The Role of Ultrasound in Selective Oxidation Photocatalysis

Juan Carlos Colmenares*, D.A. Giannakoudakis, A. Qayyum[1]; D. Łomot

Institute of Physical Chemistry, Polish Academy of Sciences, ul. Kasprzaka 44/52, 01-224 Warsaw, Poland. E-mail: jcarloscolmenares@ichf.edu.pl

Selective oxidation of lignin-inspired model aromatics alcohols to other value chemicals mostly aromatic compounds containing carbonyl and carboxylic groups is a promising field for developing new methodologies in the production of chemicals from lignin-inspired wastes, a major by-product generated from paper industries and biorefineries (e.g. in bioethanol production). The high value chemical compounds are stated to be replacement to expensive chemicals used in various products coming, for instance, from food and pharmaceutical industries [1,2]. The aforementioned issues can be approached through the use of selective heterogeneous photocatalysis coupled with the action of the physico-chemical effects of ultrasound (acoustic cavitation) which is a very innovative approache that gathers continual increase of attention, since it can positively promote selective redox reactions via a cost-effective and environmental-friendly manner.

The combination of sonochemistry and photocatalysis represents an innovative way to valorize biomass into fuels or platform molecules.

We report selected experiments of intensification of a photocatalytic selective oxidation through the use of ultrasonic waves [3]. The effort of our research is focused on the utilization of sonophotocatalysis for the selective transformation of lignin-based model molecules by nanostructured metal oxides (e.g. TiO_2). A plethora of parameters that affects the acoustic cavitation phenomena and as a result the potential of sonochemistry were investigated (e.g. ultrasound frequency and power). Various important photocatalytic parameters such as the wavelength and intensity of the irradiated light, photocatalyst loading, type of solvent, mixture of solvents, and solution pH were also optimized.

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