过程系统工程

基于优化理论的藻类生长模型及在水华预测中的应用

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摘要　　在对水华产生机理分析和研究的基础上，建立了用于藻类生长模型，研究了有约束条件的非线性极小值问题求取最优参数估计值的方法。结合实验数据对模型中涉及的参数，运用多参数同时估计法进行估计并验证。仿真与实验结果表明了该模型能够较好地描述水华从产生到爆发过程的变化规律，为水华的预警及治理提供参考依据。

关键词

水华　藻类生长模型　参数估计　模型

分类号

Algae growth modeling based on optimization theory and application to water-bloom prediction

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Abstract

Water-bloom prediction is important to environmental protection, and the mechanism model of water-bloom is the basis of water-bloom prediction. A model for algae growth was set up based on the analysis and research about the mechanism of water-bloom engendering. The model described the relationship of chlorophyll-a and temperature, solar illumination, overall phosphor, and was applicable to the lakes whose nutrition factor is restricted by phosphor in nutrition circle, without considering the influence of hydrodynamics. And an optimal method of estimating optimal parameters in a nonlinear minimum problem with constraints was proposed. The parameters in the model, such as maximum growth rate of alga, half - saturation coefficient of light, half - saturation coefficient of phosphor, maximum death rate of alga, net loss velocity of alga, and so on, were evaluated by the multi-parameter simultaneous estimation method and validated by experimental data. Through simulation and experiments, the result showed that the model could better describe the change of water-bloom from engendering to burst-out and provide reference for water-bloom prediction and control.

Key words

water-bloom　algae growth model　parameter determination　model

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