FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

Project Title: Establishment of the practical ethanol-production system from marine biomass by utilizing the bacterium with regulated oxidation –reduction system	
Name: Shigeyuki KAWAI	**Institution**: Kyoto University

1. Background of research

Fossil fuels, especially petroleum and coal, are the main culprits behind the emission of greenhouse gases. Moreover, fossil fuels will be exhausted in the near future. Therefore, Brazil and the United States have developed practical methods for producing alternative fuels (ethanol) from agricultural biomass (e.g., sugarcane and corn). However, because of the limited amount of arable land in Japan, this is almost impossible. Using weeds or forest biomass (tree products such as wood) would also be difficult**. On the other hand, because Japan is surrounded on all sides by ocean, we have access to an enormous quantity of marine biomass (e.g., brown algae). However, no practical technology yet been developed to utilize mannitol and polyuronic acid, two principal ingredients of brown algae-derived marine biomass.**

2. Research objectives

This study aims to develop a practical technology that enables production of ethanol from marine biomass (mannitol and especially polyuronic acid) by utilizing a specific bioengineered bacterium, *Sphingomonas* sp. strain A1, that exhibits high capacity for assimilation of polyuronic acid.

3. Research characteristics (incl. originality and creativity)

Chemical reactions that involve electron transfer, i.e., oxidative and reductive reactions, are necessary during ethanol production. By controlling these reactions as well as others, we will enhance the capacity of the bioengineered *Sphingomonas* sp. strain A1 to produce ethanol from polyuronic acid. This method would be the only technology capable of producing valuable materials from polyuronic acid. We also seek to practically produce ethanol from mannitol, and to efficiently utilize total marine biomass.

4. Anticipated effects and future applications of research

This research will facilitate the use of Japan's marine resources by allowing production of ethanol and other useful materials. Furthermore, we can expect the application of resulting technology to encourage economic development and job creation in the coastal regions. Use of biomass-derived ethanol will reduce emission of greenhouse gases and slow the depletion of the world's reserves of fossil fuels.