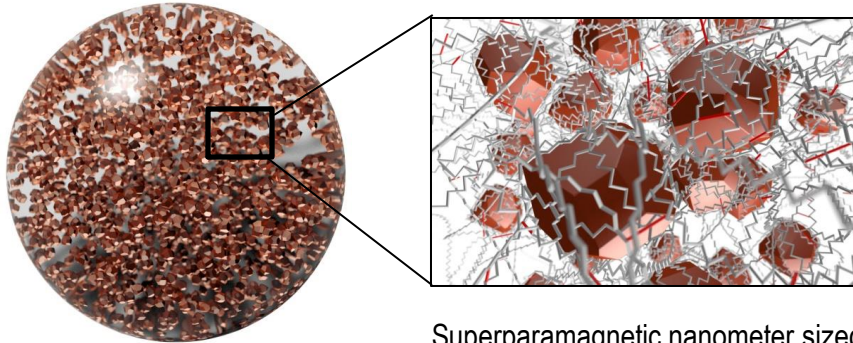
- Human body fluids/tissue
- Food and livestock
- Water
- Plants

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Core Competence: M-PVA

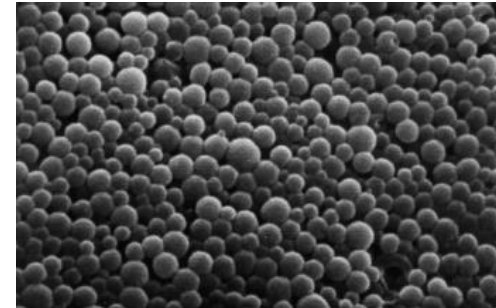


Magnetic Polymer Particles “Magnetic Beads” based on Polyvinyl Alcohol (PVA)



~ 1 μm

Superparamagnetic nanometer sized magnetite particles encapsulated in a matrix of crosslinked PVA.



Electron microscopic image

- ▶ High magnetite content
 - enables fast magnetic separation, even from large volumes
- ▶ Specific carboxylated bead surface with high affinity to nucleic acids
 - resulting in high quantitative yields of NA
- ▶ Hydrophilic bead surface with non-measurable binding properties for proteins
 - resulting in very pure DNA
- ▶ DNA can easily be eluted at room temperature
 - (in contrast to e.g. silica particles)
 - Beads can be dried without affecting the bound DNA or RNA (high purities)
- ▶ Allows the processing of inhomogeneous/compromised sample material
 - (leading e.g. to clogging of columns)
- ▶ Ideal for automation
 - (no vacuum station or centrifuges necessary)

MAGNETIC BEADS
ARE IDEAL FOR
AUTOMATION



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Chemistry and Automation

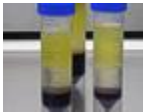


Sample Source

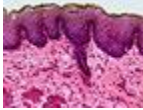
Human



Human Blood



Buffy Coats



Tissue /
FFPE Tissue



Amniotic Fluid



Serum/
Plasma



Buccal Swabs/
Saliva

Veterinary



Animal Blood

Plant

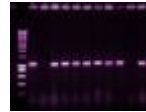


Plant



Food

Amplification Products



PCR Product
Purification



Sequencing Reaction
Cleanup

Culture



Cells



Bacteria

HUGE VARIETY OF
MAGNETIC BEAD
BASED KITS

To isolate

Genomic DNA

Pathogen DNA/RNA

Total RNA

ccf DNA

▶ chemagic Viral DNA/RNA Kit special

chemagic MSM I
9.6 ml plasma mini
pool samples
ca. 60 min
In house PCR Kits

Virus	Detection Limits [IU/ml]
HAV	2,6 ¹
HBV	0,7 ²
HCV	5,0 ²
HIV	3,3 ²
B19V	4,6 ³

Data kindly provided by

1DRK-Blutspendedienst West gGmbH, Zentrallabor Hagen;

2DRK-Blutspendedienst Sachsen gGmbH, Institut für Transfusionsmedizin Plauen;

3DRK-Blutspendedienst Hessen gGmbH, Institut für Transfusionsmedizin Frankfurt.

Principle of Manual Nucleic Acid Isolation with Magnetic Beads



Lysis



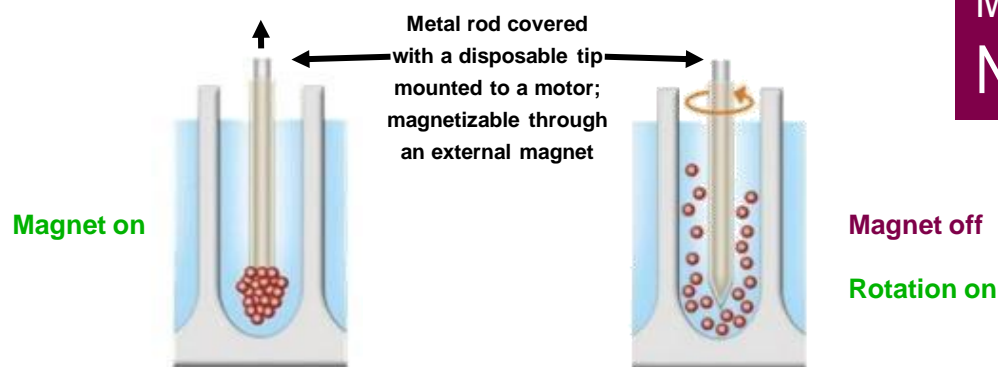
Chemically driven release of
NA depending on the
sample material

Advantages due to this process

- ▶ Different kinds of sample material can be used
- ▶ Easy automation possible

The chemagic separation and resuspension technology consists of

- ▶ a magnet that can be switched on and off
- ▶ metal rods that can be magnetized for efficient collection of particles
- ▶ a stirring motor to which the metal rods are connected enabling the efficient mixing of particles when the motor is switched on and the electro magnet is switched off



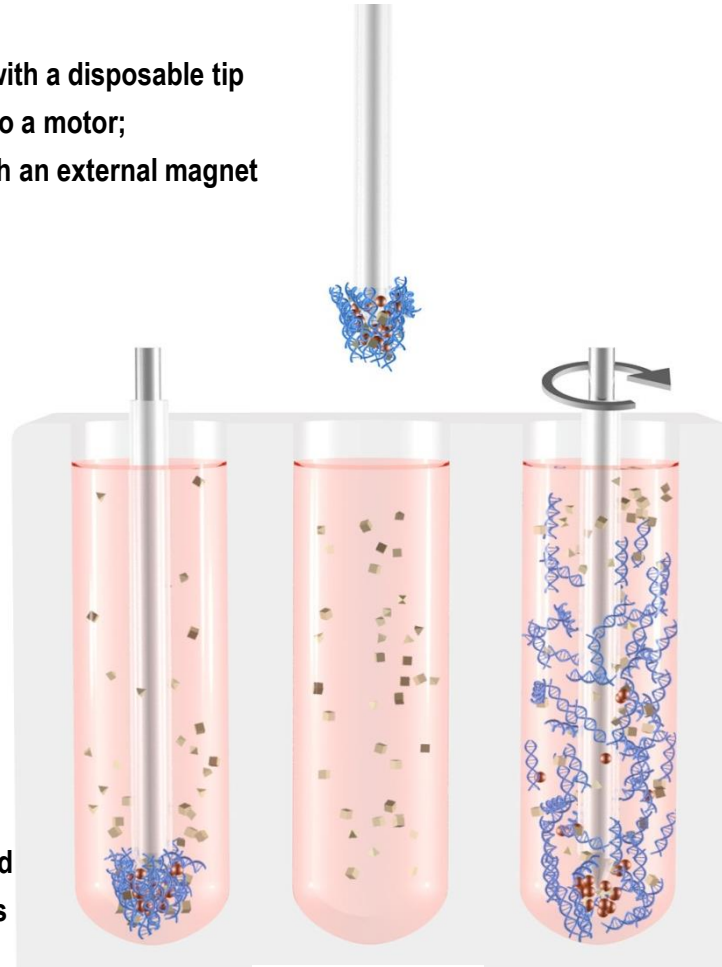
**TRANSFER OF
MAGNETIC BEADS
NOT LIQUIDS**

The chemagic Separation Technology is realized in the

- ▶ chemagic Magnetic Separation Module I
- ▶ chemagic Prepito
- ▶ JANUS chemagic Workstation

Metal rod covered with a disposable tip
mounted to a motor;
magnetizable through an external magnet

TRANSFER OF
MAGNETIC BEADS
NOT LIQUIDS



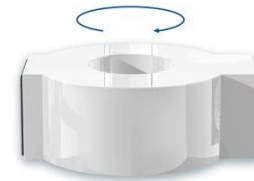
Magnet on

Efficient collection of particles:
The external magnet generates an electric field
which is strongest at the top of the metal rods

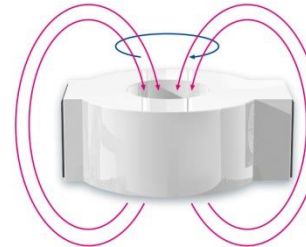
Magnet off
Rotation on

Efficient mixing of particles:
Rotating needles guarantee thorough
resuspension of the particles

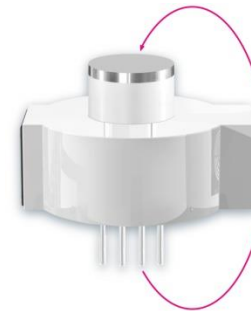
- ▶ The chemagic MSM I – use of an electro magnet to magnetize rods



The electro magnet consists of an aluminium coil in a cover. When the power is switched on, an electric field (black line) is generated



The electric field induces a magnetic field (red lines)



The magnetic field lines are conducted through metal rods. The strongest magnetic field is at the top of the rods of the chemagic Rod Head. Nearly no magnetic field is at their sides

Strongest magnetic field at the top of the rods

The main parts of the chemagic MSM I

chemagic Rod Head

Consisting of metal rods and gearbox with motor. Mounted to a linear motion system ensuring its movement up and down THROUGH the hole in the electro magnet

Electro magnet

circular unit with a hole in the center



X-Axis

Linear motion axis on which all required process solutions are placed in appropriate reaction vessels






► chemagic Dispenser

- Simultaneous filling of up to 8 different buffers with different buffer volumes
- Available for all three head formats
- Fully integrated in the chemagic MSM I software
- Reduces hands-on time
- Waste of buffer is minimized
- Based on membrane pump technology

► chemagic QA Software

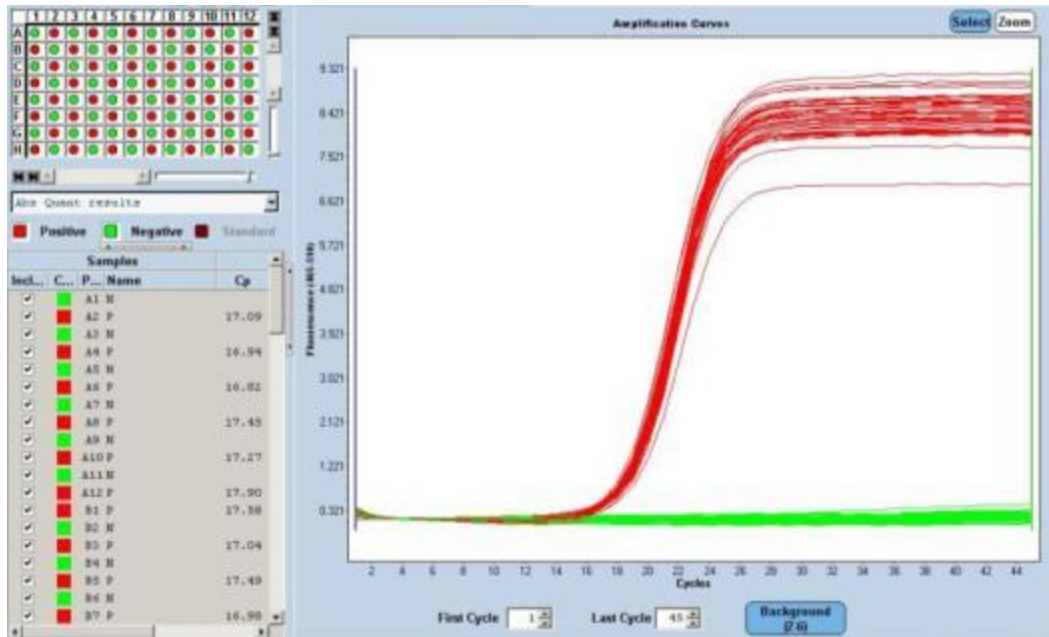
- Barcode reading/Sample tracking
- LIMS compatible log files
- User management
- Easy navigation and set up
- Pre-installed protocols
- Tracking the progress of a running protocol

► chemagic Rod Heads

	chemagic 96 96 Rod Head 	chemagic 24 24 Rod Head 	chemagic 12 12 Rod Head 
Processable Sample Volume	10 µl – 400 µl	200 µl – 4 ml	1 ml – 10 ml
Samples per Run	1 – 96	1 – 24	1 – 12

chemagic MSM I, equipped with the chemagic 96 Rod Head,
for low volume applications, from up to 400 μ l sample volume

- ▶ Chess board test with high titer and negative Norovirus samples



Real Time PCR

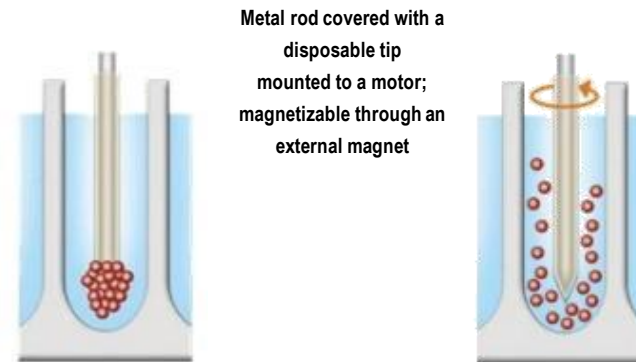
Positive and negative Norovirus samples were processed with the chemagic MSM I in one run.

In the subsequent Real-Time PCR no cross contamination occurred.

TRANSFER
OF BEADS
NOT LIQUIDS

Features at a Glance

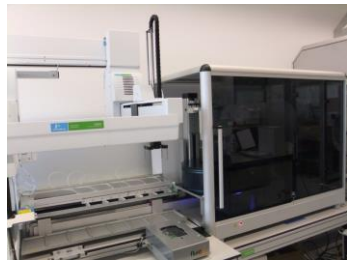
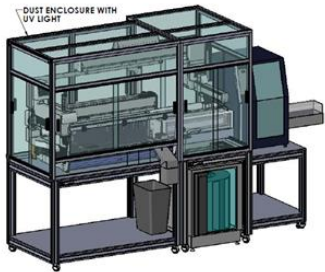
- ▶ Huge volume flexibility: one instrument for all sample volumes (10 μ l – 10 ml)
- ▶ 12 large volume samples in 45 – 60 min
- ▶ 24 medium volume samples in 35 – 60 min
- ▶ 96 low volume samples in 15 – 60 min
- ▶ Huge kit portfolio
- ▶ Enhanced success rates for downstream applications (no drop outs)
- ▶ Optional buffer dispensing and sample tracking (bar code reading)
- ▶ No cross contamination
- ▶ Highest consistency
- ▶ Automation and chemistry from the same company
- ▶ Easy to connect to Liquid Handling platforms



<http://www.chemagen.com/chemagic-concept.html>



Janus/chemagic MSM I



Linear arrangement of a chemagic MSM I with a PKI LH



Angulate arrangement of a chemagic MSM I with a PKI LH

chemagic MSM I + LH



chemagic MSM I + HAMILTON Star



chemagic MSM I + BECKMAN COULTER Biomek NX



chemagic MSM I + TECAN Freedom Evo 150



chemagic MSM I + TECAN Freedom Evo 150 with Bigneat housing

chemagic Kits adopted to LH Instruments



AUTOMATION SOLUTIONS FOR EVERY DEMAND



chemagic Kits LH + PerkinElmer JANUS Mini MDT



chemagic Kits LH + PerkinElmer JANUS expanded



chemagic Kits LH + BECKMAN COULTER Biomek® FX Robotic Workstation

Key Features and Benefits

- ▶ Independent liquid handling and extraction scheduling:
 - Primary sample transfer, normalization and PCR setup applications
 - Up to 192 samples per run with 96-rod head
 - Up to 48 samples per run with 24-rod head
- ▶ Sample volume range from 10 μ l - 4 ml
- ▶ Standardized pre-programed protocols for reproducible, high throughput extraction of DNA in blood or saliva
- ▶ Intuitive graphical user interface

Ideal solution for the unique requirements needed in

- ▶ PCR/qPCR,
- ▶ Genotyping
- ▶ Genome wide analysis



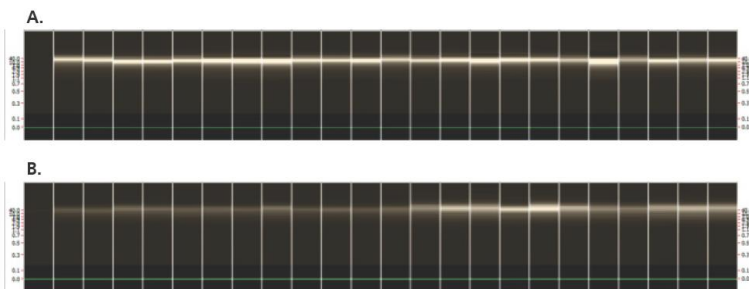
All standard features of the standard Workstation, with the following changes:

- ▶ 8-tip VariSpan Liquid Handling Workstation
- ▶ Gripper Arm
- ▶ Automated Tube Barcode Reader
- ▶ Enclosure with Table
- ▶ Optional integration of LabChip DS for UV/Vis quantitation and sample normalization



Completion of genomic analysis workflows with LabChip® Microfluidic Technology

- ▶ Genomic DNA assay is used to generate accurate size, concentration, and quality assessment of intact, full length DNA
- ▶ Additional DNA and RNA assays are available



LabChip GX analysis of gDNA isolated from 2 ml and 300 μ l blood sample volumes (Figures 1A and 1B) using the JANUS chemagic Workstation. Virtual gel images created within the LabChip software illustrate intact gDNA post extraction. n=24. Sample 1 is a blank.



LabChip DS analysis of a 96-well plate of gDNA isolated from different blood volumes using the JANUS chemagic Workstation.

Key Features and Benefits

- ▶ Revolutionary compact benchtop design
800 x 650 x 900 mm (L/WH)
- ▶ Sample Volumes from 10 μ l - 10 ml
- ▶ High throughput
- ▶ Facilitating reliable and approved chemagic Separation Technology, ensuring
 - No cross contamination
 - Smooth and efficient resuspension technology
- ▶ Convenient and improved sample management
- ▶ User-friendly modular system
- ▶ Integrates with LH platforms
- ▶ Quality Assurance through
 - Bar code reading for sample tracking
 - Ease of use chemagic QA Software

Unique Selling Proposition

- ▶ The only compact benchtop, high volume, high throughput system on the market



chemagic 360, equipped with chemagic 12 Rod Head and chemagic Dispenser 360

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Summary



- ▶ Unique M-PVA magnetic beads and chemistry for nucleic acid isolation
- ▶ MSM I technology is designed to specifically work with M-PVA beads for a premium nucleic acid purification
- ▶ We can offer Public Health Laboratories means for pathogen detection, human and animal genetics and food testing through nucleic acid purification
- ▶ PerkinElmer is able to provide a full-range of solutions from nucleic acid isolation to detection to analysis

Selection of Worldwide chemagic MSM | Customers





HUMAN HEALTH | ENVIRONMENTAL HEALTH

chemagen Technology

Thank you for your attention!

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