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From Chemostat/Retentostat to Soil: Modeling bioavailability limitations on atrazine degradation

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Atrazine has been banned in Europe since 2003, but is still a widely used herbicide in the rest of the world. It presents an environmental threat due to its environmental persistence and ecotoxicity. Although soil bacteria have evolved effective biodegradation pathways, atrazine persists in soils at low concentrations making soils to potential continuous sources of groundwater pollution. Experiments using isotopologues of atrazine in simplified systems (chemostat and retentostat) indicate, that limited mass transfer across the cell membrane controls atrazine degradation at low concentrations. We extended and parameterized an existing mathematical model of atrazine degradation in the chemostat/retentostat system using laboratory data. By integrating this modeling approach into a more complex soil model, the role of mass transfer across bacterial cell membranes can be assessed against other rate limiting processes of atrazine biodegradation in soil at low concentrations.