Marine aerosol generation by electrolysis of seawater and effectiveness for cloud generation by CCN ability evaluation

*Shoyo Taguchi[1], *Hiroto Kondo[1], *Haruki Miyagawa[1], Kazumi Igawa[1]

1. Zushi Kaisei Senior High School in Kanagawa

Looking back through the history of the earth, we can assume that the global environment has been constantly changing. For this reason, organisms on the earth have survived by adapting their appearance and ecology to the environment. However, at times, species themselves may become extinct due to rapid changes in the global environment. For example, during the ice age about 10,000 years ago, many species that could not adapt to climate change became extinct. The recent problem of global warming is no exception. One of the most serious problems is the rise in average temperatures. This trend has been increasing over the past century or two due to industrialization, but if humans do not take the initiative in curbing the rise in average temperatures, there will be even greater consequences, such as global crop failures and water shortages. We humans must take measures to avoid repeating the mistakes of past species. Fortunately, human technology is advancing at a dizzying pace, and we believe that we can use it to curb global warming.

Simply reducing global warming can be done from a variety of perspectives. For example, we can find ways to reduce greenhouse gas emissions, or we can increase the amount of carbon dioxide absorbed by forests. In this context, we have focused on aerosols, which are the source material from which clouds are formed. Aerosols are microscopic particles of less than 5 μm in diameter suspended in the air. Aerosols act as condensation nuclei to form cloud particles in highly humid environments, and are one of the substances that contribute to the formation of clouds. Aerosols can be generated in a variety of ways, including being blown up from the ground or ocean surface, or from soot emitted from factories and other sources. We wondered if it would be possible to artificially generate marine aerosols by using seawater and marine organisms as part of oceanographic research and to adjust precipitation and sunshine duration to suppress the rise in temperature by intentionally increasing the amount of cloud formation.

In this study, as a first step, we wanted to conduct an experiment to generate oceanic aerosols by electrolysis of seawater and evaluate their ability as condensation nuclei. Electrolysis of seawater ionizes sodium chloride, which makes up the majority of seawater composition, and produces substances such as chlorine and hydrogen. In this experiment, we would like to use this phenomenon to produce particles in the atmosphere by natural factors such as wind and waves, sample them as aerosols, and evaluate their condensation nucleation ability through microscopic observation and under humidity control.

I would like to explain the specific experimental method. First, we will collect about 20 L of seawater from the Zushi seashore and place it in a 60 cm x 30 cm x 25 cm tank. In order to simulate the ocean environment, artificial water flow generators were placed at both ends of the tank, and wind fans were placed on the top of the tank to simulate ocean waves and wind. Copper plates were placed at both ends of the tank and connected to a power supply unit to conduct electric current. The substance that appeared to be chlorine generated from the anode copper plate was suspended in the air by agitation using the water flow device and wind current fan, and sampled using a glass slide. First, we would like to investigate the practicality of generating aerosols by electrolysis by observing the mass, size, etc. of these samples. Next, the gas containing the generated aerosol is sampled and placed in a device that can control humidity. The humidity in the device is raised by a humidifier, and the humidity is recorded when

the formation of water droplets is visually confirmed. By comparing the humidity at this time with that without the sample, we would like to conduct an experiment to evaluate how easily the generated aerosol generates water droplets that become the source of raindrops when it functions as a condensation nucleus.

In this study, we will conduct experiments to evaluate the practicality of generating oceanic aerosols by electrolysis of seawater and the condensation nucleation ability of the generated aerosols as a countermeasure against rising temperatures caused by aerosol generation, and to demonstrate their usefulness in increasing cloud generation.

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