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鄱阳湖悬浮颗粒物絮凝沉降典型藻类的动力学研究

Study on kinetics of flocculation and settlement between typical algae and suspended particulates in Poyang Lake

关键词：水动力 悬浮颗粒物 絮凝沉降 藻细胞

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摘要： 为了探讨鄱阳湖水动力条件改变引起的悬浮颗粒物浓度变化可能导致的鄱阳湖浮游植物群落结构的变化,本文研究了鄱阳湖悬浮颗粒物絮凝沉降3种典型藻类的动力学过程.以铜绿微囊藻(蓝藻)、四尾栅藻(绿藻)和菱形藻(硅藻)为研究对象、鄱阳湖采集沉积物为悬浮颗粒物,使用混凝试验搅拌仪模拟动力学条件,在颗粒物投加量为20 mg·L^{-1}时分别研究了静置沉降时间、扰动强度和扰动时间对颗粒物絮凝沉降藻细胞的影响.结果表明,絮凝沉降效率:蓝藻>绿藻>硅藻.在扰动强度为20 s^{-1}、扰动时间为30 min时,0.5~4 h静置沉降时间均促进3种藻类的絮凝沉降.绿藻和硅藻的絮凝沉降效率随着静置沉降时间的延长而降低,前0.5 h的絮凝沉降效率最大;而蓝藻的絮凝沉降效率变化无明显规律.扰动时间和静置沉降时间均为30 min时,随着扰动强度在2~40 s^{-1}增加时,3种藻的絮凝沉降效率逐渐增大.扰动强度为20 s^{-1}、静置沉降时间为30 min时,5~60 min扰动时间均促进藻细胞的絮凝沉降,并且随着扰动时间的增加,絮凝沉降效率呈先增大后降低的趋势.30 min为蓝藻絮凝沉降的最佳扰动时间,絮凝沉降效率为12.56%;45 min为绿藻和硅藻絮凝沉降的最佳扰动时间,絮凝沉降效率分别为11.93%和7.54%.因此,水动力条件的改变可以引起悬浮颗粒物与藻类的絮凝沉降效率发生变化,从而对藻类的群落结构以及水华发生规律产生影响.

Abstract: In order to investigate the effect of the suspended particulate concentration variation caused by hydrodynamic conditions of Poyang Lake on the phytoplanktonic community structure shift, the kinetics of flocculation and settlement of three type of algae cells, *Microcystis aeruginosa* (cyanobacteria), *Scenedesmus quadricauda* (green algae) and *Nitzschia*(diatoms), caused by suspended particulates from Poyang Lake was studied. The impact of the settling time, agitation strength and time on the efficiency of algae flocculation and settlement was also studied by using jar test, under the dosage of suspended particles at 20 mg · L^{-1}. The results showed that the order of flocculation and settlement efficiency was cyanobacteria >green algae >diatoms. When the agitation strength was 20 s^{-1} and the agitation time was 30 min, the settlement of algae cells increased with the settling time from 0.5 h to 4 h. While the efficiency of flocculation-settlement for green algae and diatoms decreased with the extension of settling time, and the maximum value was observed within 0.5 h duration. But for *Cyanobacteria* cells, their flocculation-settlement efficiency fluctuated erratically during the period of settlement. As both the agitation time and settling time were 30 min, the efficiency of flocculation-settlement for algae cells gradually increased with the rise of agitation strength ranged from 2~40 s^{-1}. The variations of agitation duration from 5 to 60 min in jar tests at 20 s^{-1} of agitation strength and 30 min of settlement duration were also beneficial for the efficiency of flocculation-settlement for algae cells, which increased at first, and then decreased as the extension of agitation duration. Furthermore, the optimum agitation duration for *Cyanobacteria* flocculation-settlement was 30 min, and the corresponding efficiency was 12.56%. For green algae and diatoms, the optimum agitation durations were determined at 45 min with efficiency of 11.93% and 7.54%, respectively. On the basis of above results, it can be proposed that the changes in hydrodynamic conditions can lead to the variations of the flocculation-settlement efficiency for suspending particulates and algae cells, which could affect the Poyang Lake algae community structure, and even the regulation of blooms later.

Key words: hydrodynamic suspended particulates flocculation and settlement algae cells

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