

# 論文内容の要約 Summary of Thesis Contents

## 1. 主論文要旨(論文提出時のもの) Abstract of Doctoral Thesis (summarized at the time of submission)

論文名 Title of Thesis

### Studies on Ion Adsorption-Desorption Characteristics of Biofilm Matrices

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The ability of biofilm to attract and retain ion, including nutrient ions, is highly relevant to various functions of biofilm as a predominant habitat of microbes such as nutrient cycling and preservation of microbial gene pool. In this study, nutrient ion concentration inside biofilms during the biofilm forming process and ion adsorption-desorption characteristics of biofilm matrices, including how ions retained in the biofilm matrices, were investigated. The biofilm formed relatively quickly taking just a week to reach biomass found for the mature biofilm. The interior of the biofilm is rich in nutrient (hundreds to thousands times greater in nutrient ion concentration) compared with the surrounding water from a very early stage of the biofilm formation. Both positively and negatively charged sites exist in the biofilm polymers. A physicochemical interaction between these charged sites and ions in the surrounding water seems to promote the ion adsorption to the biofilm through an attractive electrostatic interaction and an ion exchange mechanism. The attracted ions may be reserved in two regions; 1) the regions between biofilm polymers and 2) on the charged sites of biofilm polymers. The main factor regulating the ion retaining ability inside of biofilms seems to be an electrostatic interaction between the ions and the charged sites of biofilm polymer. The greater electrostatic attraction between the retained ions and the charged sites of biofilm polymers will hinder the release of the ions from the biofilm matrices. The result obtained by the present study enable us to characterize the internal region of biofilm exchanging ions dynamically with outside environment and to find out the determinant factor regulating this dynamic exchange of ions applicable for various biofilms. According to the results of this study, biofilms may play important roles to stabilize the aquatic ecosystem concerning ion concentrations.

## 2. 論文に関するリスト List on thesis

### (1) 学位論文の基礎となった学術論文【査読あり】

The academic thesis that became a basis of your thesis 【With review】

- ① Kurniawan, T. Yamamoto, Y. Tsuchiya, and H. Morisaki, “Analysis of Ion Adsorption-Desorption Characteristics of Biofilm Matrices”, *Microbes and Environment*, Vol. 27, No.4, December, 2012, pp.399-406.
- ② Hiraki, Y. Tsuchiya, Y. Fukuda, T. Yamamoto, A. Kurniawan, and H. Morisaki, “Analysis of How a Biofilm Forms on the Surface of the Aquatic Macrophyte *Phragmites australis*”, *Microbes and Environment*, Vol. 24, No. 3, September, 2009, pp.265-272.
- ③ Y. Tsuchiya, M. Ikenaga, A. Kurniawan, A. Hiraki, T. Arakawa, R. Kusakabe, and H. Morisaki, “Nutrient-Rich Microhabitats within Biofilms Are Synchronized with the External Environment”, *Microbes and Environment*, Vol. 24, No.1, March, 2009, pp.43-51.

### (2) 国際会議発表【査読あり】

Presentation in International Conference 【With review】

【口頭】 【Oral presentation】

None

【ポスター】 【Poster presentation】

- ① Kurniawan, A., T. Yamamoto, Y. Tsuchiya and H. Morisaki, “Characteristics of ion desorption from biofilm matrices” , The 28<sup>th</sup> Annual Meeting of Japanese Society for Microbial Ecology - The 4<sup>th</sup> Japan-Korean International Symposium on Microbial Ecology, 19 - 22 September 2012, Toyohashi University of Technology, Toyohashi, Japan.
- ② Morisaki, H., Y. Tsuchiya, A. Kurniawan, and A. Hiraki, “Microenvironment inside of biofilm for preventing outside pollution” , Interfaces again pollution international conference, 11 - 14 June 2012, Laboratoire Environnement et Mineralogie, CNRS-Lorraine University, Nancy, France.
- ③ Kurniawan, A., T. Yamamoto, Y. Tsuchiya and H. Morisaki, “ Analysis of ion adsorption/desorption characteristics to/from biofilm” , The 27<sup>th</sup> Annual Meeting of Japanese Society for Microbial Ecology, 8 - 10 October 2011, Kyoto University, Kyoto, Japan.
- ④ Yamamoto, T., A. Kurniawan, Y. Tsuchiya and H. Morisaki, “バイオフィルムのイオン吸着能”, The 25<sup>th</sup> Annual Meeting of Japanese Society for Microbial Ecology, 21 - 23 November 2009, Hiroshima University, Hiroshima, Japan.

### (3) 学会誌に公刊された総説・解説

General remarks and Commentary published on Official journal of a Scientific society

None

(4) 国内学会発表 Presentation in Domestic Society  
None

(5) 特許出願 Patent Application  
None