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Study on the application of atmospheric pressure gas-liquid discharge plasma in the degradation of antibiotics in multiphase environmental wastewater

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Antibiotic is widely used in the farming industry, which can be used as feed additives for livestock disease prevention and antibacterial growth promotion or directly used for the treatment of livestock and poultry diseases.[1] After metabolism in animals, antibiotic and its metabolites will enter the environment with feces and urine. It has been found that the residual concentration of ciprofloxacin hydrochloride in livestock manure can be as high as 45.6 mg/kg. It has posed a serious threat to human health and ecological safety, because it is persistent and stable in soil, water and other environmental media, and tend to induce the development of drug-resistant bacteria.

Atmospheric pressure gas-liquid discharge plasma (APG-LDP) water treatment technology combines O_3, OH, H_2O_2 and other reactive species as well as UV light and high-energy electrons and other physicochemical effects, has the advantages of low temperature, low energy consumption and the ability to produce abundant active particles and so on [2], has received wide attention from domestic and foreign researchers. Although APG-LDP water treatment technology is very effective for antibiotic degradation, there are not many studies on antibiotic degradation in a multiphase system such as feces.

In our work, a mixture of Al_2O_3 powder, cellulose and ciprofloxacin hydrochloride was prepared to simulate the environment of a multiphase system of feces, which was treated by plasma generated by a needle-water electrode gas-liquid discharge device. The effects of gas components, applied voltage, gas flow rate, initial concentration, Al_2O_3 powder and cellulose on the discharge characteristic and degradation efficiency of ciprofloxacin hydrochloride were investigated to obtain the optimal conditions for the degradation efficiency and mechanism of ciprofloxacin hydrochloride.

Figure 1 shows that when the gas-liquid discharge plasma treated for 70min, the degradation efficiency of ciprofloxacin hydrochloride in the multiphase wastewater reaches 100%.

References

[1] J. Ren *et.al*. J. Environ. Manage., 335 (2023)
[2]Jian P. Liang, et.al. Environ. Manage., 278 111539(2023).

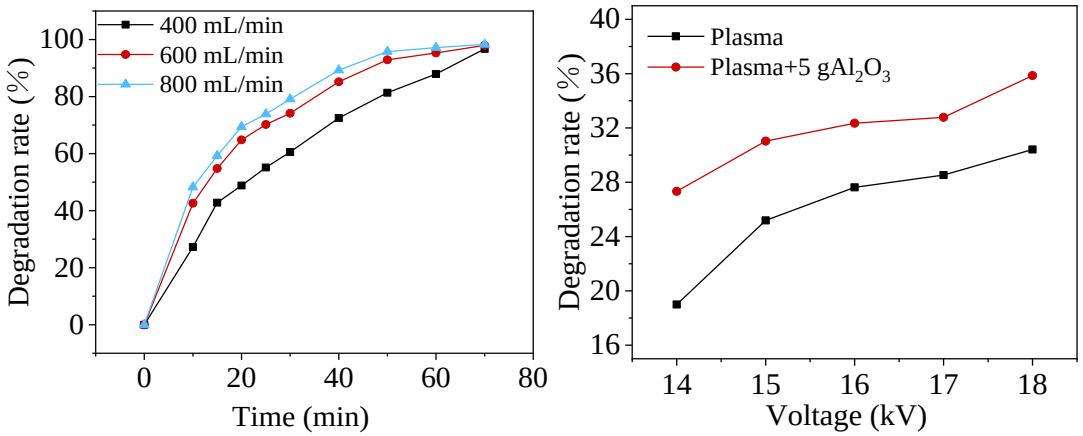

Figure 1 Effects gas flow and applied voltage on the degradation efficiency of ciprofloxacin hydrochloride