ARSENIC BIOTRANSFORMATION BY MICROCYSTIS AERUGINOSA UNDER DIFFERENT NITROGEN AND PHOSPHATE LEVELS

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Introduction

The toxicity of arsenic to organism in freshwater is dependent on its speciation and concentration. To the best of our knowledge, little has been studied regarding the potential influence of N : P ratio on arsenic metabolism in microalgae. In this study, we chose the typical freshwater cyanobacteria *M. aeruginosa* (FACHB 905) to investigate the influences of N and P on As biotransformation. Changes in As speciation for both the alga and culture media were measured at different levels of N and P. The observed results would contribute to a better understanding of nitrogen-regulated interactions between As contaminants and cyanobacteria, and facilitate the realization of As biogeochemistry in environments.

Methods

Test medium were divided into five groups according to the concentrations of N ($NaNO_3$) and P (K_2HPO_4) in the modified BG11 medium (N:P=4:0.2, 10:0.2, 20:0.2, 10:0.5, 10:1.0, respectively). Treatment groups and control groups were subjected to same treatments, and treatment groups were exposed to 15 μg/L As(Ⅴ) ($Na_3AsO_4 \cdot 12H_2O$) additionally at the beginning of the test. The experiment lasted for 8 days. Arsenic species in the medium as well as algal digestion solutions were determined by HPLC-ICP-MS using anion-exchange column as detailed by Zhu et al (Zhu et al. 2008).

Results

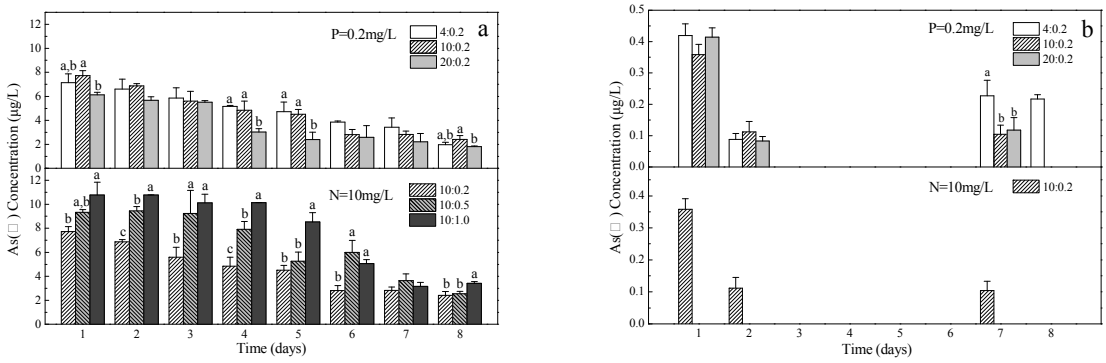

Figure 1. As(Ⅴ) (a) and As(Ⅲ) (b) in medium with exposure to 15 μg/L As(Ⅴ) under five concentrations of N and P during a 8-day cultivation.

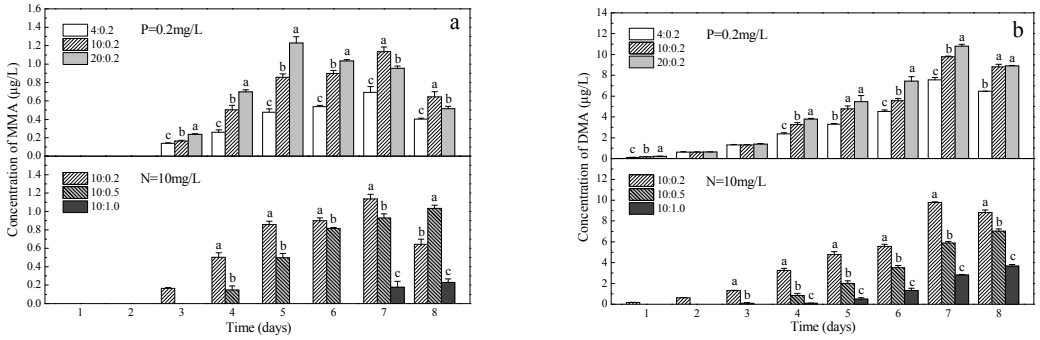

Figure 2. MMA (a) and DMA (b) in medium with 15 μg/L As(Ⅴ) exposure under different N and P conditions during a 8-day cultivation.

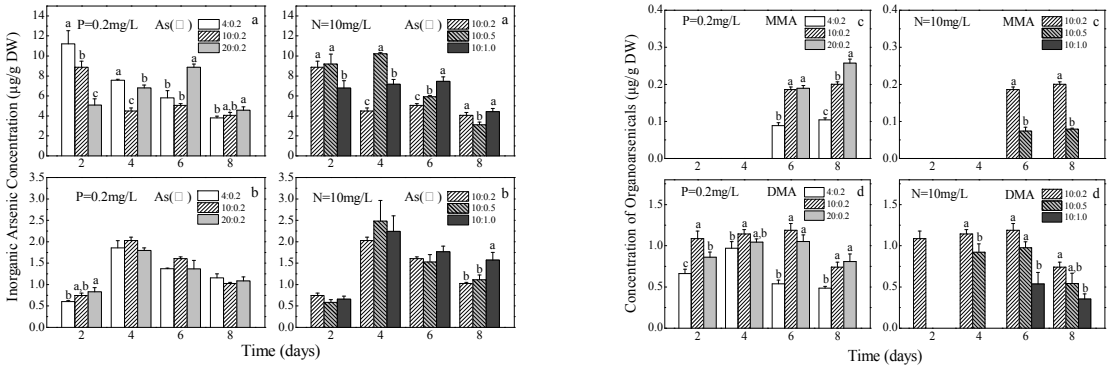

Figure 3. Intracellular concentrations of As(Ⅴ) (a), As(Ⅲ) (b), MMA (c), and DMA (d) within a 8-day As(Ⅴ) exposure under different conditions of N and P.

Conclusion

Arsenate biotransformation in *M. aeruginosa* was accelerated by increasing N levels, but was inhibited by increasing P levels in medium. Increasing N levels indirectly facilitated As metabolism possibly according to the stimulation on algal growth. Dissimilarly, P showed significant regulation on As biotransformation mainly through the mediation on arsenate uptake by *M. aeruginosa*. The finding of nutrients regulation on As metabolism can be considered to mediate As geochemical cycling, and therefore alleviate As contamination risk in aquatic ecosystem.

References

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