



# impact of NOM on advanced oxidation and biological stability

DOC2C's workshop September 21st 2016

# advanced oxidation process (AOP)

what is advanced oxidation?

- oxidation with highly reactive, short living, in situ produced OH radicals
- for instance produced via the  $O_3/H_2O_2$  or  $UV/H_2O_2$  process

why is advanced oxidation applied in drinking water production?

- micropollutants such as pesticides, industrial compounds, residues of pharmaceuticals can be degraded by advanced oxidation processes



## Ineos darf weniger Pyrazol in den Rhein leiten

Von [Stefan Schneider](#)

Laut einer neuen amtlichen Bewertung könnte die Chemikalie trinkwassergefährdend sein.



Dormagen. Das Petrochemie-Unternehmen Ineos muss bei der Einleitung seiner Abwässer in den Rhein nachbessern. Das hat die Bezirksregierung Köln dem Konzern auferlegt. Hintergrund sind Funde der Chemikalie Pyrazol im Rhein, die das Landesumweltamt (LANUV) auf den Plan

## Facing the Yuck Factor

FEATURE ARTICLE - [September 17, 2007](#) by Peter Friederici



Facing the yuck factor. PAUL LACHINE

*How has the West embraced water recycling? Very (gulp) cautiously*

# rationale for advanced oxidation process

organic contaminants are 'moving target'

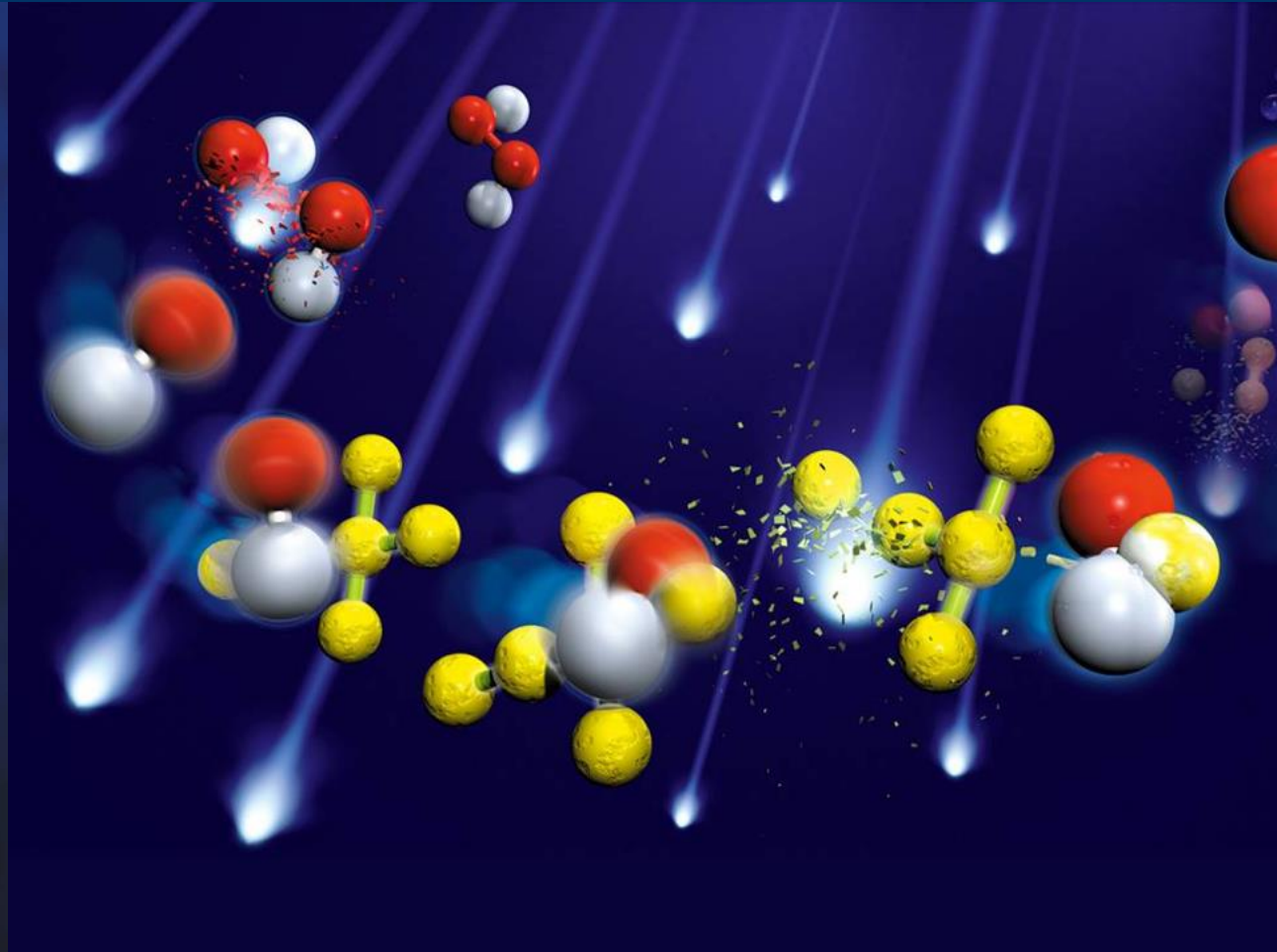
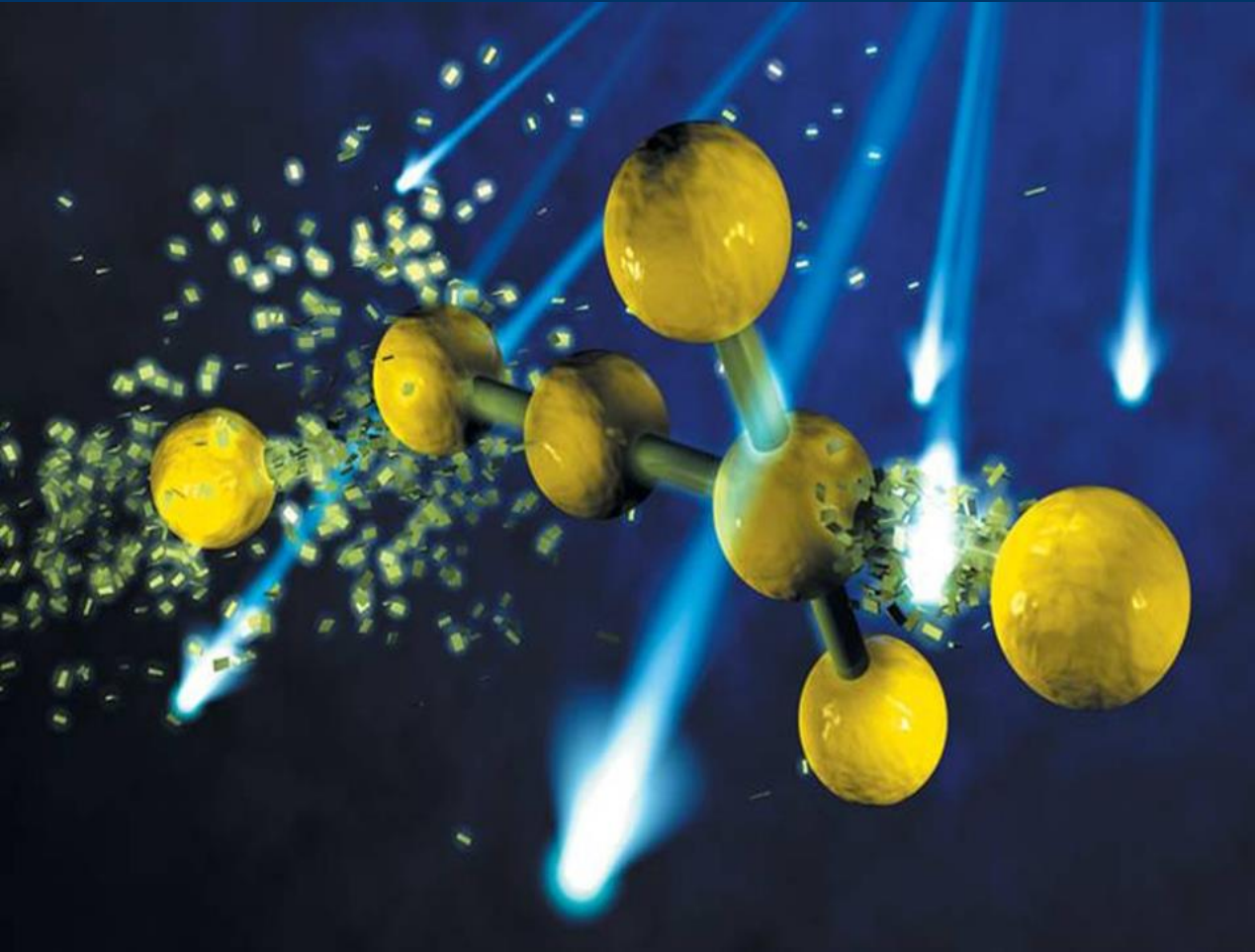
- they move faster than technology development and implementation
- toxicity, mixture toxicity, contribution via water, regulator, public perception; all influence the discussion

justifies non selective multibarrier approach against organic micropollutants

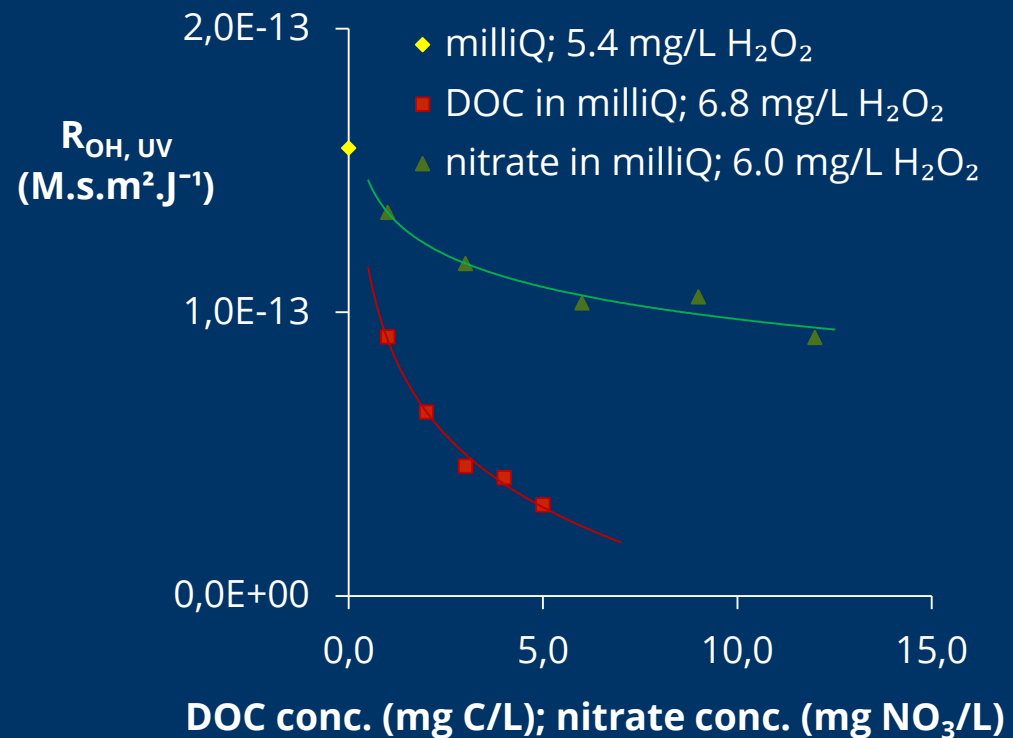
- oxidative treatment: MP UV/H<sub>2</sub>O<sub>2</sub> process
- adsorptive posttreatment by biological activated carbon filtration



# UV/H<sub>2</sub>O<sub>2</sub> treatment at PWN

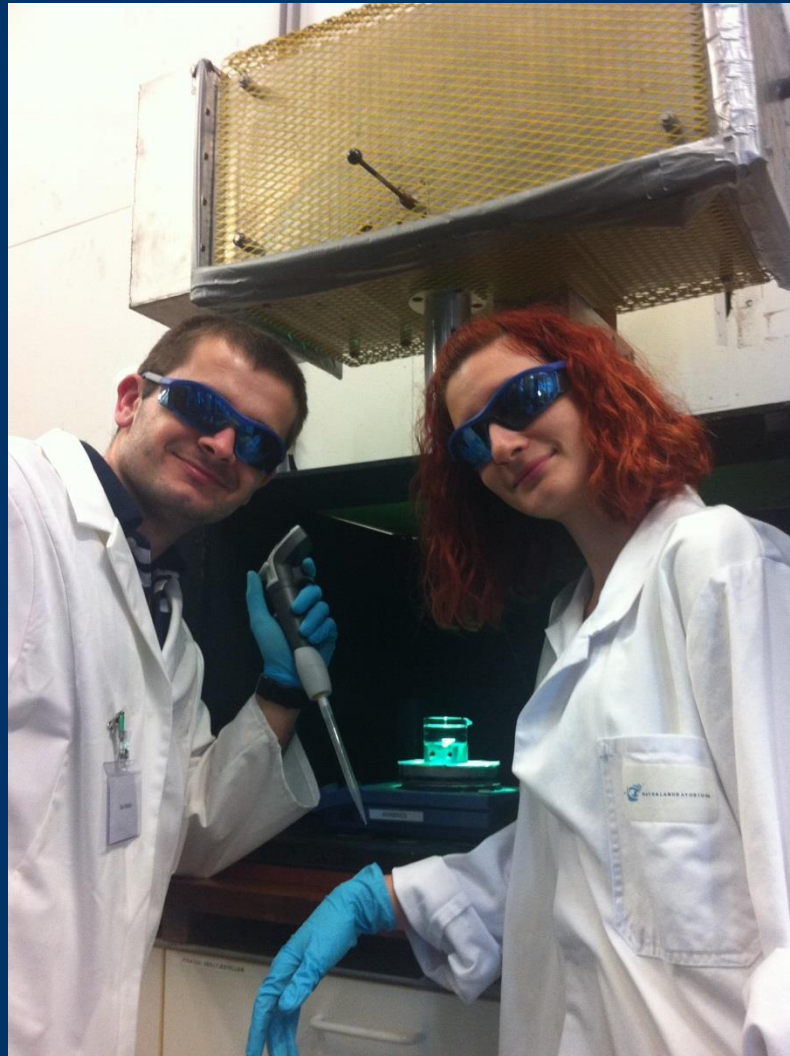


# impact of NOM and nitrate on UV/H<sub>2</sub>O<sub>2</sub> treatment



- NOM concentration of 6 mg/L already makes AOP unfeasible for drinking water treatment
- NOM removal in pretreatment required for efficient application of AOP
- does the NOM composition play a role?

# advanced oxidation: bench scale and full scale





# biological stability

what is biological stability?

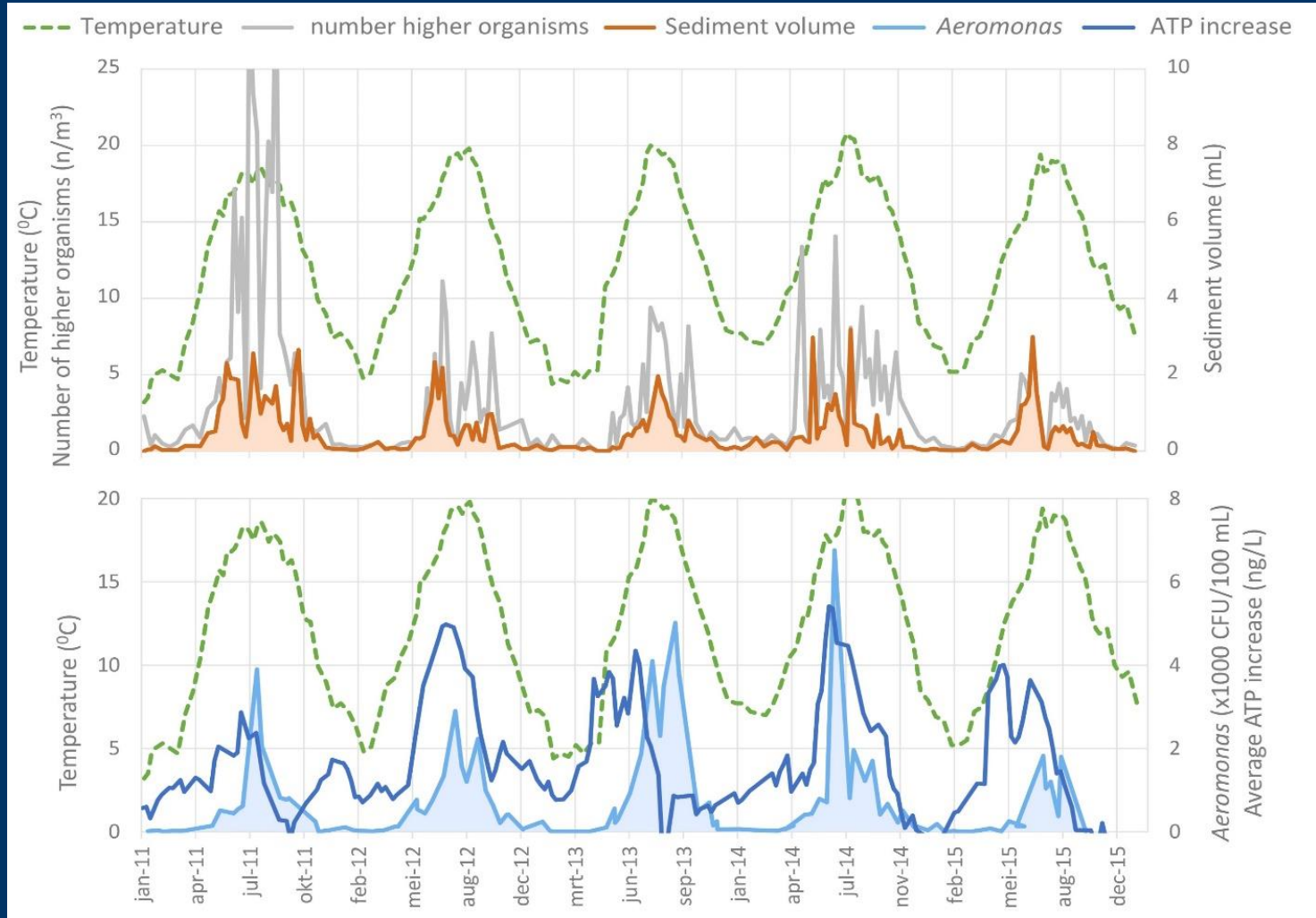
- deterioration of produced water due to biological processes is absent
- occurrence of nutrients, non pathogenic bacteria and hydrobiology remain at stable, low levels for the duration of the supply in the distribution network

why is it of interest

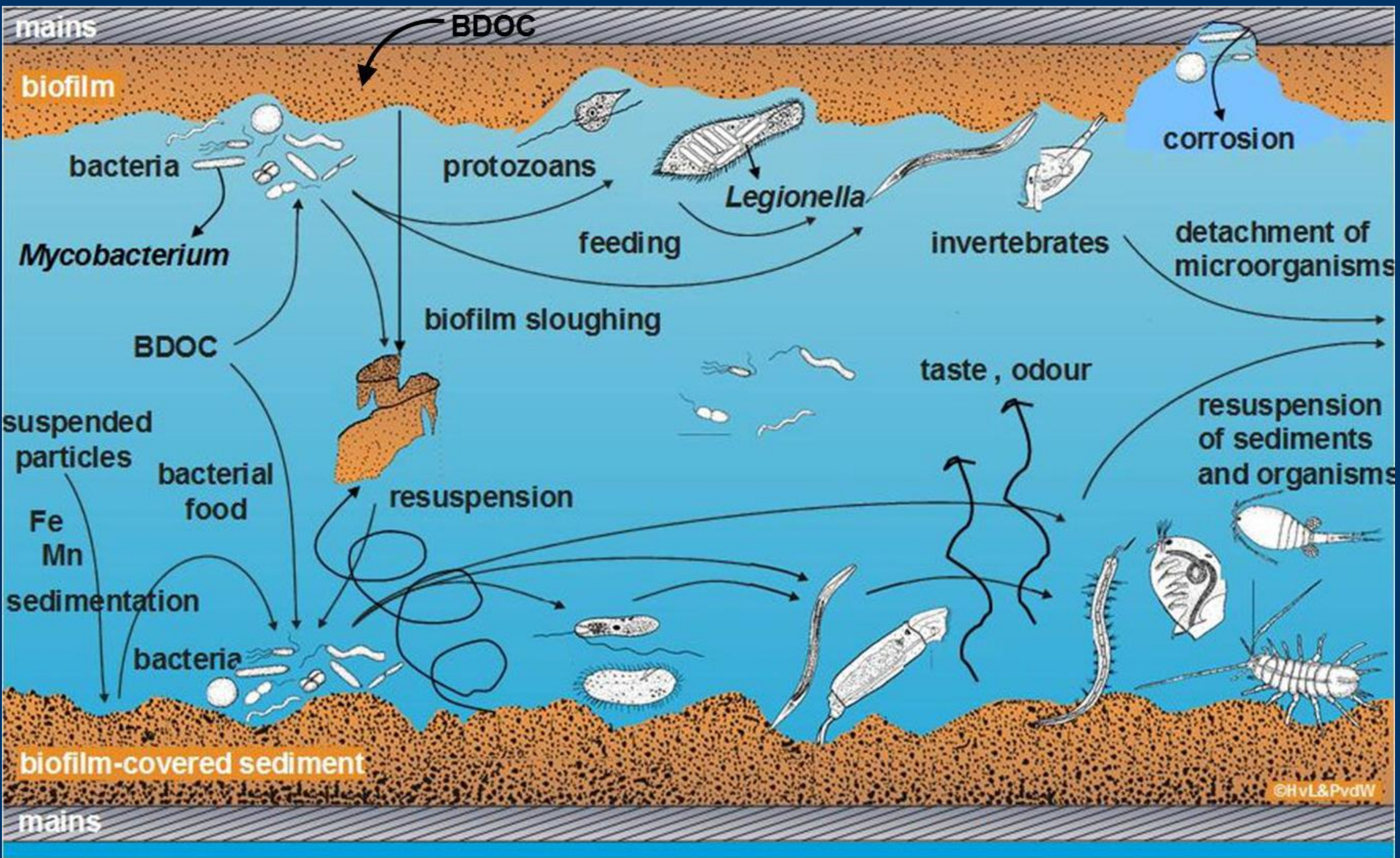
- biological instability may cause customer complaints and enhance growth of opportunistic pathogens in the biofilm



# observations from distribution network

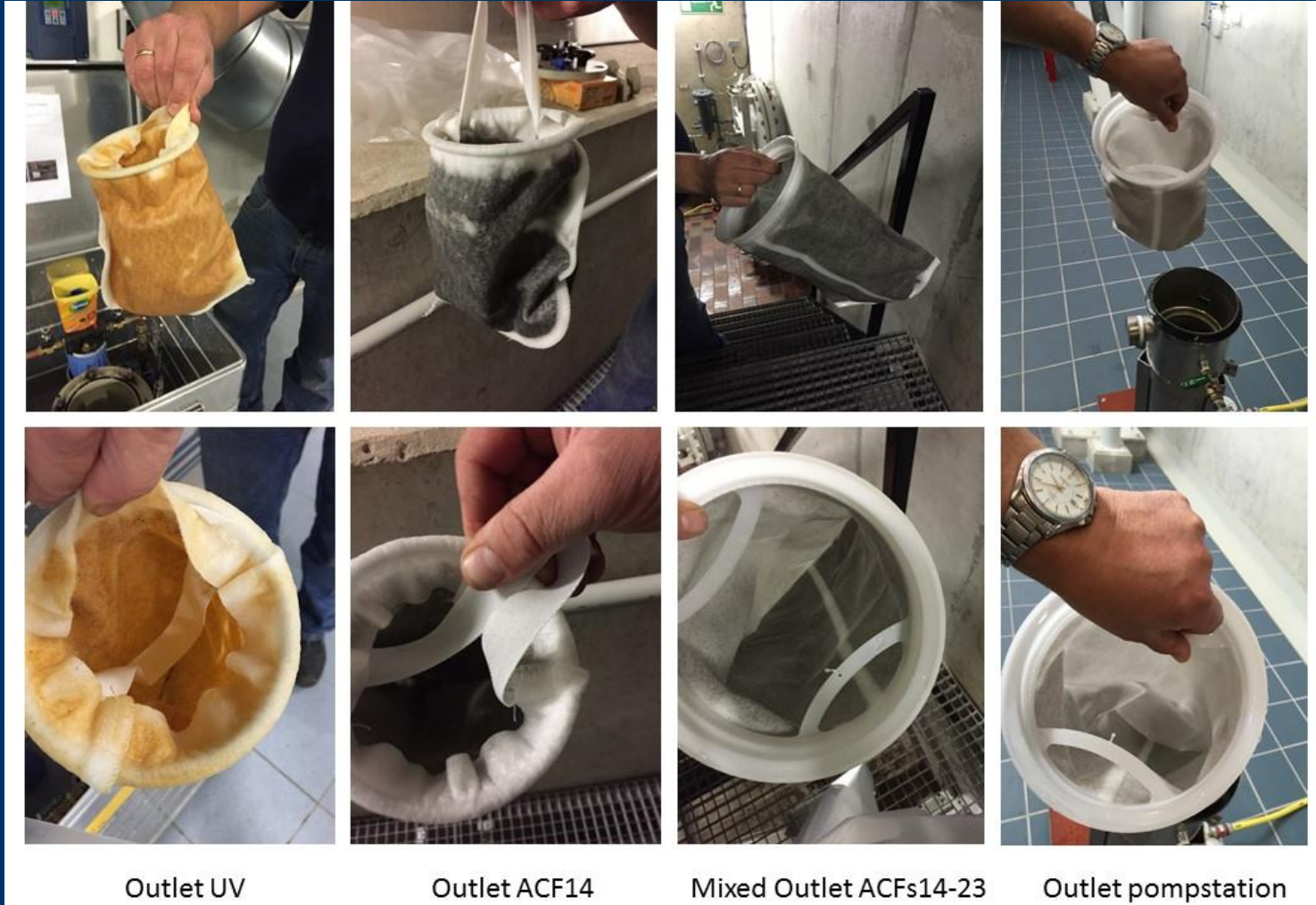




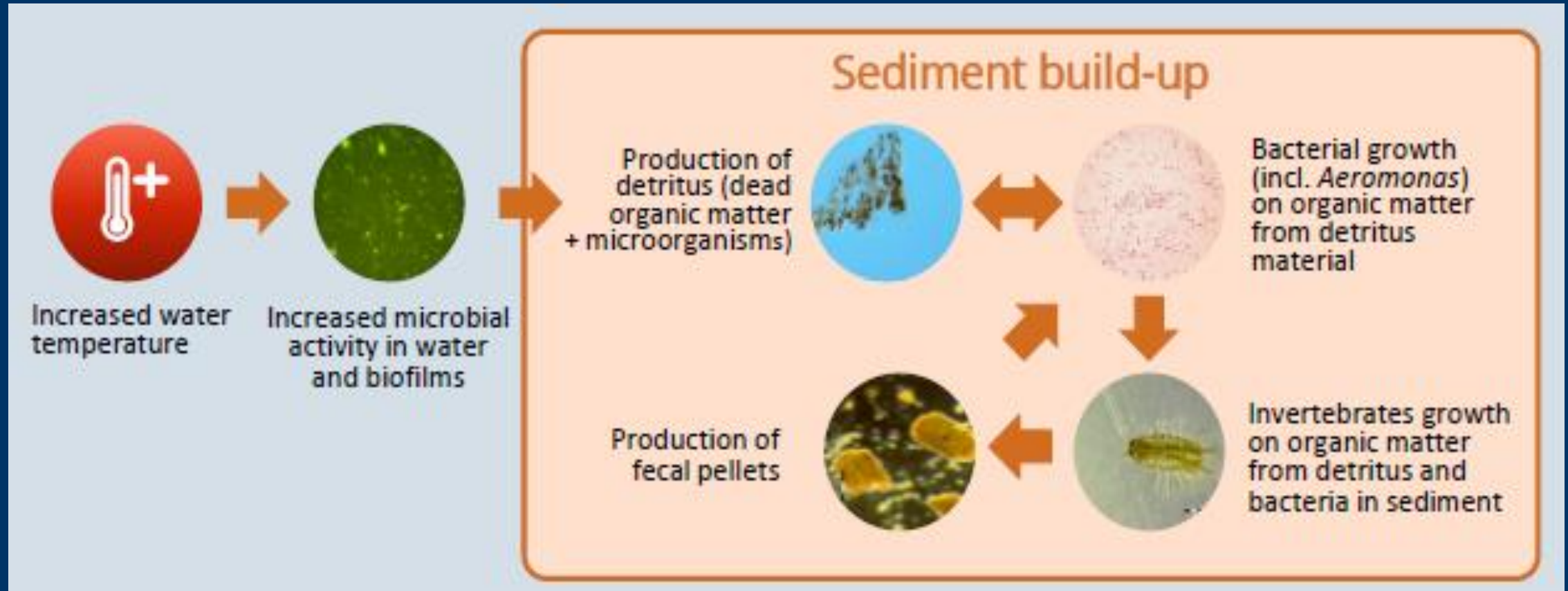




# observations in the conventional treatment

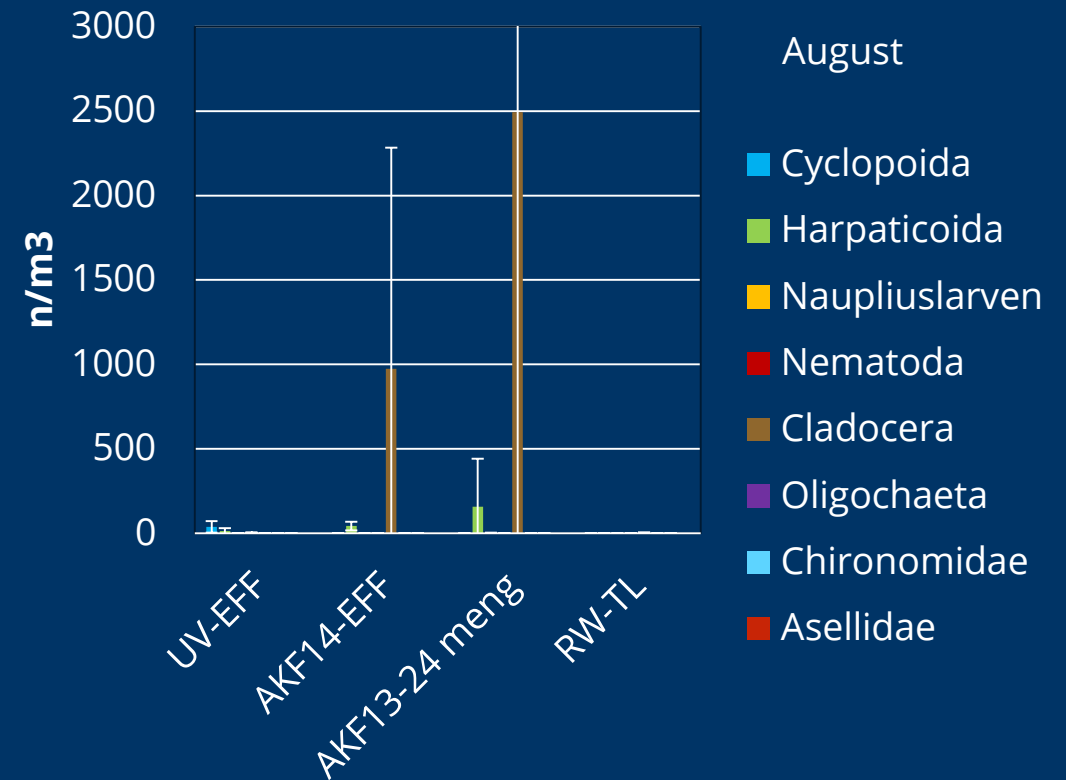
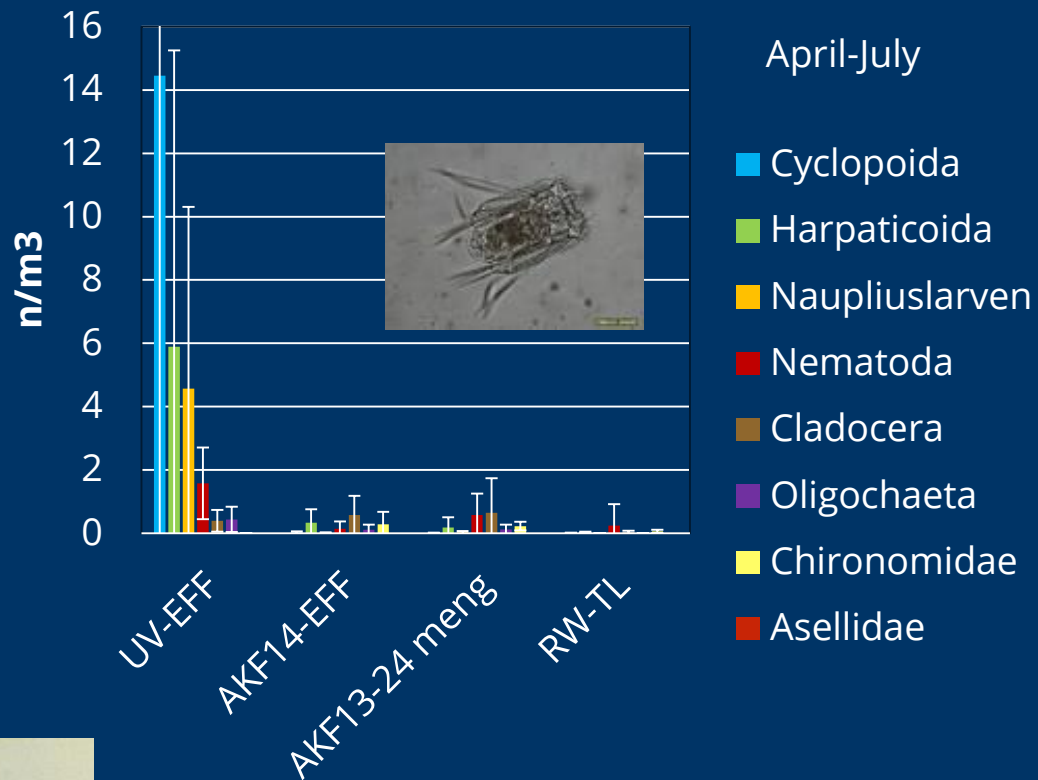


# hypothesis of sediment formation mechanism

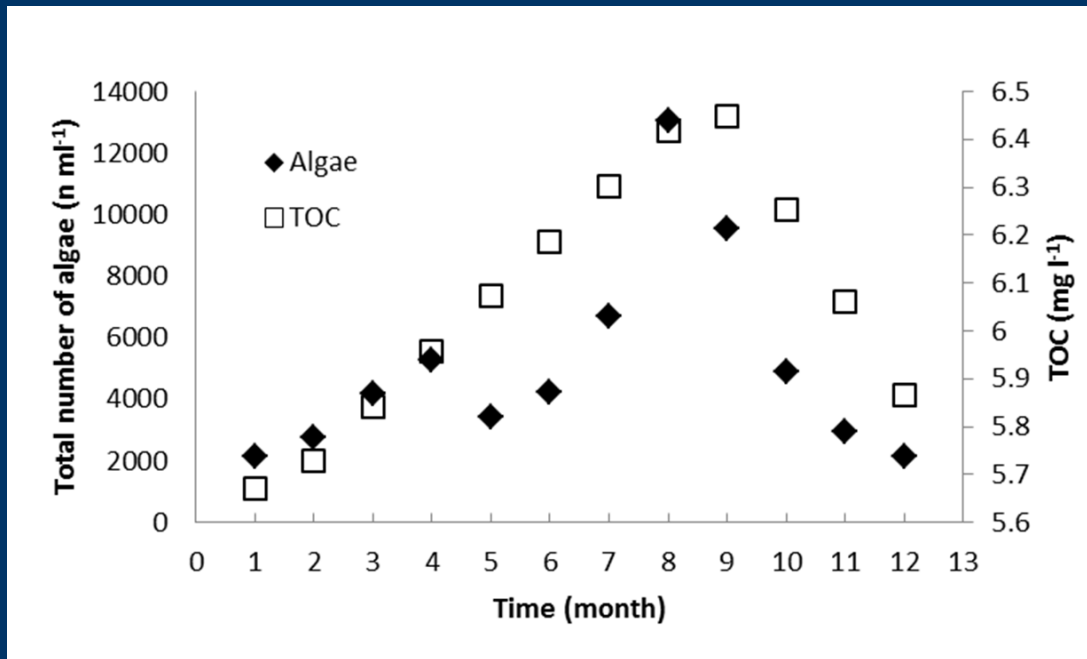




# hydrobiological dynamics in treatment



# biostability and NOM



- raw water seasonal TOC concentration and algae growth (10 year)
- biological contribution TOC concentration
- what is the identity of the NOM and to what extent does this type of NOM influence biostability?

# outlook pilot research

- $O_3$  – pretreatment – microfiltration  
– GAC pilot on wwt effluent
- complex seasonal varying NOM composition
- pilot situation allows to serve as 'backbone' for several NOM - treatment technology interactions





**Interreg**   
EUROPEAN UNION  
**2 Seas Mers Zeeën**  
**DOC2C's**  
European Regional Development Fund

# acknowledgement

Interreg program and the participants in the DOC2C's project