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The impact of microplastics on the ozonation of wastewater containing the antibiotic amoxicillin

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This study investigated the ozonation of wastewater containing microplastics (MPs) made from several different materials, including polyvinylchloride (PVC), polypropylene (PP), polyethylene terephthalate (PET), polyethylene (PE), and rubber. Fraction size of utilized microplastics was less in the range of 0.8-1 mm. The initial phase involved ozonation of 500 mL of wastewater mixed with each type of microplastic (separately) at a concentration of 1 $g \cdot L^{-1}$. Chemical oxygen demand (COD) was measured at multiple intervals: 0, 5, 10, 20, 30, 60, 90, 120, 180, 240, 300, 360 minutes; to track the effectiveness of ozonation in degrading both the microplastics and organic pollutants in wastewater. Subsequently, the MP that demonstrated the highest ability to hinder COD removal was identified. Further investigations were conducted using this selected MP in a basic mixture (pH > 10), to evaluate how this variation influenced the ozonation process and overall degradation efficiency. COD was measured at the same intervals as in the initial experiments to compare the impact of pH adjustment on ozonation performance. In the final phase of the research, ozonation took place with a combination of the chosen MPs and amoxicillin, a common pharmaceutical contaminant. Similar to the prior steps, COD was measured at the set time intervals, and selected ions were determined at the beginning and end of ozonation to assess treatment efficiency. Additionally, total organic carbon (TOC) and inorganic carbon (IC) were also measured for each sample. COD removal followed comparable trends for WW with each MP and as expected, the treatment efficiency was highest in the raw WW, while the lowest was in WW with rubber. The efficiencies reached as high as 83 % for the ozonation of WW and generally after 6 hours it was in a range of 80−70 % for all MPs samples. TOC removal also followed a common trend for ozonation of WW with each MP and reached the lowest value of 5.85 $mg \cdot L^{-1}$ for WW. Change in the pH was comparable for each ozonation, while only WW with PVC and rubber did not follow the trend. WW with PVC had a constant pH after the initial drop and with rubber it dropped to 6.50 after 90 minutes. Regarding values of IC, it was noted that the lowest values were measured in ozonated WW with rubber. It was concluded that MPs do have generally negative impact on ozonation process of WW.