Automated Nanotrap® Wastewater Protocol using QIAGEN MagAttract® Viral RNA Kit

Objective: This protocol uses Nanotrap® Magnetic Virus Particles and Nanotrap® Enhancement Reagent 2 to capture and concentrate viruses in wastewater samples. It is optimized for viral capture from 10 mL samples of wastewater and is compatible with QIAGEN MagAttract® Viral RNA Kit. This method has been verified with SARS-CoV-2 viral samples.

Materials and equipment:

1. Wastewater sample
2. Nanotrap® Enhancement Reagent 2 (ER2) (Ceres Nanosciences SKU 10112)
    a. Using ER2 improves viral detection by 1-2 Ct values when used with Nanotrap® Magnetic Virus Particles, but it is ok to skip addition of ER2in this protocol if it is not available.
3. Nanotrap® Magnetic Virus Particles (Ceres Nanosciences SKU 44202)
4. Thermo Scientific KingFisher™ Apex
5. MagAttract® Viral RNA Kit (QIAGEN Cat# 955538)
    a. Buffer ACL
    b. Buffer QSB1
    c. Buffer MW1
    d. Buffer AVE
    e. MagAttract Beads
6. 5.5M Guanidine Thiocyanate (Sigma Cat# G9277-100G)
7. 80% Ethanol
8. 3-24 well-KF Deep Well Plates
9. 1-24 well-KF Deep Well Comb
10. 5-96 well-KF Deep Well Plates
11. 1-96 well-KF 200 µL Well Plate
12. 1-96 well-KF Deep Well Comb

Procedure:

Capture and Concentrate Virus using Nanotrap® Particles

1. **Ceres Nanotrap KF Procedure - Part 1**
    a. Prepare Sample Plates
        i. Add 4,875 µL of wastewater sample from wastewater bottle to one well (one well per sample) of a new KingFisher™ 24 Well Deep Well Plate.
        ii. Add another 4,875 µL of each sample to the same well on a second KingFisher™ 24 Well Deep Well Plate. For example, if you loaded a sample into well A1 of the first plate, load the second volume of that sample into well A1 of the second plate.
        iii. Add 50 µL of Nanotrap® Enhancement Reagent 2 (ER2) Solution to each wastewater sample on the two KingFisher™ 24 Well Deep Well sample plates.
            1. Using ER2 improves viral detection by 1-2 Ct values when used with Nanotrap® Magnetic Virus Particles, but it is ok to skip addition of ER2 and proceed to the next step.

iv. Add 75 µL of Nanotrap® Magnetic Virus Particles to each wastewater sample on the two KingFisher 24 Well Deep Well sample plates.
v. Insert the comb into one of the sample plates. This will be "Sample Plate 1" while the other plate will be "Sample Plate 2".

b. *Prepare Lysis Plate*
   i. Add 300 µL of MagAttract® Guanidine Thiocyanate solution to the third Kingfisher™ 24 Well Deep Well Plate matching the number and location of the "Sample Plate" wells.

c. *Run NT KingFisher™ Protocol (See attached file)*
   i. Follow the on-screen instructions loading the previously prepared plates at the appropriate time.

d. Once the protocol is completed, the KingFisher™ plate to which lysis solution was added will contain lysate that is ready to be run on the Kingfisher's MagAttract® procedure.

2. MagAttract KF Extraction Procedure -Part 2

a. Prepare Wash Plate 1
   i. Add 500 µL of Buffer MW1 to a new KingFisher™ 96 Deep Well Plate matching the number and location of the KingFisher™ 96 Deep Well Plate- Bead Binding Plate wells.

b. Prepare Wash Plate 2
   i. Add 500 µL of Buffer MW1 to a new KingFisher™ 96 Deep Well Plate matching the number and location of the KingFisher™ 96 Deep Well Plate- Bead Binding Plate wells.

c. Prepare Wash Plate 3
   i. Add 500 µL of 80% Ethanol to a new KingFisher™ 96 Deep Well Plate matching the number and location of the KingFisher™ 96 Deep Well Plate- Bead Binding Plate wells.

d. Prepare Wash Plate 4
   i. Add 500 µL of 80% Ethanol to a new KingFisher™ 96 Deep Well Plate matching the number and location of the KingFisher™ 96 Deep Well Plate- Bead Binding Plate wells.

e. Prepare Elution Plate
   i. Add 50 µL of Buffer AVE to a new KingFisher™ 96- Well (200 µL) Plate matching the number and location of the KingFisher™ 96 Deep Well Plate- Bead Binding Plate wells.

f. Prepare MagAttract® Bead Binding Plate
   i. To a new KingFisher™ 96 Deep Well Plate, add 300 µL of the lysate from each well of the lysis plate used in Part 1 of the protocol. Keep track of which well contains which sample in this new bead binding plate.
   ii. Add 170 µL of Buffer ACL and 275 µL of Buffer QSB1 to each well in which lysate was added.
   iii. Vortex the MagAttract® Beads thoroughly and add 25 µL to each well.
   iv. Insert the KingFisher™ 96 Deep Well Comb into the Bead Binding Plate.

g. *Run MagAttract KingFisher™ Protocol (See attached file)*
    i. Follow the on-screen instructions loading the previously prepared plates at the appropriate time.

3. Once the protocol is completed, the KingFisher™ 96 -Elution Plate will contain purified viral RNA that is ready to be loaded onto a PCR plate.

Attachments: 2

KingFisher™ Apex

1. *KF-010-WW-Nanotrap-24.kfx*
2. *KF-010-WW-MagAttract-96.kfx*