APPLICATION OF TITANIA IMMOBILIZED ON GRANULAR ACTIVATED CARBON FOR ADSORPTION/DECOMPOSITION OF ORGANIC HALOGENS

Halyna Yankovych*[1], Michael Elsässer[2], Nicola Hüsing[2], Miroslava Václavíková[1]

[1]*Institute of Geotechnics Slovak Academy of Sciences, Watsonova 45, 04001 Košice, Slovakia.*

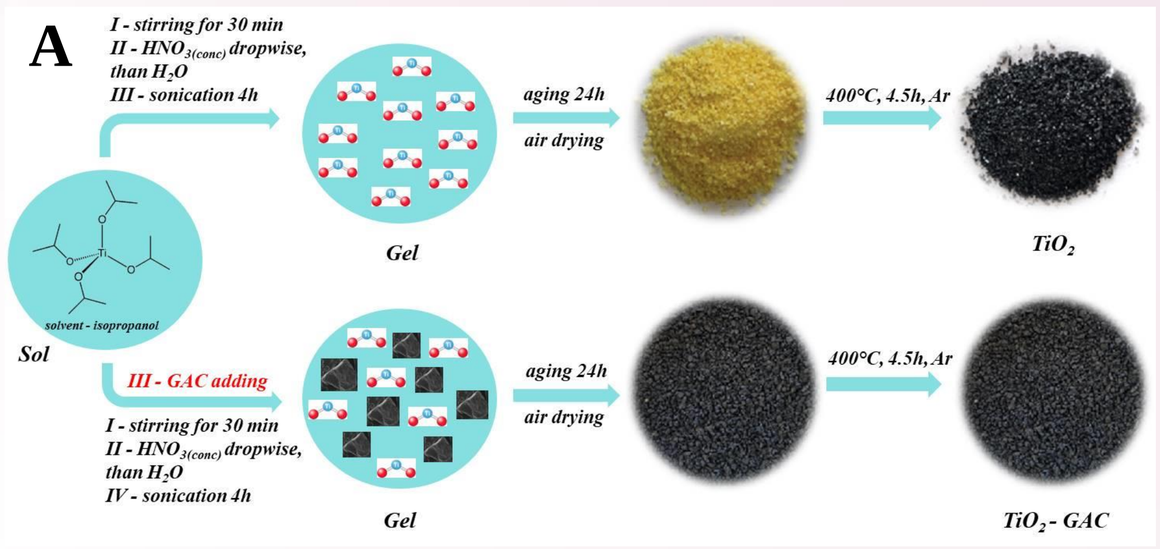
e-mail: **yankovych@saske.sk*

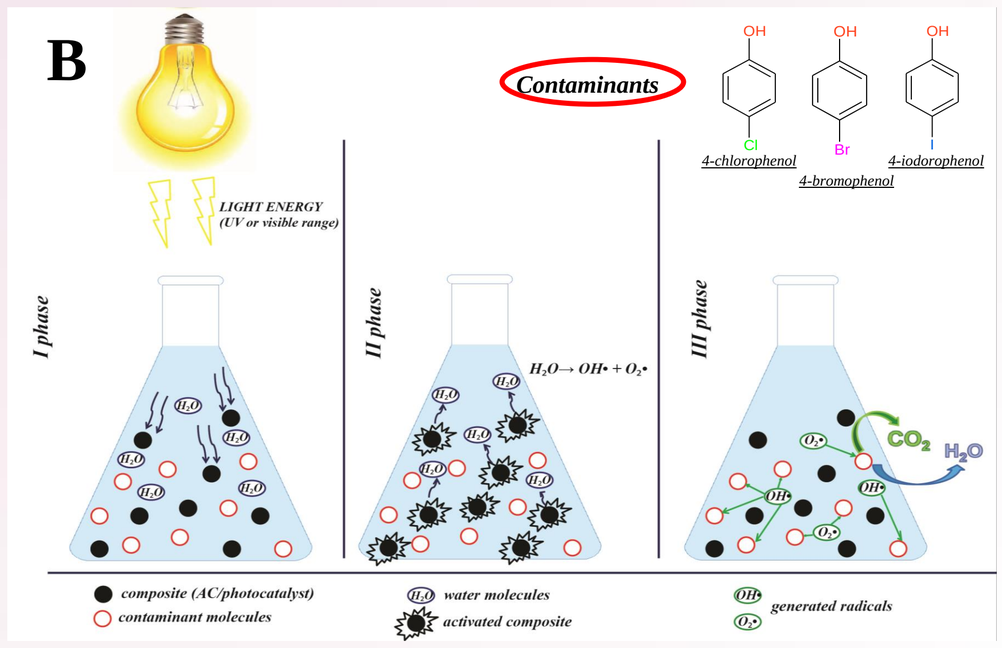
[2]*Department of Materials Science and Physics, University of Salzburg, Austria*

ABSTRACT

Adsorbable organohalogens (AOX) are persistent organic pollutants frequently found in water, which pose serious environmental and health issues. Their degradation and/or removal become an important challenge. Among the existing technologies, **photodegradation** using semiconductor catalysts is a promising alternative method [1]. To overcome the typical weak adsorption capacity of photocatalyst, photocatalyst/adsorbent composites based on high surface area activated carbons and TiO_2 can be used [2]. The present study is dedicated to the facile ***in situ* sol-gel synthesis of composite material based on TiO_2 and granular activated carbon**. The synthesized composite was examined by SEM-EDX, BET, TG-DTG and XRD techniques. TiO_2-GAC has the high surface area (907m^2/g) combined with relatively high content of crystalline phase (21.9%). These benefits allow its application for adsorption/degradation of AOX. The prepared material possesses high adsorption capacity towards 4-chlorophenol, 4-bromophenol and 4-iodophenol. The photodegradation tests revealed the excellent tendency of AOX removal. However, the decomposition pathway is not clear and requires further studies.

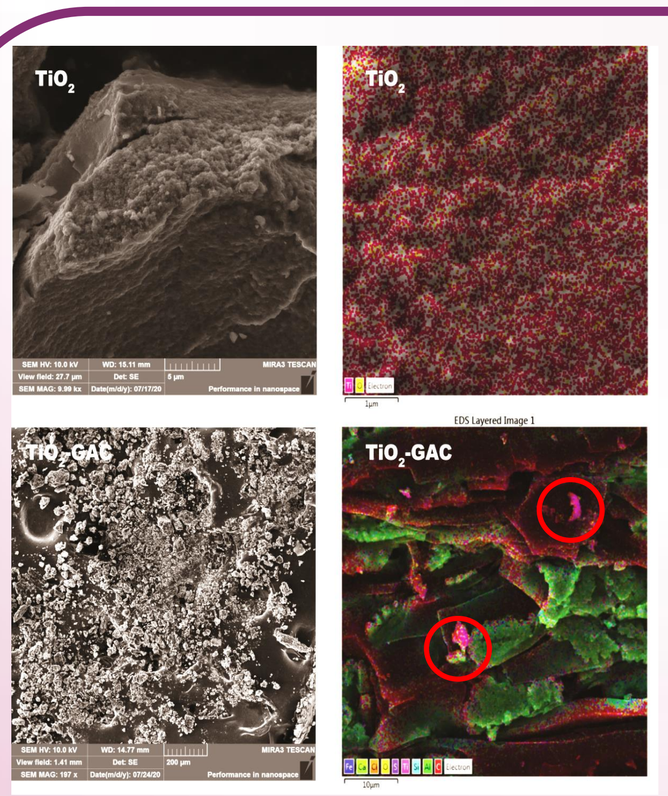
METHODS





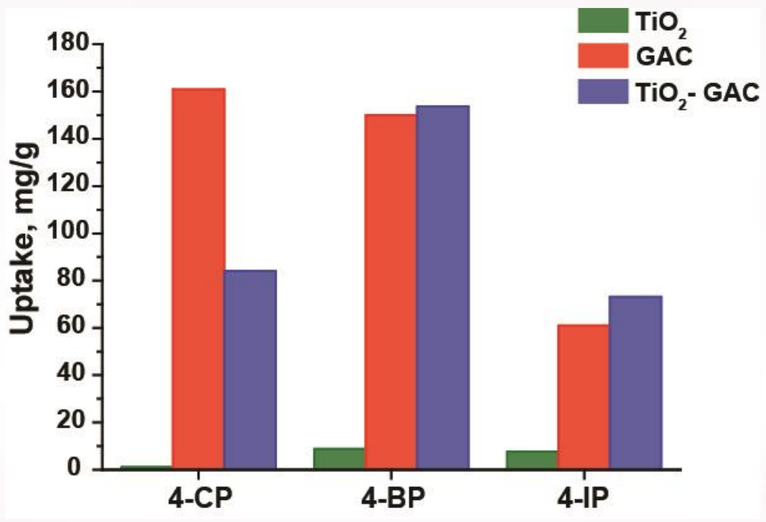
A - Scheme of sol-gel synthesis of bare TiO_2 and composite material;
B – Scheme of decomposition process.

RESULTS

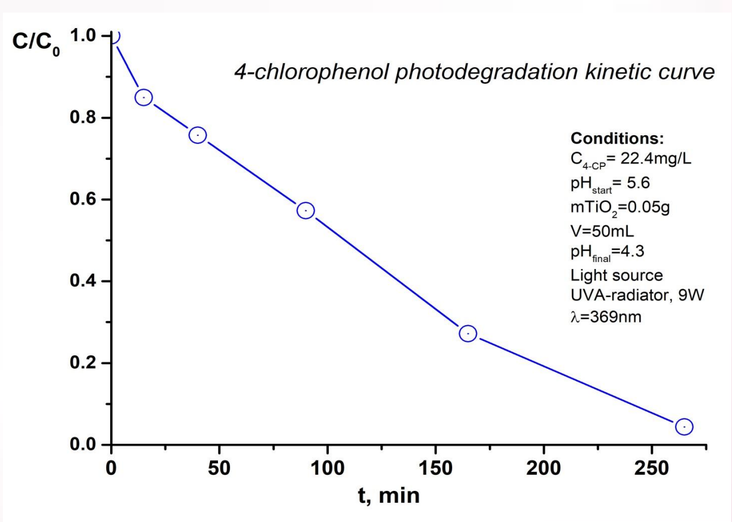


SEM micrographs of synthesized materials

Adsorption and photodegradation of target contaminants by bare titania and titania immobilized on activated carbon support



Adsorption capacity of granular activated carbon (GAC), TiO_2 and TiO_2-GAC composite towards 4-HPhs (4-CP – 4-chlorophenol, 4-BP – 4-bromophenol, 4-IP – 4-iodophenol)



Photodegradation of 4-chlorophenol by TiO_2 (C_{TiO2} = 1 g·L^{-1}, actual pH of 4-CP solution with concentration of 22.4 mg·L^{-1})

CONCLUSIONS

The present study deals with the facile ***in situ* sol-gel synthesis of composite material based on TiO_2 and granular activated carbon**. The synthesized composite was examined by SEM-EDX, BET, TG-DTG and XRD techniques. TiO_2-GAC has the high surface area (907m^2/g) combined with relatively high content of crystalline phase (21.9%). These benefits allow its application for adsorption/degradation of AOX. The prepared material possesses high adsorption capacity towards 4-chlorophenol, 4-bromophenol and 4-iodophenol. The photodegradation tests revealed the excellent tendency of AOX removal. However, the decomposition pathway is not clear and requires further studies.

Acknowledgment: The research has been supported by the VEGA 2/0156/19 MŠVVaŠ SR, H2020-MSCA-RISE-2016-NANOMED No 734641 as well as by Ernst Mach Grant.

References:

1. *Abedi K. et al.* Decomposition of chlorinated volatile organic compounds (CVOCs) using NTP coupled with TiO_2/GAC, ZnO/GAC, and TiO_2–ZnO/GAC in a plasma-assisted catalysis system // Journal
2. of Elect.- 2015.- 73.-P. 80-88.
2. *Moral-Rodríguez A. et al.* Tailoring the textural properties of an activated carbon for enhancing its adsorption capacity towards diclofenac from aqueous solution // Environ. Sci. Poll. Res. -2019.- 1.