A laboratory-data-supported mathematical model for water purification

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Abstract

The ever increasing worldwide scarcity of clean water renders wastewater treatment of paramount importance to satisfy the drinking and industrial needs. Mathematical models represent relatively cheap means of simulating the behavior of complex systems, if enough computing power is available. We present here a mathematical system that models the decolourisation process of waters flowing out of textile industrial plants.

In particular, we consider the Remazol Brilliant Blue Reactive dye (RBBR) as pollutant, and employ a selected white rot fungus, which is known to be able to degrade a wide range of recalcitrant compounds. We focus on the important role that carbon (glucose) plays in this action. Indeed, it can help fungal metabolism and growth.

The dynamical system thus contains three major actors, the pollutant, the fungi and glucose, which represent the time-dependent variables, whose behavior is then compared with the results of experimental data obtained in the laboratory experiments especially designed for this purpose. Then best fitting allows us to assess the value of the various parameters describing the growth and the chemical reactions rates in this closed system.

A more general mathematical model is finally introduced, to simulate real industrial purification reactors, that allows for a constant pollutant and nutrients input.

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