# *ElektroDeHalo*: Adsorption and electrochemical degradation of halogenated pollutants

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## Motivation

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- **Persistant organic pollutants** (POPs) e.g. perfluorinated tensides (PFT), iodinated x-ray contrast agents, pesticides and disinfectants are harmful to humans and the environment
- Resistance to photolytic, chemical and biological degradation makes them highly **bioaccumulative**
- Removal by conventional wastewater treatment plants is very difficult

## Experimental

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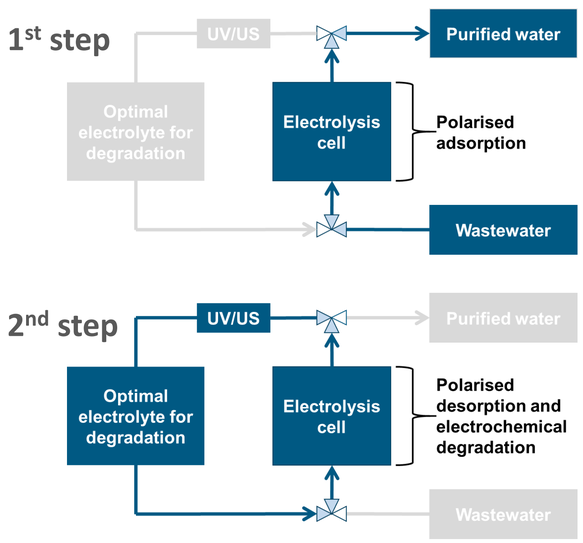
- Two-stage water purification process
- 1st step: Polarised pollutant adsorption
- 2nd step: Electrochemical degradation
- Half-cell potential monitoring with Hg/$HgSO_4$ reference electrode
- Influence of current density, flow rate, electrolyte and Temperature on electrolysis performance are investigated
- Determination of total organic carbon (TOC)




## Flow cell design

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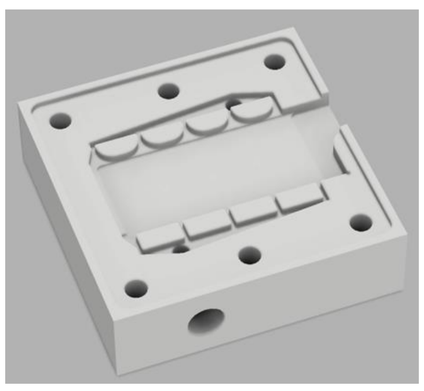
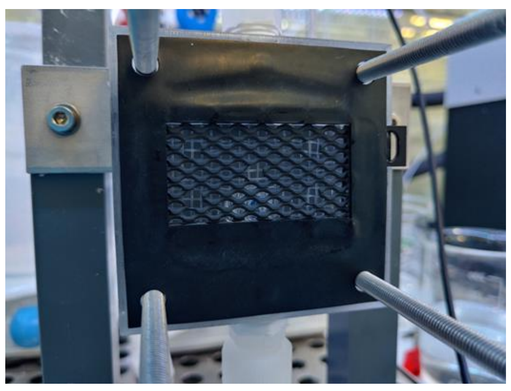
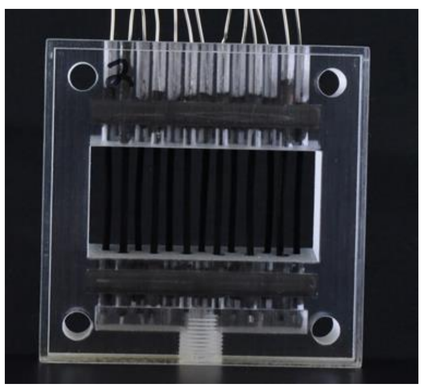
- Flow cell equipped with two **boron-doped diamond** (BDD) anodes (24 $cm^2$) and microtubular CNT based **gas-diffusion-electrodes** (GDE) as cathodes
- CNT-GDEs also function as adsorber for pollutants (A = 240 $m^2g^{-1}$)



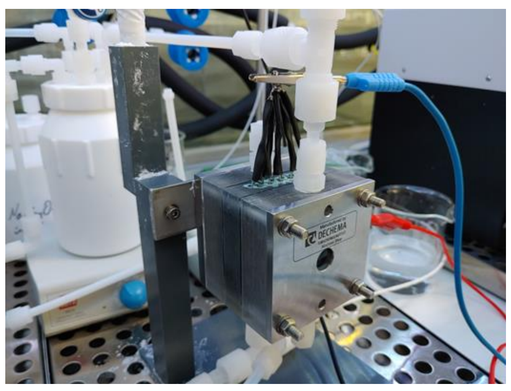
Designed with Fusion360



Anodic compartment with BDD

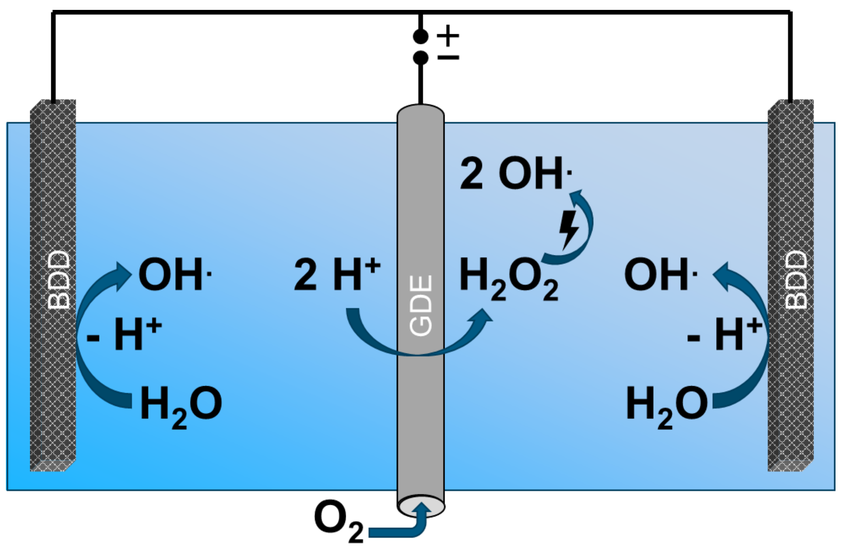


Cathodic compartment with CNT-GDEs



Fully assembled cell BDD/CNT/BDD

## Electrochemical degradation concept




## Ammonium perfluorooctanoate degradation

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### Properties

- Perfluorinated tenside
- Soluble in water
- Highly persistent
- Carcinogen, endocrine disruptor




### Tested parameters (batch mode, $c_0$ = 1 mM)

- $Na_2SO_4$, $NaClO_4$, $NaH_2PO_4$
- c(electrolyte) = 0.01 M, 0.10 M, 1.00 M
- *I* = 200 mA (16.7 $mAcm^{-2}$) – 1000 mA (83.3 $mAcm^{-2}$)
- Flow rate *Q* = 50 – 500 $mLmin^{-1}$

### Suitable parameters

- Electrolyte: 0.01 M $NaClO_4$ at pH = 7, *T* = RT, *j* = 50 $mAcm^{-2}$, *Q* = 500 $mLmin^{-1}$

  → > 98% TOC removal after 4 h




## Outlook

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- Degradation will be further investigated by HPLC-MS and IC
- Functionalization of $H_2O_2$ by Fenton or UV will be optimized
- Degradation of real wastewaters

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