

Effect of inorganic ions on the H₂O₂ formation and trimethoprim degradation during UV/VUV (185/254 nm) and VUV (172 nm) irradiation

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Nowadays, the production of right quality of drinking water is a serious challenge not only in the developing countries, but all over the world. The inappropriate and overuse of pharmaceuticals is a global environmental risk, because these drugs and its metabolites can discharge into the wastewater: During the pandemic, not only the consumption of antiviral drugs but the antibiotic use is highly increased. The efficacy of the WWTPs in the disposal of pharmaceuticals is limited. In several cases these metabolites present in the treated wastewater, causing contamination of water bodies, such as drinking water bases. The UV photolysis – a commonly used post treatment method in WWTPs – is highly efficient in term of disinfection, but not suitable for complete mineralization of contaminants.

The low pressure mercury vapor lamp made of high purity quartz glass emits 185 nm Vacuum-UV (VUV) light beside 254 nm UV photons. These lamps are commonly used for high-purity water production, but several publications proved its efficacy in terms of both antibiotic degradation and mineralization. An other VUV light source is the Xe*-Excimer lamp which used only in research emits 172 nm quasi-monochromatic light.

In this study the effect of main inorganic ions (Cl⁻, HCO₃⁻) present in wastewater is investigated on the •OH formation, is measured through H₂O₂ formation. The VUV (172 nm) photolysis based only on radical reactions, while in the case of UV/VUV (185/254 nm) photolysis the direct photolysis also plays an important role. Nevertheless, the inorganic ions have similar effect on the H₂O₂ production. Both the Cl⁻ and HCO₃⁻ significantly decreased the formation rate of H₂O₂, in the presence of Cl⁻ decreased on proportion to the Cl⁻ concentration, but in the case of HCO₃⁻, the negative effect on the H₂O₂ equilibrium concentration decreased with the increasing anion concentration. The effect of inorganic ions was also investigated in the presence of organic matter, for this, trimethoprim, a commonly used antibiotic was used. The concentration of inorganic ions was adjusted the value measured in the biologically treated wastewater. In this case the effect of inorganic ions was investigated separately and together. Although the Cl⁻ and HCO₃⁻ influence the H₂O₂ formation similarly both in UV/VUV (185/254 nm) and VUV (172 nm) photolysis, in the case of trimethoprim the effect of Cl⁻ on VUV (172 nm) photolysis is more significant, and there is no significant effect of HCO₃⁻. In the case of VUV (172 nm) photolysis Cl⁻ decreased both the formation and mineralization rate of trimethoprim, while in the case of UV/VUV (185/254 nm) photolysis the Cl⁻ has negative effect only in the mineralization.

Acknowledgment

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11 – 11:20am
ST

**The role of alcoholic sacrificial agents in photocatalysis:
Is it always trivial?**

Krishnamoorthy Sathiyar¹, Ronen Bar-Ziv², and Tomer Zidki¹

¹Department of Chemical Sciences, the Centers for Radical Reactions and Material Research, Ariel University, Ariel, Israel

²Department of Chemistry, Nuclear Research Center Negev, Beer-Sheva, Israel

Session 2: Photocatalysis for Degradation of Various Pollutants I

11:20 – 11:45am
IL

The effect of peroxydisulfate ion on the heterogeneous photocatalysis

Tünde Alapi, Máté Náfrádi, Bence Veres, Dorottya Dudás, Luca Farkas

Department of Inorganic and Analytical Chemistry, University of Szeged, Szeged, Hungary

11:45 – 12:10am
IL

Photocatalytic treatment of polluted air and water in CPC based pilot reactor: similarities and challenges

I. Grčić*, L. Radetić, K. Mikleć, M. Tomaš, P. Benjak, B. Radetić, K. Leskovar, D. Težak and M. Božičević

University of Zagreb, Faculty of Geotechnical Engineering, Department of Environmental Engineering

12:10 – 12:30pm
ST

Visible light activation of persulfate and H₂O₂ by TiO₂/Fe₂O₃ composites for degradation of amoxicillin: Degradation Mechanism, transformation pathways and toxicity assessment

Francis M. dela Rosa^{1,2,3*}, Marin Popović⁴, Josipa Papac¹, Gabrijela Radić¹, Marijana Kraljić Roković¹, Marin Kovačić¹, María José Farré^{2,3}, Urška Lavrenčič Štangar⁵, Hrvoje Kušić^{1*}, Ana Lončarić Božić¹, Mira Petrović^{2,6}

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⁶ Catalan Institut on for Research and Advanced Studies (ICREA), Barcelona, Spain

9:50 – 10:15am
IL
The degradation studies and toxicity reduction of microcystins (MC-LR and MC-RR) by double frequency ultrasonic reactor
Zeynep Eren, Fatmagül Özdemir
¹Ataturk University, Engineering Faculty, Environmental Engineering Department, Erzurum Turkey

10:15 – 10:35am
ST
Investigation of the UV/S₂O₈²⁻ and UV/VUV/S₂O₈²⁻ processes for the elimination of trimethoprim antibiotic - the effect of reaction parameters and matrix components
Luca Farkas, Adrienn Szirmai, Tünde Alapi
Department of Inorganic and Analytical Chemistry, University of Szeged, H-6720 Szeged, Dóm square 7, Hungary

10:35 – 11:05am
Coffee Break

Session 6: Oxidation Technologies III

11:05 – 11:30am
IL
PMOC destruction after adsorptive enrichment – novel concepts for degradation of challenging contaminants using zeolites
Anett Georgi, Lin Qian, Katrin Mackenzie
Helmholtz Centre for Environmental Research – UFZ, Department of Environmental Engineering, Leipzig, Germany

11:30 – 11:55pm
IL
Mn–Mn coupling in photoluminescence kinetics of doped ZnS nanoplatelets
Christian Klinke
University of Rostock, Germany

11:55 – 12:20pm
IL
The change of the biochemical property of microorganism under the photo-disinfection process
Jing-Hua Tzeng^{1,2}, Chih-Huang Weng³, Chun-Chieh Wang⁴, Mon-Shu Ho⁵, Li-Ting Yen^{1,6}, Gulomjon Gaybullaev¹, Chakkrit Poonpakdee⁷, Yao-Tung Lin^{1,8,*}
¹Department of Soil and Environmental Sciences, National Chung Hsing University, Taichung, Taiwan
²Department of Civil and Environmental Engineering, University of Delaware, Newark, DE, USA
³Department of Civil and Ecological Engineering, I-Shou University, Kaohsiung City, Taiwan
⁴National Synchrotron Radiation Research Center, Hsinchu, Taiwan

Nanotechnology and Advanced Materials Program, Energy & Building Research Center, Kuwait Institute for Scientific Research (KISR), Safat, Kuwait.

3:10 – 3:40pm

Coffee Break

3:40 – 4:05pm
IL

Fabrication of a metal-free 2D-2D Nb₂CT_x@g-C₃N₄ MXene-based Schottky-heterojunction with the potential application in photocatalytic processes

Lekgowa C Makola,^{1,2} Sharon Moeno,³ Cecil N. M. Ouma,⁴ Langelihle N. Dlamini^{1,2,*}

¹Department of Chemical Sciences, University of Johannesburg, Doornfontein Campus, Johannesburg, South Africa.

²Centre for Nanomaterials Science Research, University of Johannesburg, South Africa.

³Department of Oral Biological Sciences, Faculty of Health Sciences, University of The Witwatersrand, Johannesburg, South Africa.

⁴HySA Infrastructure Centre of Competence, Northwest University, Faculty of Engineering, South Africa

4:05 – 4:25pm
ST

Dynamics of semiconductor-supported co-catalytic nanoparticles in photocatalytic applications

Guido Mul, Kai Han, Bastian Mei

University of Twente, The Netherlands

Posters

4:30 – 5:30pm

The effect of inorganic ions on the H₂O₂ formation and trimethoprim degradation during UV/VUV (185/254 nm) and VUV (172 nm) irradiation

Luca Farkas, Tünde Alapi

Department of Inorganic and Analytical Chemistry, University of Szeged, Szeged, Hungary

4:30 – 5:30pm

Synthesis, characterization, and application of TiO₂-SnS₂/GO-RGO-based material for photocatalytic H₂ production under Solar light irradiation

Perović Klara, Josipa Papac, Hrvoje Kušić, Marin Kovačić, Ana Lončarić Božić, Marijana Kraljić Roković

Faculty of Chemical Engineering and Technology, University of Zagreb, Zagreb, Croatia