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## **RV Filter System – Product Analysis**

Reference WO #: 0605-407

### **Background**

Jim Worden contacted Microbac to validate the effectiveness of a portable filter system that attaches to RV/Motorhomes. The filter is to remove potential contaminants from various water sources found at campsites and RV parks. The first goal was to establish the filters effectiveness at removing bacteria, specifically bacteria from fecal material, from the water sources. The second goal was to test the systems effectiveness at removing viral particles such as Hepatitis A from water sources.

### **Materials and Methods**

Two types of analyses were set up to test the efficiency of the RV filter system. The first involved the spiking of known concentrations of E. coli (ATCC# 15597) into the filter, capturing the outflow from the filter, and subsequent plating of the outflow to recover spiked bacteria. Duplicate dilutions were setup from  $10^3$  to  $10^7$  bacteria cells then filtered through the system. Bacteria were recovered onto 0.45uM filters then plated using specific E. coli media. Bacteria were allowed to grow overnight at 37°C and then plates were read the following day to determine filter efficiency.

For the virus challenge, a large initial spike of  $1.87 \times 10^6$  virus particles (ATCC# 15597-B1) was filtered through the system and then dilutions of the recovered outflow were plated onto TSA plates containing host E. coli (ATCC# 15597) bacteria. Dilutions were made from both the filtered material and pre-filtered stock to establish the efficiency of the filter.

## Results

The following is a summation of the results.

### Bacteria – E. coli (ATCC#15597)

| Dilution Spike     | 10 <sup>3</sup> Cells | 10 <sup>4</sup> Cells | 10 <sup>5</sup> Cells | 10 <sup>6</sup> Cells | 10 <sup>7</sup> Cells |
|--------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Recovery Results 1 | 0 CFU                 | 0 CFU                 | 0 CFU                 | 0 CFU                 | 0 CFU                 |
| Recovery Results 2 | 0 CFU                 | 0 CFU                 | 0 CFU                 | 0 CFU                 | 0 CFU                 |

### Virus – E. coli phage MS2 (ATCC#15597-B1) – Initial Spike 1.87x10<sup>6</sup> virus particles

| Dilutions        | 10 <sup>0</sup> | 10 <sup>-1</sup> | 10 <sup>-2</sup> | 10 <sup>-3</sup> | 10 <sup>-4</sup> | 10 <sup>-5</sup> |
|------------------|-----------------|------------------|------------------|------------------|------------------|------------------|
| Before Filtering | TNTC            | TNTC             | TNTC             | TNTC             | 120pfu           | 25pfu            |
| After Filtering  | TNTC            | 87pfu            | 13pfu            | 0pfu             | 0pfu             | 0pfu             |

TNTC: Too Numerous To Count

CFU: Colony Forming Units

PFU: Plaque Forming Units

## Discussion

For the bacteria testing, all recovered spikes returned negative results indicating complete (100%) removal of the contaminants by the filtration system.

Results from the virus challenge show that the filter system, while not able to fully remove all of the virus particles, was able to significantly reduce the overall number of the viral particles from 1,870,000 pfu down to 1,085 pfu, achieving a 99.9% reduction of the total viral load.

While the filter achieved complete reduction of very high bacterial levels and 99.9% reduction of the viral particles, it is important to note that most water sources found at normal camping / parking sites would not contain contamination of viral or bacterial above that which were successfully removed by the filtration series.