

# Nanotrap<sup>®</sup> Wastewater Solutions

*Do you know what you are missing?*

## A Method That Works For You

*Capture and concentrate viruses from wastewater, while eliminating the time-consuming and laborious processes of filtration and centrifugation.*

Large-scale wastewater surveillance can be used to help communities monitor infection dynamics for SARS-CoV-2, but wide-spread implementation of wastewater surveillance has been stymied by lack of a robust, high-throughput viral concentration method.

Nanotrap<sup>®</sup> Magnetic Virus Particles integrate seamlessly into existing workflows and reduce the time and effort associated with other traditional methods of virus concentration.

Use Nanotrap Magnetic Virus Particles to replace filtration or centrifugation methods for virus concentration, without sacrificing assay sensitivity.



Figure 1. Traditional wastewater processing workflow

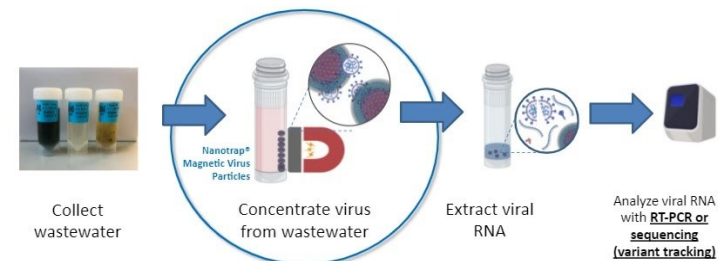


Figure 2. Nanotrap particle workflow

## Particles That Push Results Further

*Capturing more RNA decreases the chances of a miss in your downstream test.*

The throughput improvements using Nanotrap Magnetic Virus Particles are substantial. Nanotrap Magnetic Virus particles concentrate virus from 24 wastewater samples in less than one hour with the use of an automated method.

The viral RNA recovery from low sample volumes is remarkable, as well. A method using Nanotrap Magnetic Virus Particles was shown to detect 1 asymptomatic individual in a building of 415 residents<sup>1</sup> from a 10 mL sample volume. With manual and automated methods available, there are many options to implement the Nanotrap technology in a way that works best for you.

### Key benefits of the Nanotrap method:

- Works with many leading RNA extraction kits from vendors such as MACHEREY-NAGEL, Promega, Applied Biosystems, QIAGEN, Zymo Research, and IDEXX. Protocols available at <https://www.ceresnano.com/protocols-virus>
- Compatible with RT-qPCR, RT-ddPCR, and sequencing-based analysis methods.
- Replaces filtration and centrifugation methods, without sacrificing assay sensitivity.
- Supported by the U.S. National Institutes of Health RADx<sup>SM</sup> Initiative.

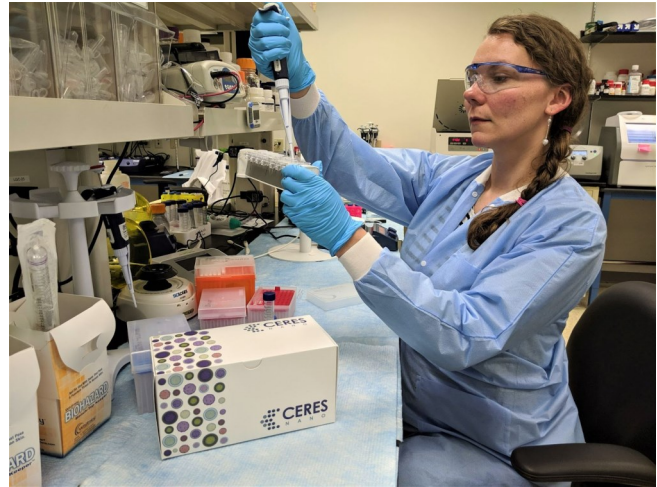
<sup>1</sup>High throughput wastewater SARS-CoV-2 detection enables forecasting of community infection dynamics. mSystems, March 2021. <https://journals.asm.org/doi/10.1128/mSystems.00045-21?permanently=true>

# Methods That To Do More

Whether you use automated or manual methods, Nanotrap Magnetic Virus Particles enable rapid and simple methods for sample concentration.

Use Nanotrap Particles to capture and concentrate viruses with manual or automated methods for optimum performance, flexibility, and scalability. Nanotrap Magnetic Virus Particles methods provide greater:

- **Efficiency**, so you can spend more time doing what is meaningful to you, not conducting tedious filtration and centrifugation methods;
- **Accuracy**, so you can trust the process - and your results; and
- **Reproducibility**, so you can be confident in your results.



Reduce the processing time by at least **20-fold** using an automated Nanotrap Magnetic Virus Particle method<sup>1</sup>

By switching virus concentration methods to Nanotrap particles, a **customer<sup>2</sup>** improved turnaround time for wastewater test results from > 2 days to less than 1 day, while simultaneously increasing throughput to more than 100 samples per week.

## The Key To Capturing with Higher Affinity

Nanotrap Enhancement Reagents improve the binding of viruses to Nanotrap<sup>®</sup> Magnetic Virus Particles and provide the most accurate results and user-friendly methods.

Nanotrap Enhancement Reagent 1 (ER1) and Enhancement Reagent 2 (ER2) improve SARS-CoV-2 RNA detection in wastewater by at least 1-2 Ct values when used with Nanotrap<sup>®</sup> Magnetic Virus Particles.

Incorporating ER1 or ER2 into workflows is simple. Add to wastewater samples at the same time as Nanotrap<sup>®</sup> Particles, or add to wastewater samples up to 18 hours before. Use Table 1 to determine which reagent is right for you.

Vendor	Product	SKU	Reagent
MACHEREY-NAGEL	NucleoMag <sup>®</sup> DNA/RNA Water Kit	744220.1	ER1
Applied Biosystems <sup>™</sup>	MagMAX <sup>™</sup> Microbiome Ultra Nucleic Acid Isolation Kit	A42357	ER1
Applied Biosystems <sup>™</sup>	MagMAX <sup>™</sup> Viral/Pathogen Nucleic Acid Isolation Kit	A42352	ER1
Applied Biosystems <sup>™</sup>	MagMAX <sup>™</sup> Viral/Pathogen II (MVP II) Nucleic Acid Isolation Kit	A48383	ER1
Promega	Maxwell <sup>®</sup> HT Environmental TNA Kit	AX9190	ER2
QIAGEN	MagAttract <sup>®</sup> Viral RNA Kit (960)	955538	ER2
QIAGEN	QIAamp <sup>®</sup> Viral RNA Mini Kit (250)	52906	ER2
QIAGEN	AllPrep <sup>®</sup> PowerViral <sup>®</sup> DNA/RNA Kit (50)	28000-50	ER2
Zymo	ZymoBIOMICS <sup>™</sup> 96 MagBead DNA/RNA Kit	R2135	ER2
IDEXX	Water DNA/RNA Magnetic Bead Kit	98-0014719-00	ER2

**Table 1.** Select the appropriate Nanotrap Enhancement Reagent for your preferred nucleic acid extraction kit.

<sup>1</sup>High throughput wastewater SARS-CoV-2 detection enables forecasting of community infection dynamics. mSystems, March 2021. <https://journals.asm.org/doi/10.1128/mSystems.00045-21?permanently=true>

<sup>2</sup>The Value of Wastewater Surveillance to Support COVID-19 Response in a Community with Large-scale Asymptomatic Testing. [https://www.nemc.us/meeting/2021/load\\_abstract.php?id=295](https://www.nemc.us/meeting/2021/load_abstract.php?id=295)



# Nanotrap Technology in Action

*With a wastewater testing workflow built around the Nanotrap Magnetic Virus Particles, the University of California San Diego (UCSD) processed over 22,000 samples in less than one year.*

The University of California San Diego achieved impressive results in detecting SARS-CoV-2 with the use of Nanotrap Magnetic Virus Particles to process wastewater samples from over 100 campus buildings on a daily basis.

## Using Nanotrap Magnetic Virus Particles, UCSD was able to:

- Process 96 samples (from raw sewage to RT-PCR result) in under 4.5 hours<sup>1</sup>;
- Enable detection of one asymptomatic individual in a building with 415 residents<sup>1</sup>; and
- Increase COVID-19 testing rates from 1.9x to 13x by notifying individuals within a building when positive signals were found<sup>2</sup>.

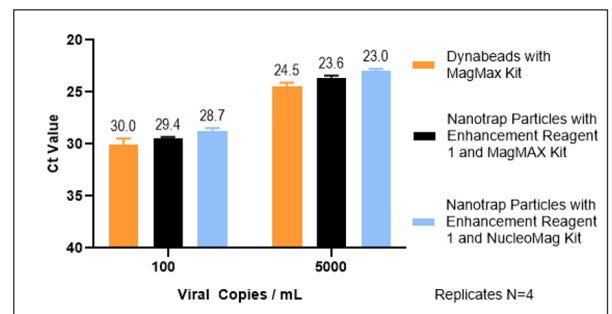
When UCSD reviewed its Fall 2020 COVID-19 campus data, it found that 85% of all individual clinical cases on campus during Fall 2020 were preceded by positive wastewater samples.<sup>2</sup>

Extracted RNA from wastewater processed with Nanotrap Magnetic Virus Particles is also ready for sequencing. UCSD reported recovery of near complete SARS-CoV-2 genomes (>99% genome coverage) from wastewater samples with cycle threshold values as high as 37.6 using a miniaturized tiled amplicon sequencing approach.<sup>3</sup>

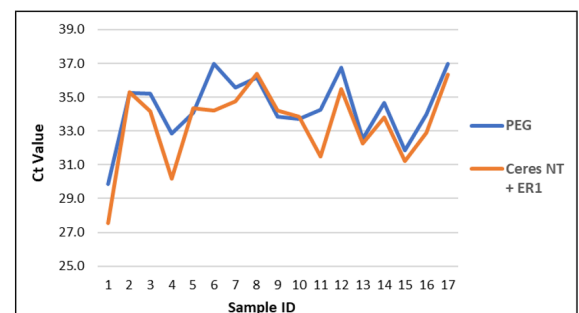
## Outperform Other Virus Concentration Methods

The performance of the Nanotrap protocol with either the NucleoMag DNA/RNA Water Kit or the MagMax Microbiome Ultra Kit was compared to a protocol utilizing Invitrogen™ Dynabeads™ Intact Virus Enrichment Beads and the MagMax Microbiome Ultra Kit. For this comparison, negative wastewater samples were spiked with SARS-CoV-2 at 100 viral copies/mL and 5000 viral copies/mL. These results demonstrate that the Nanotrap Magnetic Virus Particles and ER1 enable superior detection of SARS-CoV-2 with both RNA extraction kits [Figure 3].

In a separate study, the University of Kansas compared Nanotrap Magnetic Virus Particles and ER1 with a PEG precipitation method to concentrate SARS-CoV-2 from real wastewater samples prior to RNA extraction. The results from the Nanotrap protocol, performed on a KingFisher™ Apex System, correlated well with those from the PEG method. Moreover, the Nanotrap protocol improved Ct values in 12 of the 17 samples and was equivalent to the PEG method in the remaining 5 samples [Figure 4].



**Figure 3.** Nanotrap Magnetic Virus Particles with ER1 compared to Dynabeads™ Intact Virus Enrichment Beads method.



**Figure 4.** Nanotrap Magnetic Virus Particles with ER1 compared to PEG precipitation method.

<sup>1</sup>High throughput wastewater SARS-CoV-2 detection enables forecasting of community infection dynamics. mSystems, March 2021. <https://journals.asm.org/doi/10.1128/mSystems.00045-21?permanently=true>

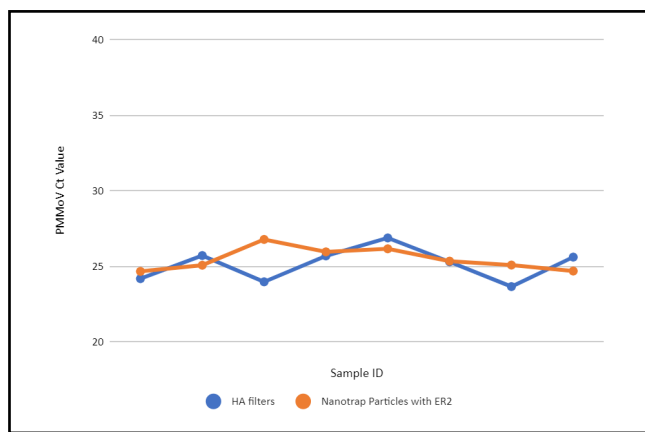
<sup>2</sup>Rapid, large-scale wastewater surveillance enabled early detection of nearly 85% of COVID-19 cases. mSystems, July 2021. <https://journals.asm.org/doi/10.1128/mSystems.00793-21>

<sup>3</sup>Wastewater and surface monitoring to detect COVID-19 in elementary school settings: The Safer at School Early Alert project Fielding-Miller R, et al. medRxiv 2021.10.19.21265226; doi: <https://doi.org/10.1101/2021.10.19.21265226>

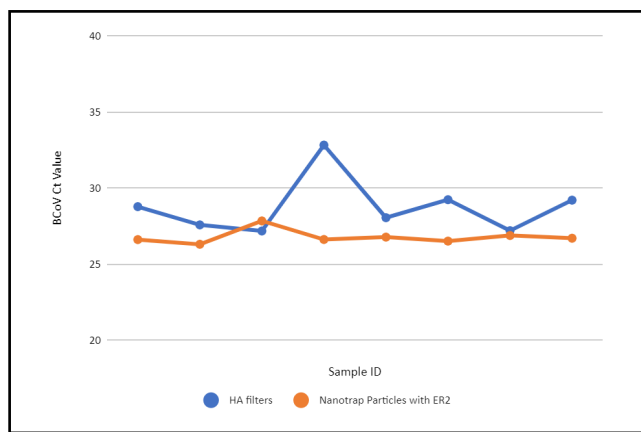
# Outperform Other Virus Concentration Methods

Nanotrap Enhancement Reagent 2 (ER2) enables a gain in sensitivity in wastewater virus detection in combination with Nanotrap Magnetic Virus Particles and RNA extraction kits from QIAGEN, Promega, IDEXX and Zymo Research.

A customer at a university lab compared a traditional HA filter concentration method against the Nanotrap Magnetic Virus Particles with ER2 with an RNA extraction kit from Promega (Maxwell® HT Environmental TNA Kit). The qPCR results for N1, N2, Bovine Respiratory Coronavirus (BCoV), and Pepper Mild Mottle Virus (PMMoV) are shown Figures 5-6. The Ct values demonstrate greater or equivalent sensitivity to the standard HA filter process. Cost savings in consumables and labor were noted by the lead microbiologist.



**Figure 5.** Nanotrap Magnetic Virus Particles with ER2 compared to HA filtration method for SARS-CoV-2 N1 gene.



**Figure 6.** Nanotrap Magnetic Virus Particles with ER2 compared to HA filtration method for BCoV.

## Our Commitment

Our dedicated applications support team takes a collaborative approach with our customers. We deliver high quality and innovative solutions through a consultative support approach, and we can think out-of-the-box, when necessary. Together, we can solve your sample preparation challenges.

## Quality You Can Count On

Ceres delivers the highest caliber products and solutions to its customers. With a Quality Management System built to ISO 9001 standards and with products that have been incorporated successfully into RT-PCR assays with FDA Authorization, we have the experience to support your regulatory and quality requirements.

Nanotrap kits are not intended or validated for use in the diagnosis of disease or other conditions.

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## Ordering

**Connect with the Ceres Nanosciences Team to learn more**  
[sales@ceresnano.com](mailto:sales@ceresnano.com) 1.800.615.0418 EXT. 1

Nanotrap® Magnetic Virus Particles (SKU# 44202)

Nanotrap® Enhancement Reagent 1 (SKU# 10111)

Nanotrap® Enhancement Reagent 2 (SKU# 10112)

