Design of a photocatalytic process for the removal of persistent organic micropollutants (POMs) for the drinking water's production

Julien GERVASI*, Diane THOMAS, Robin RONNEAU, Florent BAUDART, Marie BEAUVOIS, Anne-Lise HANTSON
Chemical and Biochemical Process Engineering Unit, Faculty of Engineering of Mons, University of Mons, Belgium
*Julien.Gervasi@umons.ac.be

**Context of the study**
- Conventional drinking water’s treatments are inefficient for the elimination of persistent organic micropollutants (POMs):
  - Endocrine disrupting effect and toxic effects for th living beings (carcinogenic effect, endocrine disruptor effect, etc.)
  - Need of an efficient treatment such as advanced oxidation processes (AOPs) to mineralized POMs

**Selected POMs**

Pesticides with specific structures and chemical properties:
- **Isoproturon**: Weedkiller
- **Bentazon**: Weedkiller
- **Atrazine**: Weedkiller
  Forbidden use in Europe

**Photocatalysis principle with supported TiO₂**

- Photolysis Reaction zone
- Conduction band
- Valence band
- Reaction zone
- Reduction (O₂/O₂⁻)
- Oxidation (OH/OH⁻)
- e⁻
- Activated carbon
- Lamp, distance, power
- Bath chiller
- Support

**Preliminary study**

- UVC light
- Petri dish
- Supported photocatalyst
- Orbital shaker
- Half-life time reduction with photocatalysis

**Main results:**
- Promoter effect of the supported TiO₂
- No positive effect with the addition of activated carbon
- Other Process parameters investigated:
  - No negative matrix effect
  - Optimum photocatalytic activity with a maximally 0,6 mg.cm⁻² of photocatalyst

**Experimental study**

- UVC light
- Supported photocatalyst
- Buffer tank
- Peristaltic pump
- Magnetic stirrer
- TOCmetrer

**Main results:**
- Effectiveness of supported photocatalyst
- Increase of performances for the isoproturon with mineral water (in agreement with the Petri dish assays)
- Slow mineralisation (TOCmeter) kinetic (by-products toxicity risks)
- Other Process parameters investigated:
  - Decrease of T₁/₂ with higher power lamp and distance between support and the UVC lamp

**Conclusions**
- An efficient photocatalytic formulation was chosen
- The AC addition did not improve the photocatalytic degradation during the photocatalysis time-scale
- Experimental apparatus showed good removal rate of pesticides but slow mineralisation
- Possibility to optimize the process (power lamp, distance between the UVC lamp and the support)

**Prospects**

- Simulation/Scaling-up of the process with kinetic data using MATLAB/SIMULINK® software
- Experimental tests with the best conditions (40 W power lamp, higher distance between support/UVC lamp)

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