

## Development of Basic Assessment Method for Elucidation of Metal Corrosion Mechanisms Caused by Microorganisms

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### Summary

Biofilms are biological membranes enclosed in a matrix composed of polymeric substances produced by multiple species of microorganisms. When microorganisms adhere to the metal surfaces of infrastructure in the marine environment, biofilms form on the metal surfaces. Metal corrosion of marine infrastructure caused by biofilms is responsible for approximately 20% of metal corrosion affecting the marine infrastructure, resulting in significant economic losses due to rising maintenance costs. Thus, metal corrosion is a global problem. Based on the problem, I hypothesized that guidelines to prevent and control biofilm formation on metal surfaces of marine infrastructure could be established if the structure of the bacterial community on metal surfaces could be characterized before biofilm formation. Moreover, the lifetime of marine infrastructure might be extended if such guidelines could reduce the occurrence of metal corrosion. In this study, as a preliminary study for developing guidelines for biofilm prevention and control, bacterial community analysis was performed on two types of samples. First, biofilms formed on mooring rings were analyzed to obtain information on the bacterial community of biofilms collected from metal without corrosion. On the other hand, the bacterial community analysis was also performed to determine if it is possible to analyze the bacterial community of the enrichment culture with a metal piece using a low nutrient source medium.

When bacterial community analysis was performed on the biofilms, a total of 18 of genera bacteria were observed, and *Alkanindiges* bacteria were observed as the dominant species, and their relative abundance was more than 95%. Apart from *Alkanindiges*, several bacteria such as *Sphingomonas* and *Pseudomonas* were also observed as OTUs, but the relative abundances of those bacteria were less than 3%. In the genomes of *Alkanindiges* bacteria, the gene and the gene cluster related to metal corrosion is not present, which indicated that *Alkanindiges* bacteria act in the formation of biofilms before the occurrence of metal corrosion.

When bacterial community analysis was performed on the enrichment culture, the bacterial community before biofilm formation contains a mixture of bacteria such as  $\alpha$ -Proteobacteria,  $\beta$ -Proteobacteria,  $\gamma$ -Proteobacteria and *Sphingobacteria*. Moreover, biofilm formation may occur by the increase of the relative abundance of *Sphingomonas*, *Methylobacterium* and *Pseudomonas* species, if the growth is not inhibited by environmental stresses and external sources of nutrients can be obtained.