

Process combinations

Urs von Gunten

Treatment trains - chlorine

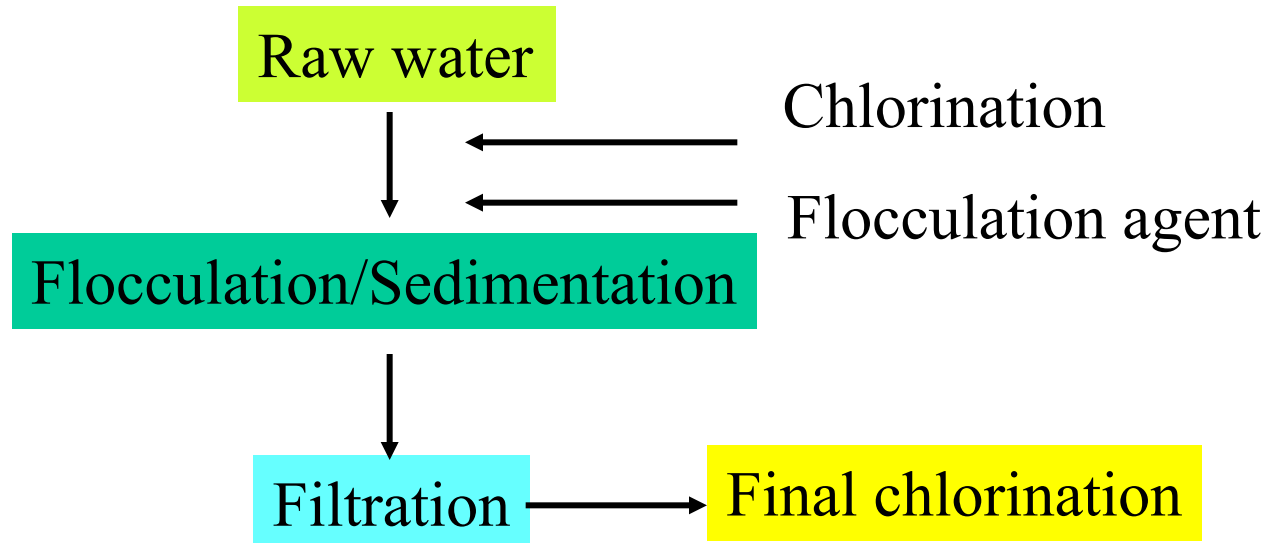
From about 1910

Disinfection → Filtration

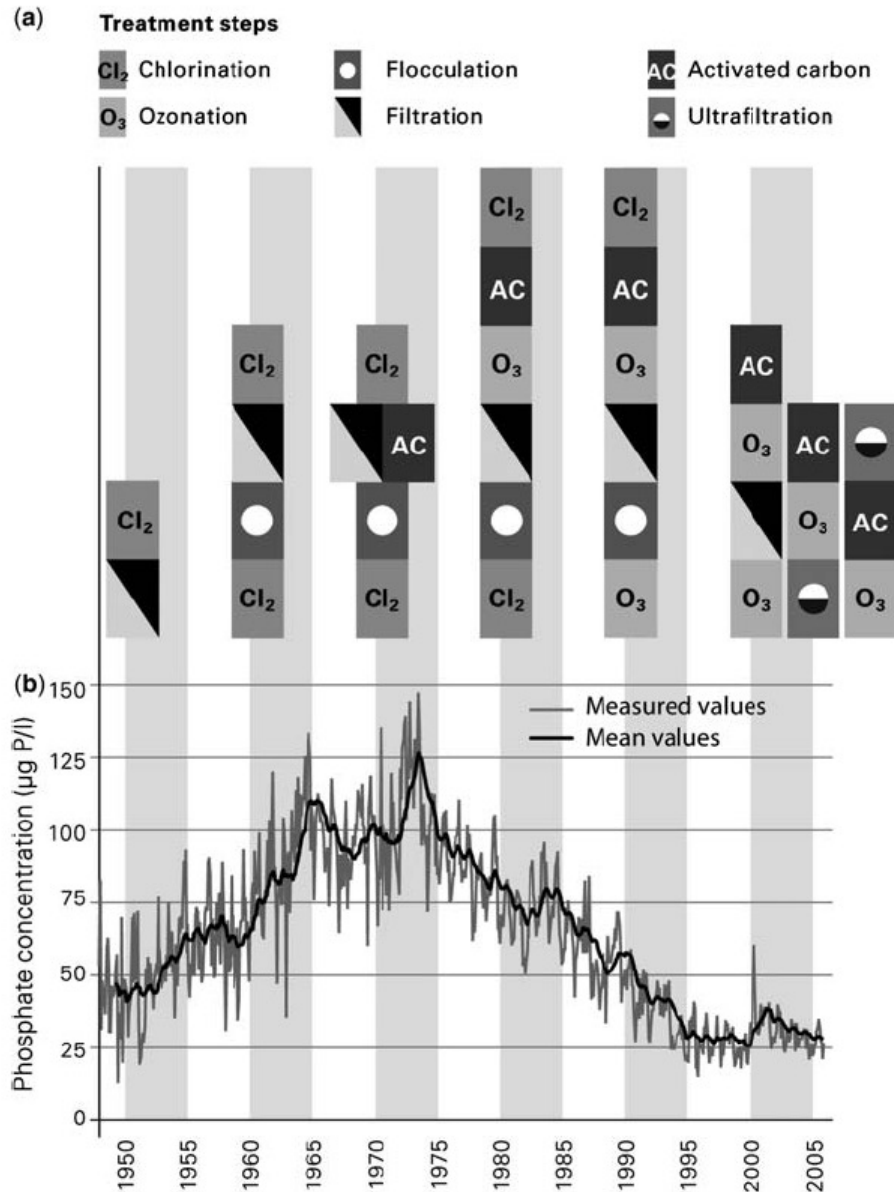
After 1960

Filtration → Disinfection

Today



Ozonation: Development of lake water treatment in Switzerland



Important drivers

Hygiene

Turbidity

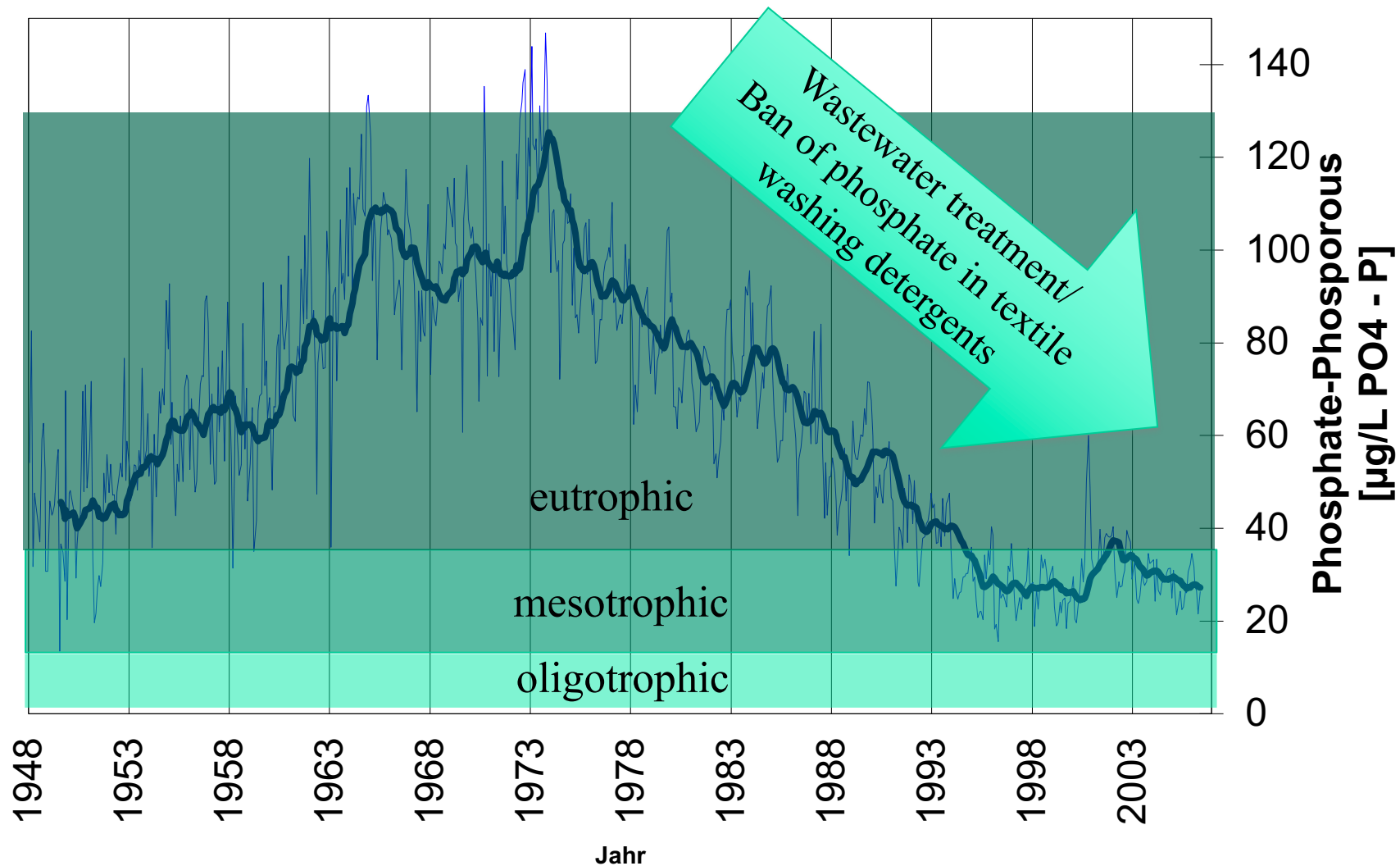
Algal products (e.g. taste and odor, cyanotoxins)

Micropollutants

A. Gmünder, Wabag
Water Supply Zurich

Influence of water quality on treatment schemes:

Phosphate concentration in Lake Zurich



Daten Wasserversorgung Zürich

Pilot plant

Water Supply Zürich/Wabag

Ozonation

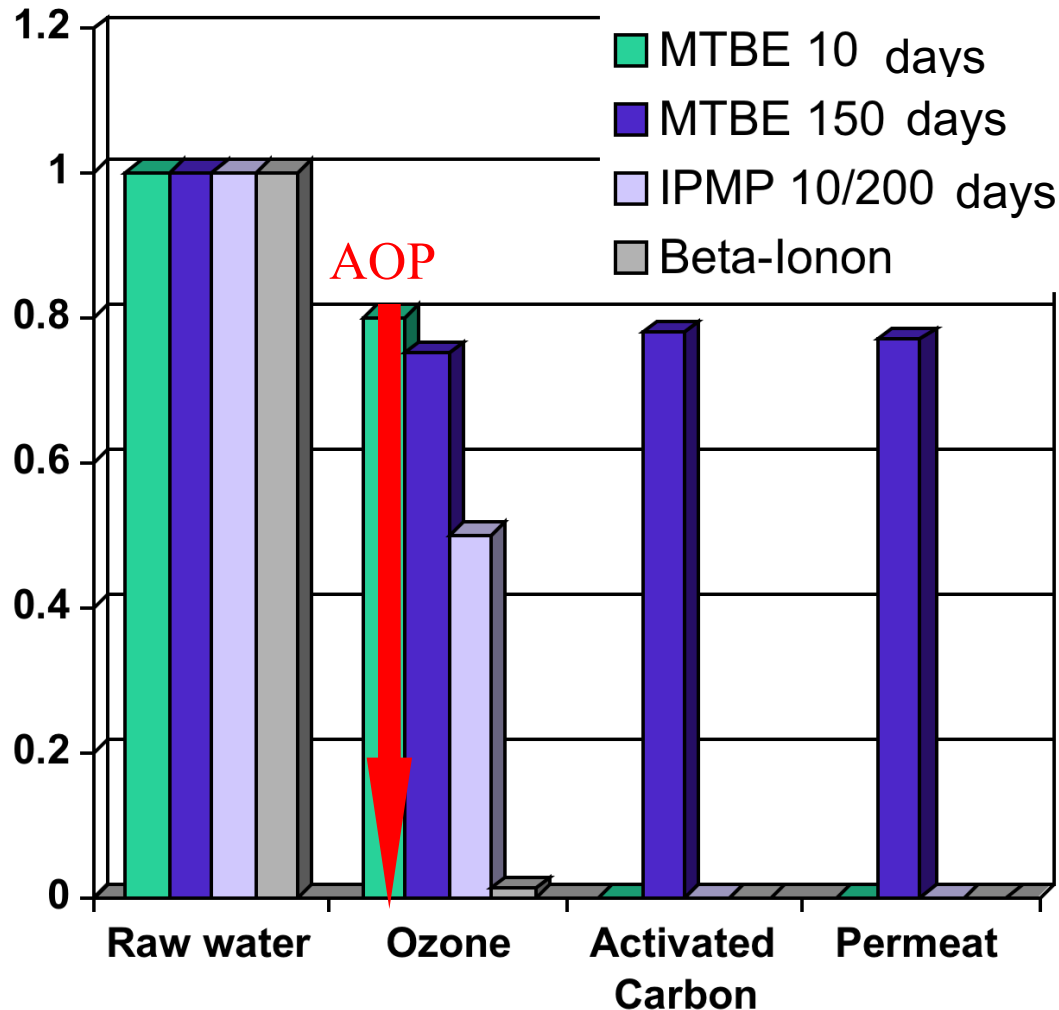
BAC

Ultrafiltration



Elimination of micropollutants in the pilot plant

Scenario for accidental spills



MTBE

$k_{O_3} = 0.15 \text{ M}^{-1}\text{s}^{-1}$,
 $k_{OH} = 1.9 \times 10^9 \text{ M}^{-1}\text{s}^{-1}$
 $\log K_{ow} = 0.94$

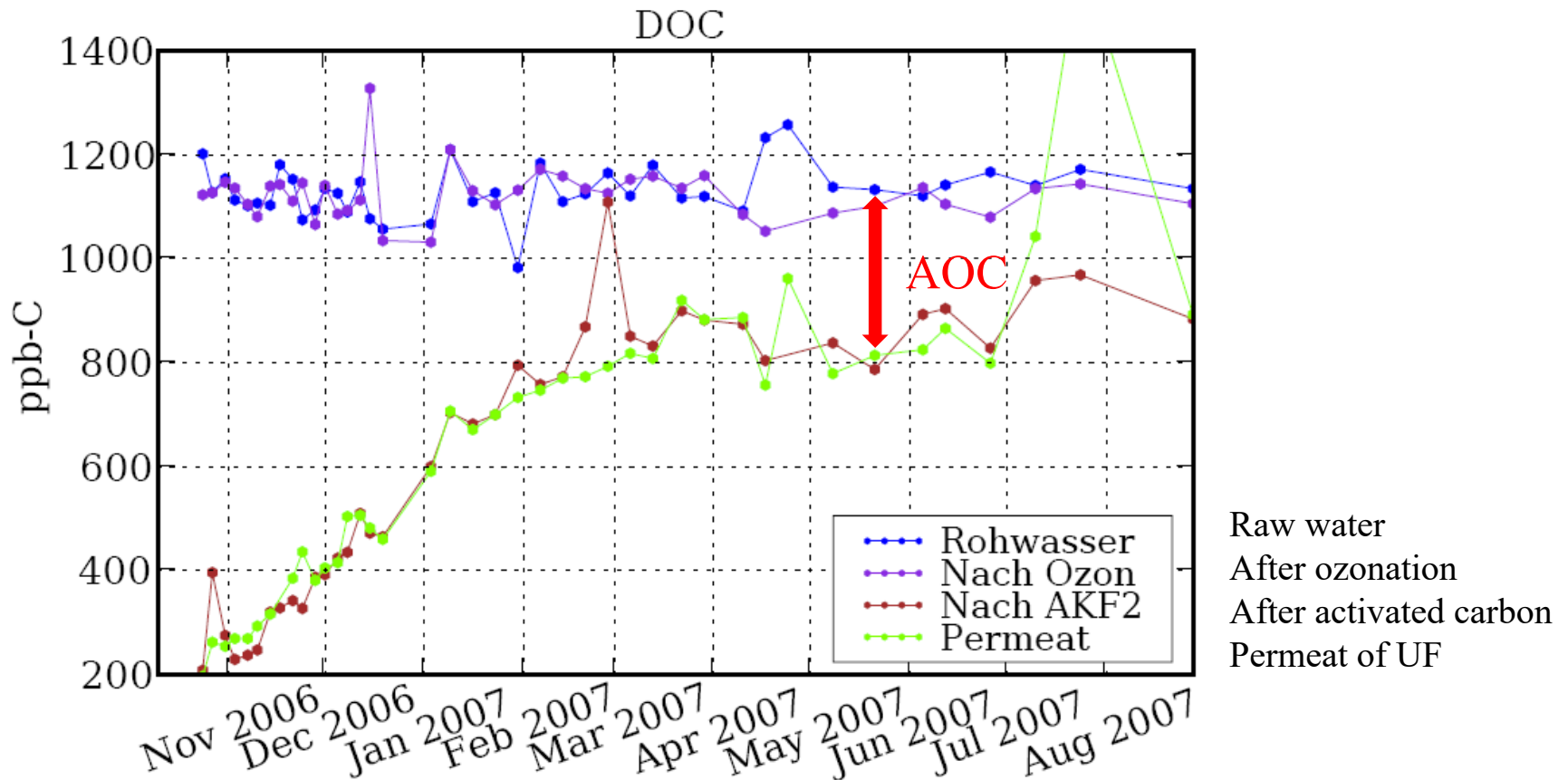
IPMP

$k_{O_3} = 50 \text{ M}^{-1}\text{s}^{-1}$,
 $k_{OH} = 5 \times 10^9 \text{ M}^{-1}\text{s}^{-1}$
 $\log K_{ow} = 2.41$

β -Ionon

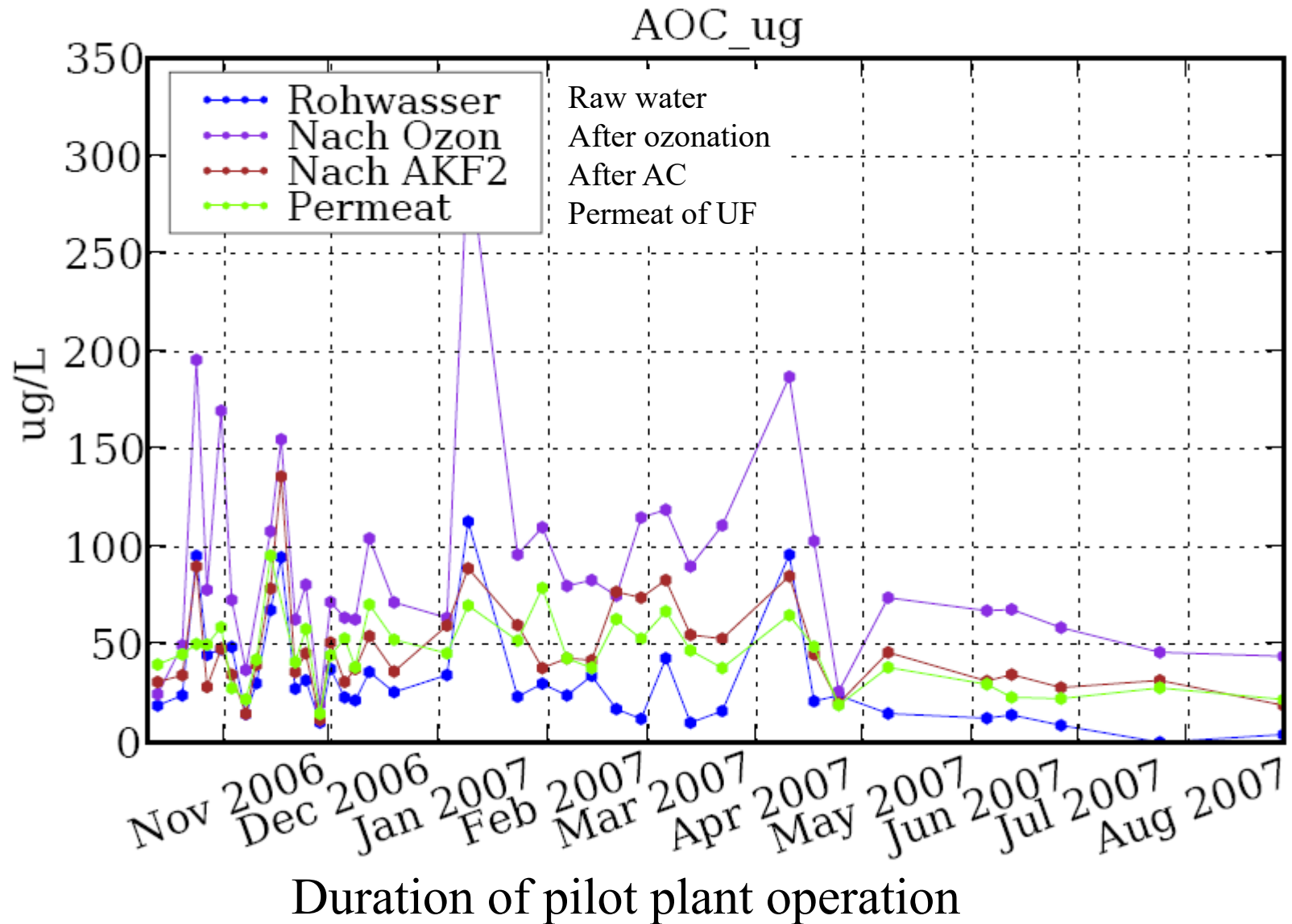
$k_{O_3} = 1.6 \times 10^5 \text{ M}^{-1}\text{s}^{-1}$,
 $k_{OH} = 7.8 \times 10^9 \text{ M}^{-1}\text{s}^{-1}$
 $\log K_{ow} = 3.84$

Behavior of DOC in the process O₃-BAC-UF



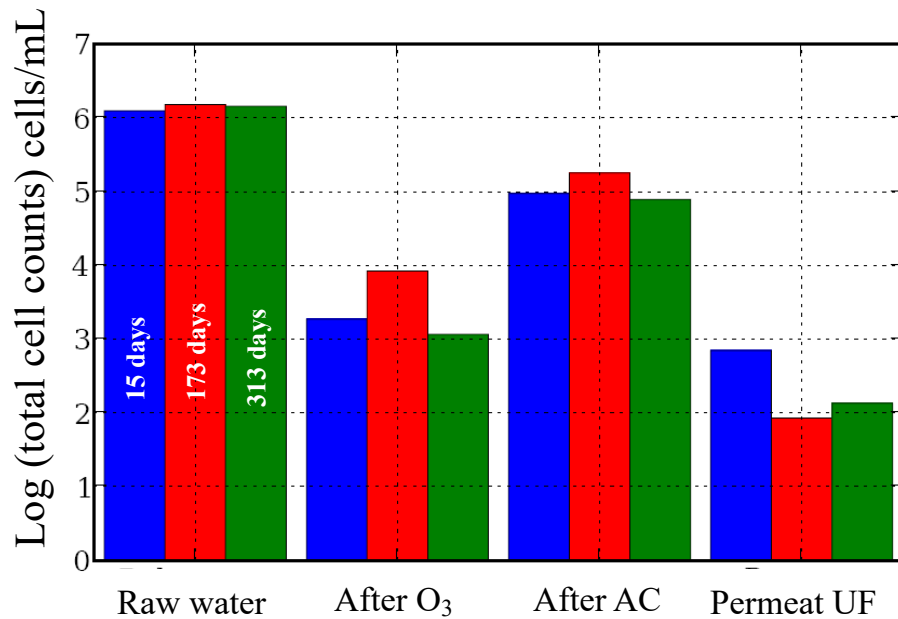
Duration of pilot plant operation

Assimilable organic carbon AOC in the process O₃-BAC-UF

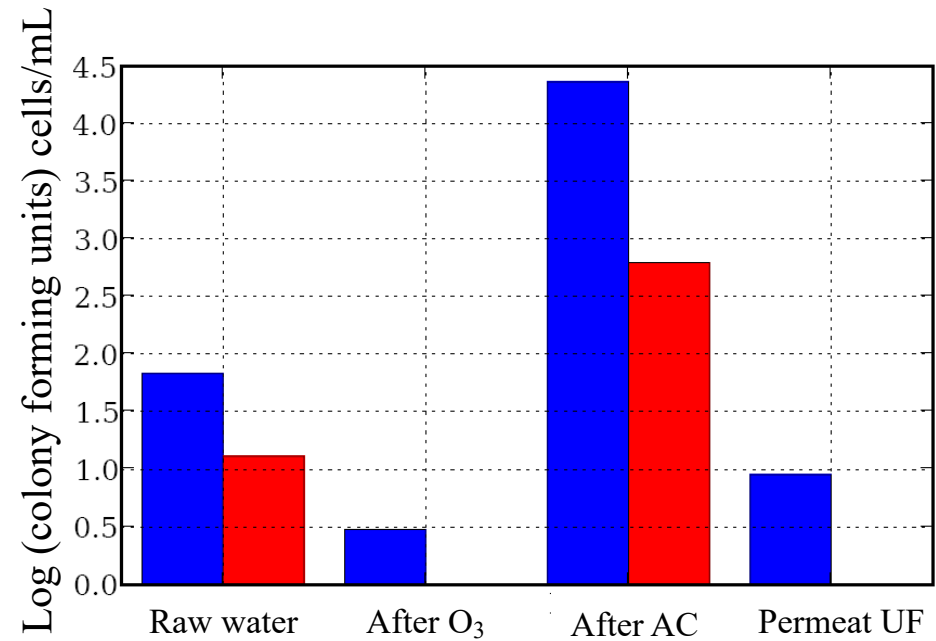


Microorganisms in the process O₃-BAC-UF

Total cell counts: flow cytometry



Heterotrophic plate counts



Possible new process combinations including membrane technology

