

# Sonochemical Route for Removal of Recalcitrant Pollutants from Wastewater †

Priyanka P. <sup>1</sup>, Maneesh Kumar Poddar <sup>2</sup>

<sup>1</sup> M.Tech student, NITK Surathkal; priyankaprabhakar65@gmail.com (P.P.);

<sup>2</sup> Assitant Professor; maneeshpoddar@gmail.com (M.K.P.)

\* Correspondence: e-mail@e-mail.com; if there are multiple corresponding authors, add author initials) (F.L.);

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**Abstract:** Recalcitrant compounds are new synthetic compounds that are slowly biodegradable or non-biodegradable—conventional methods for wastewater treatment do not always allow the removal of all undesired substances. The work focuses on degrading pharmaceutical recalcitrant compound ciprofloxacin through a sonochemical route using an enzyme. Horseradish Peroxidase (HRP) enzyme is used for sonochemical degradation. UV-vis spectrophotometer was used to determine the residual ciprofloxacin. Plackett Burman's design was used to select the three most significant degradation process parameters. The six potential parameters selected were initial CIP concentration, temperature, pH, time, HRP enzyme concentration, and H<sub>2</sub>O<sub>2</sub> concentration. The Plackett Burman design determined peroxide concentration, initial CIP concentration, and sonication time as the most significant parameters. CCD design was used to obtain the optimized values of these three significant parameters. The optimized condition resulted in 97.37% degradation of ciprofloxacin.

**Keywords:** recalcitrant compound; sonochemical degradation; ciprofloxacin; Horseradish peroxidase; sonoenzymatic; ultrasound-assisted.

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## Conflicts of Interest

The authors declare no conflict of interest.