Enhanced Degradation of Ciprofloxacin by Sri Lankan Red Earth

U.S.T. Sachintha[1], Nadeesha H. Kroalegedara[1*], Rasika Jinadasa[2]

[1]*Department of Geology, Faculty of Science, University of Peradeniya, Sri Lanka*
[2]*Department of Veterinary Pathobiology, Faculty of Veterinary Medicine and Animal Science, University of Peradeniya, Sri Lanka*
[*]*nadeeshak@sci.pdn.ac.lk*

Ciprofloxacin is the most widely prescribed fluoroquinolone-class antibiotic in the world. Excess application and improper utilization cause ciprofloxacin accumulation in natural environments. It's long half-life in soil can lead to the development of antibiotic resistance among microorganisms, which is a global health issue. Therefore, identifying mechanisms to enhance antibiotic degradation to reduce their half-life is highly important. This study investigated the efficiency of ciprofloxacin degradation via photocatalytic oxidation and Fenton process by a natural Fe and Ti oxides rich red soil (RE). The degradation experiments were carried out by mixing 500 mg of ciprofloxacin in 100 g of RE. Ciprofloxacin containing crude was extracted at different time intervals (1 day, 1, 3, 5, 7, 9 and 16 weeks) using methanol. The extracted crude was analyzed by the Fourier Transform Infrared Spectroscopy (FTIR) to identify the structural changes in ciprofloxacin. Antibacterial activity of the crude against *Staphylococcus aureus* ATCC 25923 was tested using the agar diffusion method and determining the minimum inhibitory concentration (MIC) by broth dilution method to semi-quantitatively assess the degree of degradation of ciprofloxacin by RE. Appearance of FTIR peak at 1741 cm^{-1} position after five weeks exposure time confirmed the formation of by-products by ciprofloxacin degradation. A decreased inhibition zone was observed at day 25 and no inhibition zone was observed after 64 days indicating complete degradation of ciprofloxacin. The MIC increased from 39 mg/kg to 1250 mg/kg at day 1 and week 16, respectively, suggesting a 32-fold reduction in biologically-active ciprofloxacin concentration. Results of the present study indicate that RE has the potential to degrade and reduce the half-life of ciprofloxacin.

Keywords: Ciprofloxacin, Iron rich soil, Degradation, Antibiotic

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