THE CONTRIBUTION FROM PARTICULATE ORGANIC CARBON (POC) TO DISSOLVED ORGANIC CARBON (DOC) IN EUTROPHIC LAKE TAIHU, CHINA

Yanhong Xu, Yuxin He, Yongge Sun, Jiali Pang

School of Earth Sciences, Zhejiang University, China;

Lakes play an important role in the regional and global carbon cycle through transportation, mineralization and burial of organic carbon (Cole et al., 2007; Tranvik et al., 2009). In eutrophic lakes, the increasing autochthonous sources added to dissolved organic carbon (DOC) pool and particulate organic carbon (POC) pool affect subsequent degradation of organic carbon and further organic carbon fluxes. However, carbon cycle between POC pool and DOC pool remains largely unknown in eutrophic lakes. In this study, we collected water samples in the Meiliang Bay, northwest of Lake Taihu every month over an annual algal blooming-disappearance cycle (May 2017 to May 2018) and investigated the stable carbon isotopic compositions of both the POC and the DOC, the optical characteristics of the DOC, and the molecular compositions of the DOC. The main aim of this study is to probe the dynamics of DOC and POC compositions at molecular level upon the algal blooming and disappearance cycle in Lake Taihu and further the conversion relationship of the two parts in water column. The $\delta^{13}C$ value of POC ranged from -17.2 ‰ to -28.7‰ in the annual cycle, and reached the heaviest $\delta^{13}C$ value in August 2017 and the lightest one in November 2017. The $\delta^{13}C$ variation of POC illustrated that phytoplankton-derived carbon might be the main contributor to POC pool. The stable carbon isotopic composition and optical characteristics suggested that DOC mainly consisted of tryptophan-like substance and humic-like substance. During the algae blooming period, large amount of refractory DOC from algae (humic-like) largely contributed to the DOC pool due to labile DOC utilized by microbial community rapidly, resulting in the heavier $\delta^{13}C$ and high humification index (HIX). In the late algae blooming period (November 2017), with the further utilization of DOC by microbial community the DOC pool showed more aromatic contents with higher specific UV absorbance ($SUVA_{254}$), aromaticity index (AI) and high HIX. During the stage of blooming disappearance, the release of fresh intracellular substance from decomposing algae to the DOC pool was the most likely reason for the biological index (BIX) rising, because the terrestrial organic carbon usually showed a low BIX value. Thus, extracellular organic carbon from living algae should be responsible for the increasing DOC in the algae blooming period, while the intracellular organic carbon from decomposing algae might accelerate the conversion of POC to DOC during the stage of algae disappearance.

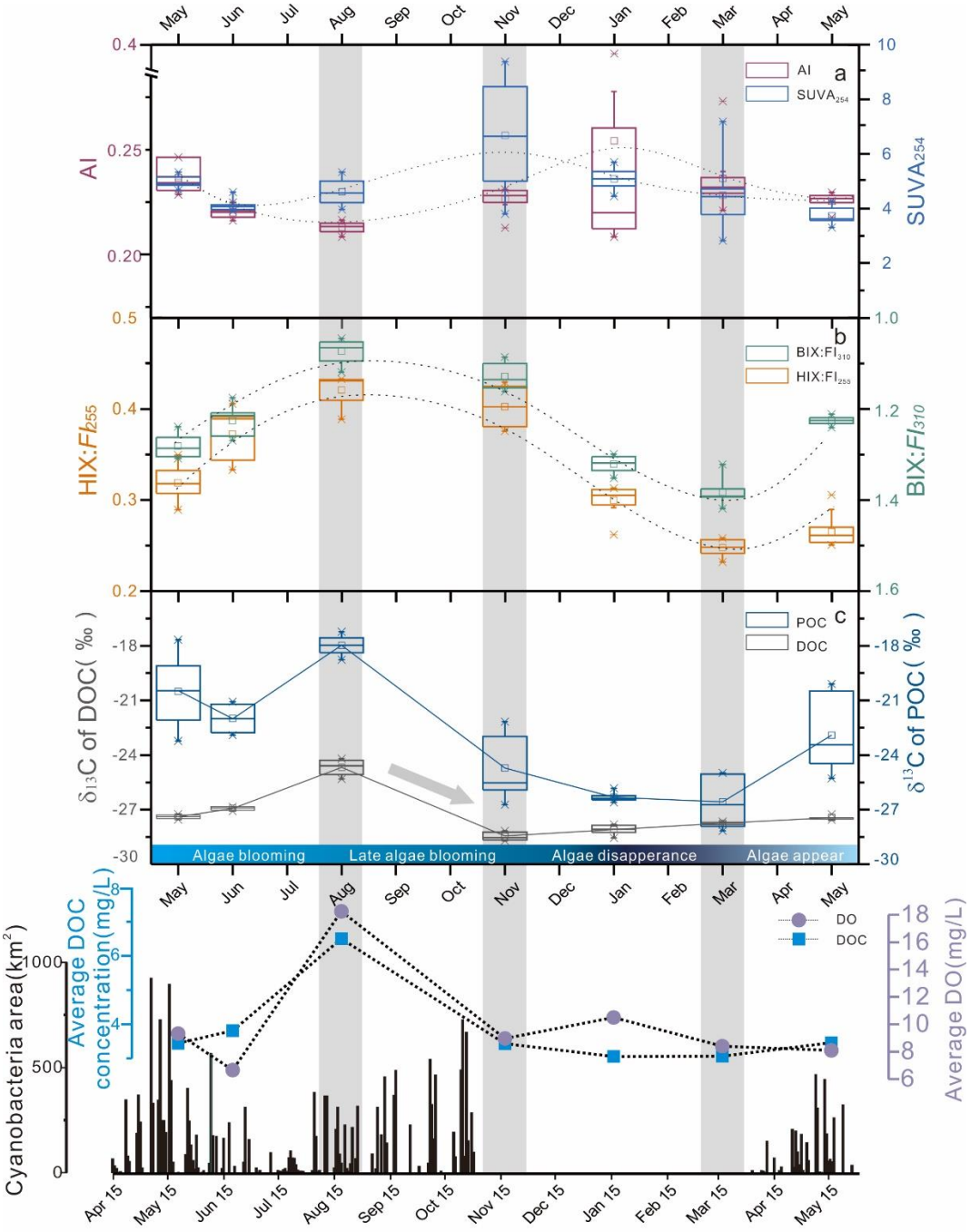

Figure 1 *The seasonal change of DOC pool and POC pool in Lake Taihu (a) the aromaticity index (AI), the specific UV absorbance ($SUVA_{254}$) (b) the humification index (HIX), the biological index (BIX) (c) the $\delta^{13}C$ of POC, the $\delta^{13}C$ of DOC. Blue box and purple dot represent the average DOC concentration and the average DO concentration of four sampling sites in Lake Taihu, respectively. Histogram represents the cyanobacteria area from remote sensing image, which can be fund only from April to October.*
Website: http://www.jsem.net.cn/mrygyt/thlz/

References:

Cole, J. J., et al. "Plumbing the Global Carbon Cycle: Integrating Inland Waters into the Terrestrial Carbon Budget." Ecosystems 10.1(2007):171-184.

Tranvik, Lars J., et al. "Lakes and reservoirs as regulators of carbon cycling and climate." Limnology and Oceanography54.6_part_2(2009):2298-2314.