

Supporting information for

Integrating Activated Carbon into Conventional Sand Filtration Boosts

Biological Mn(II) Removal Efficiency

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This file includes supplementary text, tables, and figures:

- 11 pages
- 2 parts of supplementary text
- 1 table
- 7 figures

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Text S1 Water Sample Collection and Analysis

The water samples were collected from the bottom effluent water of the filter columns during the first 2 hours of the daily flow state. Water samples were filtered through 0.22- μ m polyethersulfone membrane and the filtrate was then acidized with nitric acid to achieve a HNO₃ concentration of 1% (w/w). All water samples to be measured in this experiment were stored in 15 mL polypropylene centrifuge tubes, and acidified for at least 24 h before analysis. The inductively coupled plasma mass spectrometry (ICP-MS, Agilent Technologies 7900) was used to analyze the dissolved Mn (assumed to be Mn(II)) concentration in the filtrate. A HQ2100 Portable Multi-Meter (Hach, USA) was used to measure the pH and dissolved oxygen of water samples.

Text S2 Information of Primers

The primer pair 338F and 806R is used for the amplification of the bacterial 16S rRNA gene. The 338F primer has the sequence 5'-ACTCCTACGGGAGGCAGCAG-3', a length of 20 nucleotides, and a melting temperature (T_m) of approximately 60-62°C, specifically targeting the V3 region of the 16S rRNA gene. The 806R primer, with the sequence 5'-GGACTACHVGGGTWTCTAAT-3', is also 20 nucleotides long, with a T_m of about 55-57°C, designed to amplify the V4 region. This primer pair is widely used in 16S rRNA gene sequencing of microbial communities, aiding in the study of community structure and diversity.

Table S1 Water quality data for raw water and air flotation pool effluent used for the filtration experiments.

Parameters	Source water	effluent water of air flotation
Dissolved organic carbon	1.0 ~ 3.0 mg/L	1.0 ~ 2.0 mg/L
Dissolved oxygen	7.6 ~ 8.7 mg/L	7.9 ~ 10.7 mg/L
Total manganese	10 ~ 20 µg/L	10 ~ 20 µg/L
Dissolved manganese	5 ~ 10 µg/L	3 ~ 10 µg/L
pH	7.6 ~ 7.8	7.5 ~ 7.9
Total iron	10 ~ 100 µg/L	20 ~ 35 µg/L
Dissolved iron	10 ~ 20 µg/L	< 10 µg/L
Total aluminum	200 µg/L	90 ~ 150 µg/L
Dissolved aluminum	10 ~ 50 µg/L	5 ~ 30 µg/L
Temperature	25 ~ 35 °C	22 ~ 30 °C

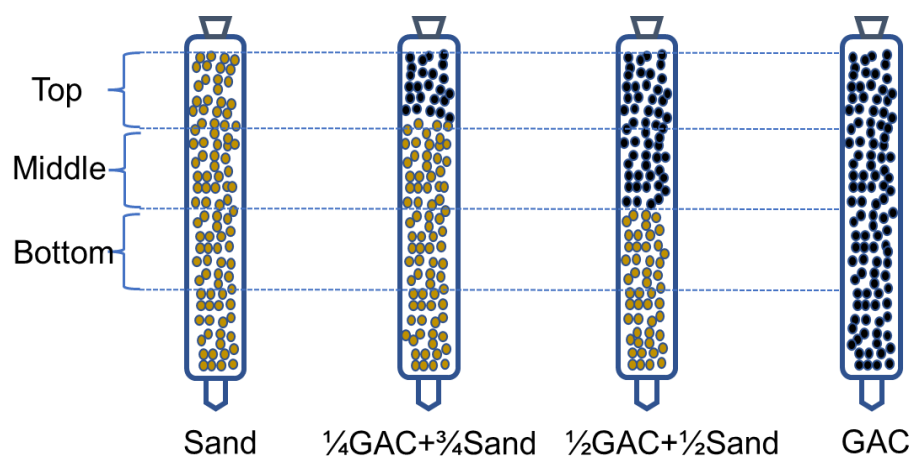


Figure S1. The model diagram of different filtration columns.

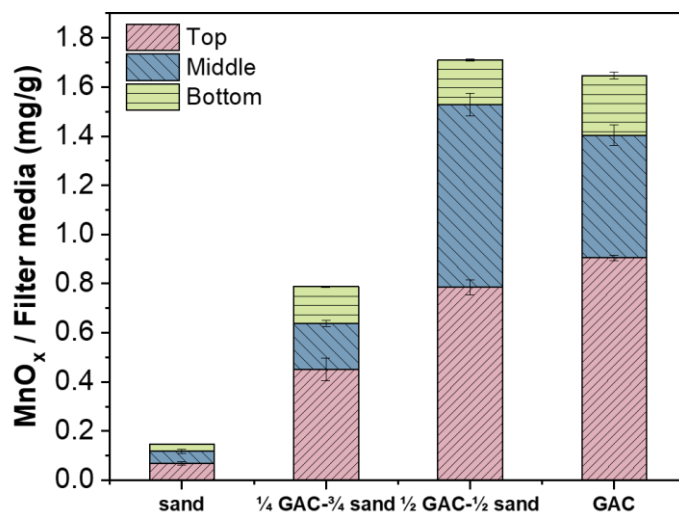


Figure S2. The quality of MnO_x enriched by different filter columns.

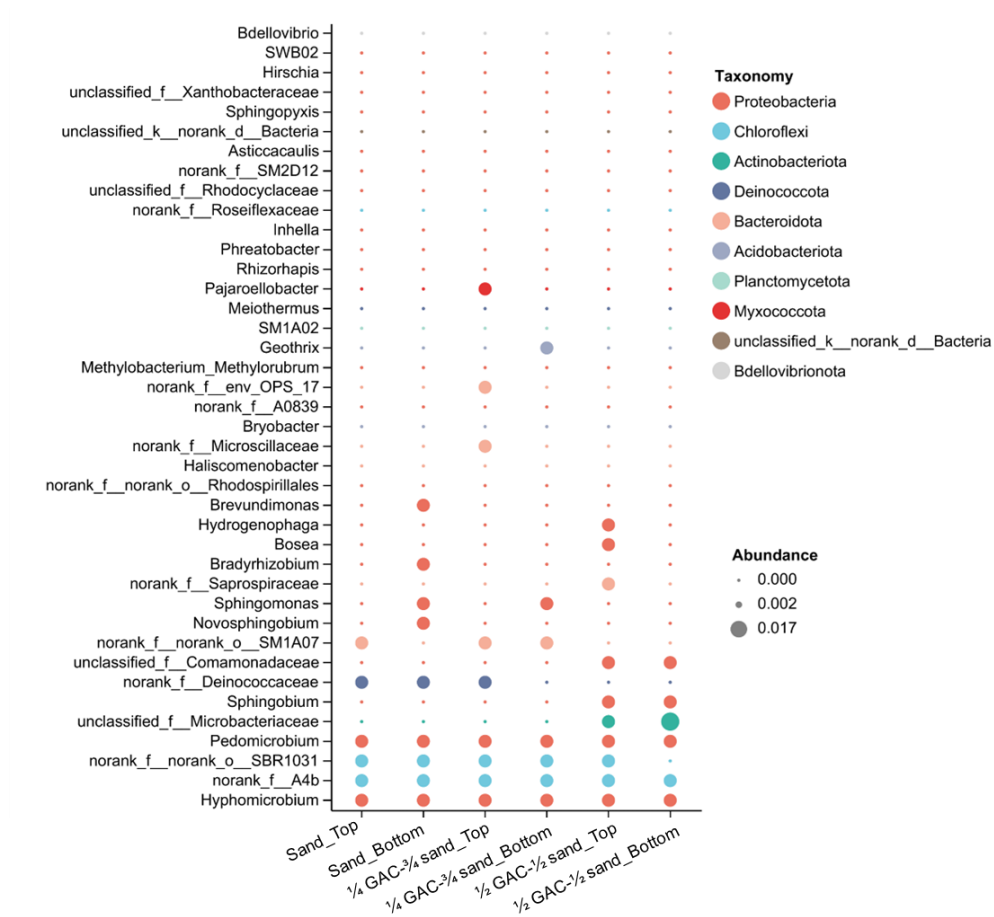


Figure S3. The relative abundance of bacteria in the top and bottom layers of different filter columns.

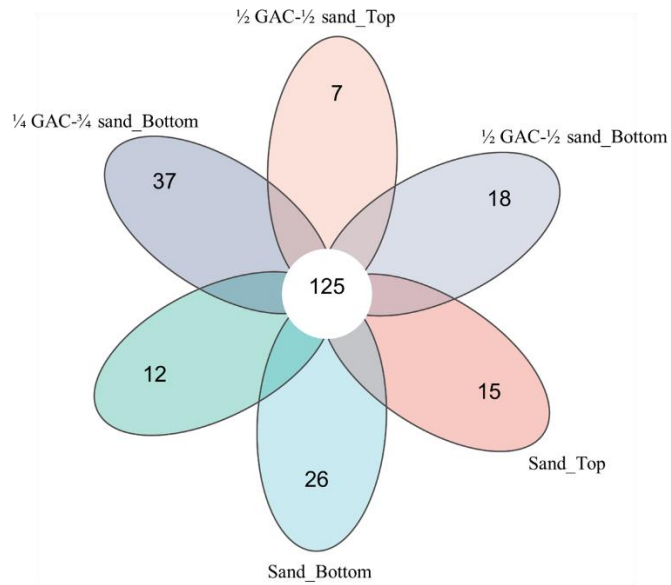


Figure S4. Venn diagram of bacterial community of different biofilm samples collected from the top and bottom layers of different columns.

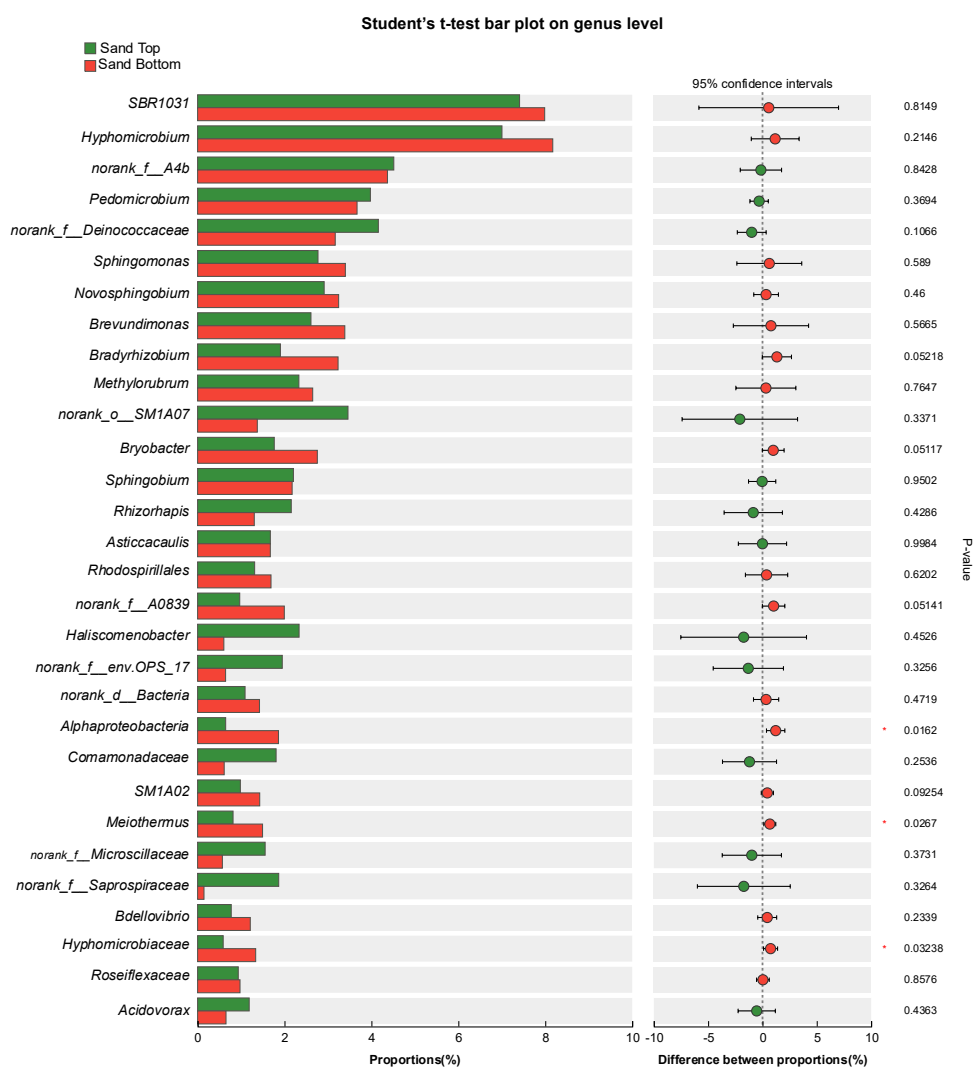


Figure S5. The difference in the abundance of the 30 most abundant bacteria in the top and bottom layers of the sand column.

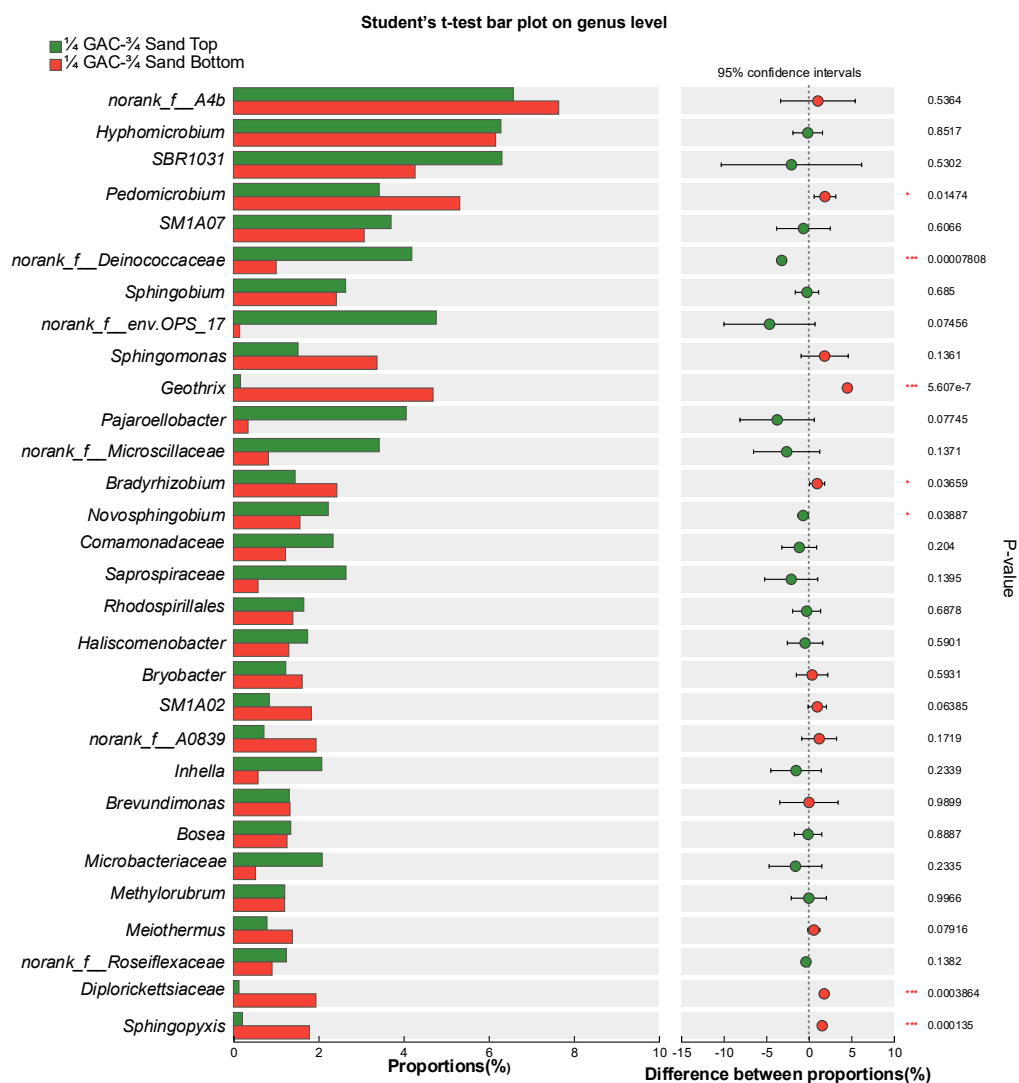


Figure S6. The difference in the abundance of the 30 most abundant bacteria in the top and bottom layers of the 1/4 GAC-3/4 sand filter column.

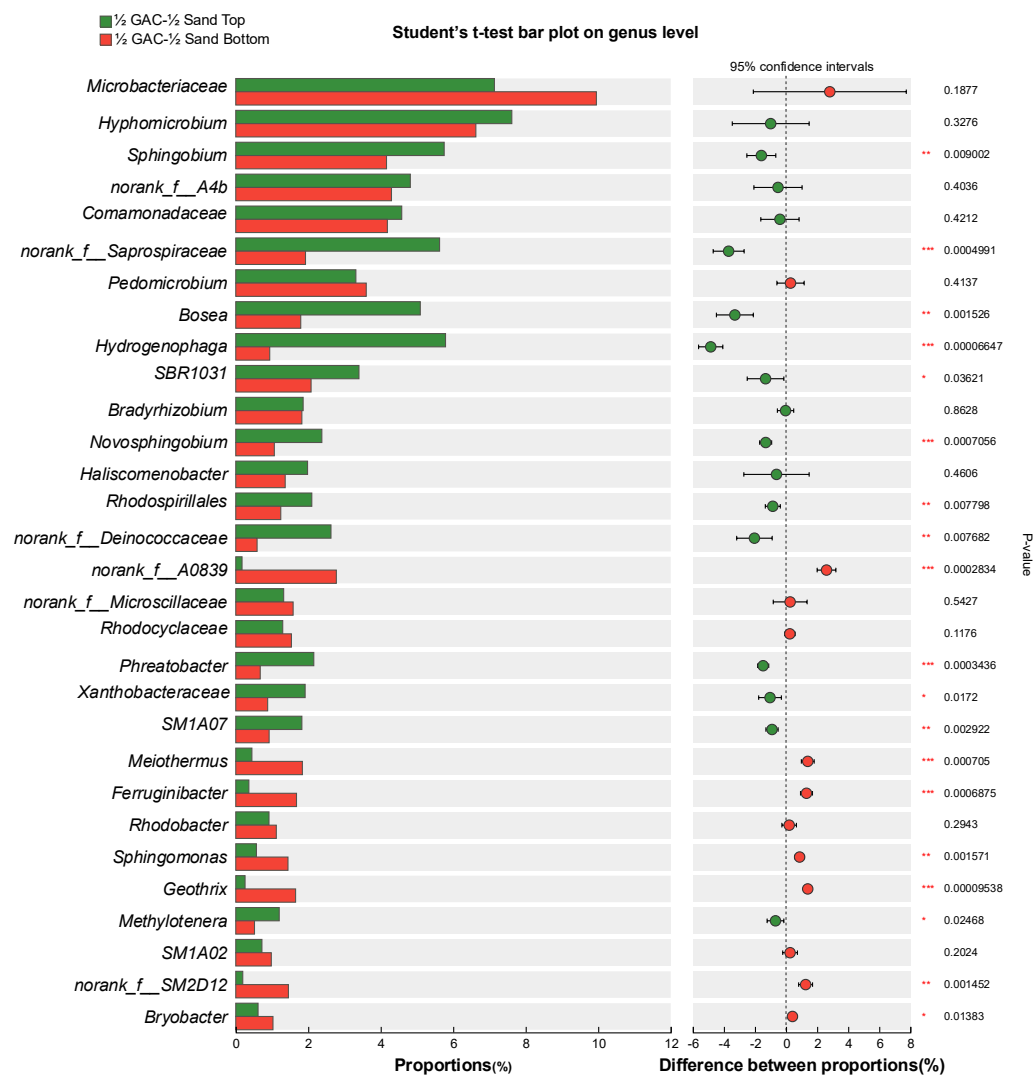


Figure S7. The difference in the abundance of the 30 most abundant bacteria in the top and bottom layers of the ½ GAC-½ sand filter column.