Comparative performance of ultrasonic reactors configurations for ibuprofen removal

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The application of ultrasound-based technologies for the degradation of emerging contaminants in water is gaining increasing attention due to their ability to enhance radical formation and promote efficient oxidation pathways [1,2]. In this study, two ultrasonic configurations—a probe-type horn and a Meinhardt Ultrasonics reactor—were employed to investigate the degradation of ibuprofen (IBU), a widely used and persistent non-steroidal anti-inflammatory drug, in aqueous media. The oxidative processes were performed in the absence and in the presence of bismuth oxybromide (BiOBr) as a visible-light-responsive photocatalyst, under three operating modes: sonocatalysis, photocatalysis, and their synergistic combination (sonophotocatalysis). The performance of each approach was compared in terms of IBU removal efficiency.

To assess the environmental relevance of the process, UHPLC-MS/MS analyses were carried out to identify the transformation products (TPs) formed during the processes. Several intermediates were structurally proposed based on MS and MS/MS fragmentation patterns.

The findings provide insight into the reaction pathways and potential environmental impact of the resulting TPs. This work underscores the promising role of ultrasound-driven advanced oxidation processes (AOPs) in the sustainable treatment of pharmaceutical contaminants.

[1] Galloni, M.G. et al., Applications and applicability of the cavitation technology, *Curr. Opin. in Chem. Engin*., 2025, **48**, 101129.

[2] Falletta, E. *et al.*, Fast and Efficient Piezo-Photocatalytic Mineralization of Ibuprofen by BiOBr Nanosheets under Solar Light Irradiation, *ACS Photonics* 2023, **10**, 3929−3943.