Scientific Research Publishing

Journal of Water Resource and Protection, 2023, 15, 631-676
https://www.scirp.org/journal/jwarp
ISSN Online: 1945-3108
ISSN Print: 1945-3094

Study on the Possibility of Raw Seawater into Drinking Water

—A Religious Water Literacy

Akira Hiratsuka[1*], Yoshiro Yasuda[2], Marco Ruggiero[3]

[1]Japan International Cooperation Agency (Former Expert), Kyoto, Japan
[2]Department of Management, University of Hyogo, Kobe, Japan
[3]National Coalition of Independent Scholars, Battleboro, USA
Email: *ugj4339@iris.eonet.ne.jp

How to cite this paper: Hiratsuka, A., Yasuda, Y. and Ruggiero, M. (2023) Study on the Possibility of Raw Seawater into Drinking Water. *Journal of Water Resource and Protection*, **15**, 631-676.
https://doi.org/10.4236/jwarp.2023.1511035

Received: September 21, 2023
Accepted: November 27, 2023
Published: November 30, 2023

Abstract

This paper explores the conversion of raw seawater into drinking water from a religious water literacy (RWL) perspective. RWL is here defined as a socially just water literacy that is based on the respect for the dignity of life of all living beings on the Earth. It discusses the importance of sustainable water sources and proposes purification methods. That is, the study aims to show a brief outline of the drinking water source (inland waters; mainly river water) and their purification technologies in recent times and today and propose the purification method (Freezing-Thawing-UV method) in case of taking the seawater as the source. And, it emphasizes the need for dialogue and cooperation between countries in order to proceed. The paper also discusses the relationship among religion, culture, and civilization, and highlights the similarities between Marx's historical materialism and Umesao's ecological view. It further discusses the importance of water purification technology, separation methods, and the potential for seawater as an energy source. The paper concludes by discussing the importance of dialogue, communication and understanding environmental decision-making. In order to carry them forward, it is convinced that citizens in the world are nothing but people with self-awareness of "Bodhisattvas of the Earth" as identities. As a result, the new findings that suggest the possibility of raw seawater into drinking water from a religious water literacy perspective through the lens of Kawakatsu's maritime view have been obtained.

Keywords

Raw Seawater, Drinking Water, Freezing and Thawing, UV-A&B, Religious Water Literacy

1. Introduction

It is thought that the number of the goals related to the water among the United Nations SDGs is two, *i.e.* Goal 6 (Clean Water and Sanitation) and Goal 14 (Life Below Water). It has raised the beverage issue which is one of the most important items for humankind in the previous paper [1], and examined the possibility of changing raw seawater into beverage using ethanol as a renewable resource. As a result, it has obtained the new findings that suggest the possibility of it. It is thought that this study is an approach viewed from the geographical perspective (An Ecological View of History). It is true that ethanol is one of the sustainable and renewable resources. However, the ethanol can be obtained on the assumption that the world's climate is sustainable for a long time. However, the climate change is progressing more rapidly than one's imaginings. Therefore, it is said that if it does not act quickly, it will be too late. In that sense, the word such as "Climate risk/Climate crisis/Climate emergency" has become frequently used. The several risks of the climate change (forecast) listed by IPCC are: 1) Continuous rising of temperature, 2) Occurrence of extreme weather events, 3) Decreasing of agricultural land, 4) Alteration of ecosystems, 5) Increasing of speed of spreading epidemics, and 6) Attenuation of North Atlantic Current drift [2]. Incidentally, the lowering of the sea level has been recently occurring due to the "drought" in Venice known as the canal city since long ago in Europe. And that brings about bad influences (Disruption of life/Reduction of public ship/Bad odor) to the lives of the people [3]. Under the current circumstances, climate emergency declaration (CED) is now issued one after another all over the world (≥1100 countries/regions) [4]. Therefore, the decarbonization for preventing the climate change will be a long-term issue to be addressed thoroughly for the next quarter century in the world.

Considering the risks due to the climate change in the future, it is thought that the approach viewed from the geographical perspective (An Ecological View of History) is gradually limited. Therefore, the way of changing raw seawater into drinking water was searched without the ethanol (Renewable resource). That is a purification way with 4 conditions (low price, large quantity, simple technology, safety). As a result, it was thought the geographical perspective (An Ecological View of History) was put into a new approach based on a "Maritime View of Civilization" in which the land is included to keep the source sustainable. That is, it is a way of thinking from a different perspective that we focus on the "raw seawater itself" and get the drinking water from it directly. We conscientiously call it "a religious water literacy".

By the way, now considering the solving of the world's water shortage, it is thought that the most important key phrase is particularly "protecting all humankind's thing (High seawater) with all humankind". In this sense, on the one hand, Goal 6 (Clean Water and Sanitation) could be a geographical perspective in attitudes toward the water. But on the other hand, Goal 14 (Life below Water) could be a perspective viewed from "Maritime View of Civilization". It is thought

that the latter has a perspective that includes the both goals. That is, we think that if we could seriously protect all humankind's things (High seawater as life below water) with all humankind, "the road to change the raw seawater into drinking water" will surely bring about a bright future.

Now then, the rainwater does not belong to anyone (everyone's thing) in the atmosphere. However, when the rain landed on the land and became the river water, it belonged to the area of the rainfall at that point, *i.e.* the thing of the owner of the land. Such understanding is popular among the people in the countries of the world. On the other hand, when the rain landed on the ocean and became the seawater, it divided into three zones at that point, *i.e.* Territorial Sea, Exclusive Economic Zone (EEZ) and High Sea, respectively. This is prescribed by the United Nations Convention on the Law of the Sea. From this classification of view, everyone's seawater is just only "High Sea" for the two blocs (inland and maritime).

By the way, it is said that the water quality of the seawater (especially surface) in the high seas is nice and clean (low TOC water) because of the full and constant supply of oxygen from the atmosphere [5]. Therefore, if we directly carry out the execution of changing "the raw seawater into drinking water" using the surface water of the sea, it could play a messianic function in the global water shortage. However, one of the bottlenecks is that we have the two blocs (inland and maritime) in the world as mentioned above. Regarding this, if one can cooperate for the benefit of each other and the parties involved by paving the way for the sincere negotiations and dialogues, the issue must be resolved. Incidentally, looking from the sea, several countries (inland and maritime) that can be geographically negotiated are as follows: India and Nepal, India and Butane, Vietnam and Laos, China and Mongolia, Mongolia and Georgia via Azerbaijan through Central Asia (Inland areas) using flying partially, Kazakhstan and Kyrgyzstan, Turkmenistan and Uzbekistan, Turkmenistan and Tajikistan, Kyrgyzstan and Tajikistan (Asia), Russia and Belarus, Ukraine and Belarus, Ukraine and Moldova, Italy and Austria, Italy and Switzerland, Romania and Hungary (Europe), Kenya and Uganda, Cameroon and Central African(Africa), and Brazil and Paraguay, Peru and Bolivia (South America), etc.

It is expected that roles are shared with each other for carrying out this work jointly (Raw Seawater into Drinking Water). For instance, "ice-making work (proper removal of impurities including salinity and fine plastics, etc. [Water purification])" and "sterilization work (UV-A&B irradiation after thawing of the ice [Disinfection])" for the inland bloc area, and the sampling of the surface water of the sea for the maritime bloc one, respectively. Especially, if the inland bloc has a high mountain, ice-making work utilizing the natural freezing phenomenon (at $\geq -2^{\circ}C$) will be possible. In addition, it is needless to say that if the maritime bloc has a high mountain, the ice-making work and its sterilization by UV-A&B after the thawing are also possible inside the bloc area.

In this regard, it is here compared Kenya (Africa) and Kyoto (Japan) which

are maritime bloc areas as an example. The altitude of Mt. Kenya (Eastern province/Central province in Kenya) is 5199 m and its temperature at summit is about −5˚C and Nairobi city (flat land) is about 30˚C throughout a year-round. (There is no winter in Kenya.) On the other hand, Mt. Atago (Central province in Japan) is 924 m and its summit is about −5˚C and Kyoto city (flat land) is about 10˚C in winter. Therefore, as steps of the water purification processes in both areas, the ice-making work [Water purification] is first carried out at the summit of the Mountain, and then the ice comes down to the flat land by cable car, etc., and next, thawing at ordinary temperature. After that, its sterilization [Disinfection] by UV-A&B is conducted. In short, it is important to construct a good system, so-called, conscientious (religious) environmental social system. It can be expected that this system will create new jobs by utilizing it.

In addition, if the small nuclear fusion generation plant at the bottom of the sea as an energy measure will be set up in the future, this seawater purification system is at the same time highly possible for separating the heavy hydrogen (Deuterium & Tritium, etc.) from the seawater directly as a fuel [6] [7]. Therefore, this study occupies an important place (Killing two birds with one stone) in meaning of the development of a fuel source that is inexhaustible in the seawater.

As mentioned above, it is first pointed out the limitation of the drinking water resource based on the "Geographical Perspective of Civilization" and next tries a new approach based on a "Maritime View of Civilization" which includes the land to keep the source sustainable in this paper. That is, it will be aimed at the possibility of an approach on the ideal of the drinking water source viewed from the ocean as a "Religious Water Literacy". And in this context, it will be specifically shown a brief outline of the drinking water source (inland waters; mainly river water) and their purification technologies in recent times and today and propose the purification method (Freezing-Thawing-UV method) in case of taking the seawater as the source. In addition, the two purification methods ("Freezing-Thawing" for mainly salinity reduction and "UV-A&B" irradiation for main sterilization) to change "Raw Seawater into Drinking Water" were used in view of the importance of the utilization of the natural energy (natural freezing/sunlight irradiation) in this study. Furthermore, a "Degrowth Communism" of the water (common) between the two blocs (inland and ocean) viewed from the exchange form as an economic base was simply examined from the viewpoint of the "Perspective of Creativity in History".

As mentioned above, Goal 14 (Life below Water) is widely accepted. Protecting the richness of the ocean stably and peacefully is a prerequisite for making the system sustainable in reality. The compliance with the UN Convention on the current law of the sea and its resilience (reform) is required for that. However, looking at the current status of the world, it may be necessary to make an effort to create a new institution that has the actual authority such as "World Ocean Organization [Tentative]", etc. And it is thought that if the institutions realize one's full potential as a leader, the sustainable operation of the system of chang-

ing "raw seawater into drinking water" will be guaranteed. However, if this is dysfunctional even if the seawater in the high seas is used, dark clouds could be looming over in the future. Therefore, the resilience of a good sense of solidarity which keeps on seeking the fundamental image of humans (Conscience of the International Society) saying that humankind protects seriously the life below seawater (humankind's thing) is required. It is considered that here is why the fundamental image of humans (Human being to Human Co-becoming) [8] is absolutely being requested.

It emphasizes the need for dialogue and cooperation between countries in order to proceed. 1) The relationship between religion, culture, and civilization is discussed in the paper. 2) The similarities between Marx's historical materialism and Umesao's ecological view are highlighted. 3) The importance of water purification technology, separation methods, and the potential for seawater as an energy source are further discussed. 4) It is concluded that the paper shows the importance of dialogue, communication, and understanding in environmental decision-making.

Although the evidence of the seawater quality obtained through this study is of obvious importance in understanding the water, it is thought that the dialogue (exchange between a subjective and a subjective) between water and humankind is more important. However, the evidence in the dialogue has only the ability to finish that. That is, the "morality/ethics" has not been led due to this. Therefore, it is thought that "a narrative-based water literacy" that puts emphasis on "a subjective" and "a narrative" will be one of the key values in the future.

In order to carry them forward, it is convinced that citizens in the world are nothing but people with self-awareness of "Bodhisattvas of the Earth" as identities.

2. Glossary for Religious, Marxian, Marxists and Communism

2.1. A Simple Explanation of "Religious" Mentioned in the Text

As it is known, each culture has a different concept of religion; Italy is a Catholic country and Türkiye is an Islamic one, and so on. The understanding of that would be different depending on the culture. At the same time, we should be aware that the yearning of "the culture" is also connected to the formation of "the civilization". Samuel Phillips Huntington (1927-2008) was a famous American political scientist, adviser, and academic. Although he had stated that the world after the Cold War would be separated into eight civilizations (Western Europe, Hindu, Confucianism, Japan, Latin America, Orthodox Catholic Church, Islamic, and Africa), we think that his recognition has a point judging from the current situation. Therefore, the word "religious" mentioned here has a much broader significance.

By the way, what is now expected for protecting people from naked violence of the current Capitalism is "the existence of the intermediate organizations" such as NPO (Labor Unions·Religious Organizations, etc.) and Worker's Cooperation, etc., which are all connected to "communal" as a modern asylum. We

think that building a new culture (civilization) would be started with close and small "Human revolution" first.

One of the reasons why we have chosen to use the word in this paper is that we want to improve "Religious Water Literacy" as a socially just water literacy that is based on the respect for the dignity of life (First priority) of all living beings (all things under the sun) on the Earth toward "a culture (Unity of Man and Law)", in turn, "a civilization". This is one's long-cherished wish for the humankind.

2.2. A Simple Explanation of the Difference between "Marxian" and "Marxists" Mentioned in the Text

As it is known, the term "Marxian" was taken up by people who wanted to seriously study economics based on Marx's point of view, but they did not want to be associated with the political activism, or the stigma of being a communist. Marxists have a reputation for dogmatism but Marxians did not want to be associated with a communist. They insisted on dialectical and historical materialism per se (Historical view of materialism). For example, it is remembered David Harvey (a British Marxist, an economic geographer, a podcaster, and a Distinguished Professor of anthropology and geography at CUNY, USA), but we would call him a Marxian descended from Anwar M. Shaikh. Marxian economics—particularly in academia—is distinguished from the normative aspects of Marxist thought as well as Marxism as a political ideology: this reflects Marx's original approach to understand Marxian economics and economic development is intellectually independent from his own advocacy of revolutionary socialism. Marxian economists do not entirely lean upon the works of Marx at all and other economists are widely known as Marxists but have done their works from both Marxist sources and non-Marxist ones. In Section 3, we correctly mention K. Uno's Marxian economics. The readers with no deep knowledge of the difference between "Marxian" and "Marxists" would understand the difference between the two terms through the explanation this time.

By the way, it is thought that the difference between the two looks just like that between Shakyamuni Buddha (the Former Day of the Law/the Middle Day of the Law) and Nichiren Buddhism (the Latter Day of the Law). Therefore, it is thought that the theory of "the Mutual possession" of "the Ten Worlds" (the Lotus Sutra) by Shakyamuni Buddha and Nichiren Buddhism (the theory of "Oneness of the Person and the Law") are very useful as a reference in order to promote the understanding between the two Buddhisms. The brief outline for that has been shown in JWARP (2018/2019).

2.3. A Simple Explanation of the "Communism" Mentioned in the Text

The distinction between a Marxian approach and a Marxist approach is the well-known fact that Marxists and Communists are atheist and, in general, hostile to all forms of religion. Marx himself was critical of religion, arguing that it

was a form of "opium for the masses". It kept people from religion was a tool of the ruling class and that it should be abolished in a communist society. In general, both in Japan and USA the word "Communism" has the same negative stigma of fascism, or national socialism (nazi).

In the article, the term "Communism" is used in its original etymological meaning of communal that means common property. It comes from the Latin word "communis" which means "commons" or "shared". The word "communism" mentioned here draws a line, namely is obviously independent of any affiliation with any communist party either in Japan or elsewhere.

3. A Brief Outline of Kawakatsu's Bunmei No Kaiyo-Shikan (a Maritime View of Civilization)

3.1. K. Marx's Historical Materialism [9]

Dr. Kawakatsu says that K. Marx's historical materialism is a geographical perspective of civilization (Ordinary historical materialism) which is based on the dogma (Humans make history = Anthropocentrism), and Getting out of Marx (Authentic historical materialism) should be intended.

Here, K. Marx's historical materialism is outlined.

The following is an outline of K. Marx's historical materialism described by him. He first states the points as follows. 1) K. Marx's writings ("The Capital", etc.) are total criticism of the modern Western society. 2) He evaluates an essence (Power of material production) of the civilization with which, the central three countries (Germany, France, UK) in Western Europe were built, but at the same time he washes away its limitation. 3) The modern Western society is the final stage of the prehistory of the human history. 4) The incoming of the communism Society is viewed. That is, the special feature of the thought of Marx is the intension of "Transcending the Modern Age (Out of Western)".

Second, the intense acceptance of the Marx's thought by Japanese is based on the Japanese history, *i.e.* "acceptance and overcome" of the system by the defeated country. That is, the modern Japan has a western countervailing consciousness that she would like to remove the different ethnic groups since the Bakumatsu (幕末) Restoration. It is also stated that the intense rivalry and Marxism that criticizes internally/totally the European modern civilization resonate with each other. In short, he understands that Marx's theory has brilliantly fitted with the current ideas, and describes that socialists had appeared at the late Meiji period as a proof, too.

Third, he understands that modern Japan's crisis is due to the failure of the historical theory of Marxism. It is because the returning phenomenon to the capitalism at the former Socialist bloc countries happens actually, and the classification of historical periods (slavery → feudalism → capitalism → communism) which is one of the missions of historical sciences has not been made meaningful.

Forth, he states that America is not taken into consideration in Marx's theory System. And Japan has moved forward with the periods such as Datsu-A (leave

Asia/China), Datsu-O (leave Europe), Datsu-Bei (leave America) through the early-modern and modern times.

In that context as mentioned above, he says that although modern Japan has experienced the period of Marxism which paired with Westernization, the era was almost over. And he describes that now would be the time to sum up Marx's theory fundamentally, too. It is widely accepted that Marx set up a materialism confronting German idealism (a position that gives the mind the upper hand for nature). However, he does not strangely enough discuss "the thing itself". "The foundation of reality" of Marx is economic relations in which humans conclude to live in the society. That is, it is concretely the relationship between capital and labor. It says that human economic relationships stipulate the ideal way of other all human beings. That is, he points out that although Marx advocates "historical materialism" the perspective of embracing "things" is missed, *i.e.* it is human-centrism. "Things" are the essential conditions of human existence. To think about not only the relationships between "people" and "people" in an economic life, but also the ones between "people " and "things" is just the subject of "True historical materialism".

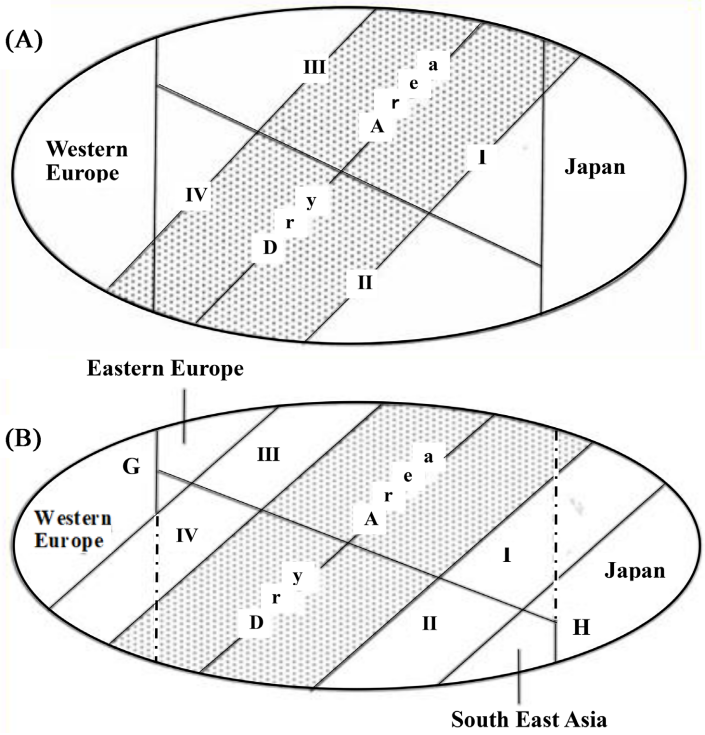
3.2. T. Umesao's Bunmei No Seitai-Shikan (an Ecological View of Civilization)

Dr. Kawakatsu says that T. Umesao's Bunmei No Seitai-Shikan (An Ecological View of Civilization) is based on the dogma (environmental determinism of history = environmental centricity) that human life depends on the natural ecosystem, and in other words, it is "Geographical perspective of Civilization" (A Vulgar Ecological View of Civilization) and then one should intend to De-Marx, followed by De-Umesao. Umesao's Bunmei No Seitai-Shikan (An Ecological View of Civilization) is here summarized.

First, it is said that the World's civilization map drawn by the ellipse viewed from the Asianic ground is Umesao's Bunmei No Seitai-shikan (An Ecological View of Civilization) (see **Figure 1**). This ecological view is a way of thinking for explaining the civilization bloc using analytical method of ecology. However, the ellipse he used is the Old World (Eurasian continent and its surrounding). And the dry area running in the dry area running in the center is from the Gobi Desert in north Asia in which Nomadic tribe crosses to Afghanistan which extends to the south around the Caspian Sea. In addition, new world America is not included in this map. In this map, the world is divided into four blocs (I. the Chinese bloc, II. the Indian bloc, III. the Russian bloc, IV. the Mediterranean/Islamic bloc).

Figure 1(A) is the simplest model and **Figure 1(B)** is its revised one. It can be roughly situated into 2 types. One is called "First bloc (R1) (Western Europe and Japan as surrounding areas)", and the other, "Second bloc (R2) (I~IV, Southeast Asia and Eastern Europe (so to speak, central area))". And, Southeast Asia and Eastern Europe are positioned as "Middle area" (**Figure 1(B)**).

Umesao says that the differences in nature between the blocs [(R1) and (R2)]



Source: Sakamoto (2004) [9] (some information is added in the original figure).

Figure 1. Map of civilization ((A) & (B)) presented by Sakamoto based on Umesao's one.

are described as follows: "The bloc (R1) [Surrounding area] is completely different from the latter (R2)". People in the latter (R2) have "the inclination to the land". If one has the inclination to the land, the exclusive consciousness of possession that this land is my property grows up. However, in inclination of the islands, the exchanging/sharing is connecting to the benefit (abundance) between the two. That is, one has a highly sense of economy which is different from the exclusive ownership. This is suitable for the information society [10].

Therefore, it has been roughly termed the bloc (R1) "so to speak, Sea Peoples" and the bloc (R2) "so to speak, Land Peoples", the areas respectively in this context. Perhaps, the perspective (susceptibility gene) towards the sea may make a fundamental difference for the peoples who live in the both areas. It is considered that this viewpoint will be worthy of reference when considering "Power and Form of Exchange" (see below for further details).

By the way, nowadays it is well-known that Umesao's ecological view (Anti-K. Marxizm) is antithesis of historical materialism (Marxism). It is said that Umesao has described the dynamism between the dry area and the agricultural one as a view of the model.

The most important thing in his map is that there is a huge dry area which is located diagonally across the Eurasian Continent from Northeast to Southwest. And next, he points out that the "semi-dry area" is running parallel to the both sides of the "dry area". And then, he has a point of view that the farther away the area is from the "semi-dry area", the wetter the area. Furthermore, if the area

stays away from it even more, it originally becomes "the ocean (sea) of the wet itself". However, its western edge is situated in the Western Europe and the eastern one, Japan and Southeast Asia in **Figure 1(A)**. That is, the "ocean (sea)" has been abstracted from the map to make a simple model.

And, the western edge which is the farthest place from the "dry area" is situated in "Eastern Europe" and "Western Europe", and then the eastern edge, "Japan" and "Southeast Asia" respectively in **Figure 1(B)**. However, it is said that according to Kawakatsu's research works, this "Eastern Europe" is not situated in "land", but "ocean (sea)" in reality. In addition to that, there seems to be an impossibility in the situation of "Southeast Asia" in eastern edge too. That is, the place bordering on the south west of "Japan" is relevant to the "China Sea (ocean/sea)". The feature of **Figure 1(B)** is that the difference in the position between South and North regarding both Japan and Western Europe is described.

Therefore, it can be confirmed that the important thing in **Figure 1** is that the three mappings of ecosystems such as the central "dry area", the "semi-dry area" which runs on both sides in parallel and "ocean (sea)" which spreads to both sides in parallel exist. That is, this means that "Japan" and "Western Europe" are floating in the ocean (sea) at both ends of the east and the west, respectively.

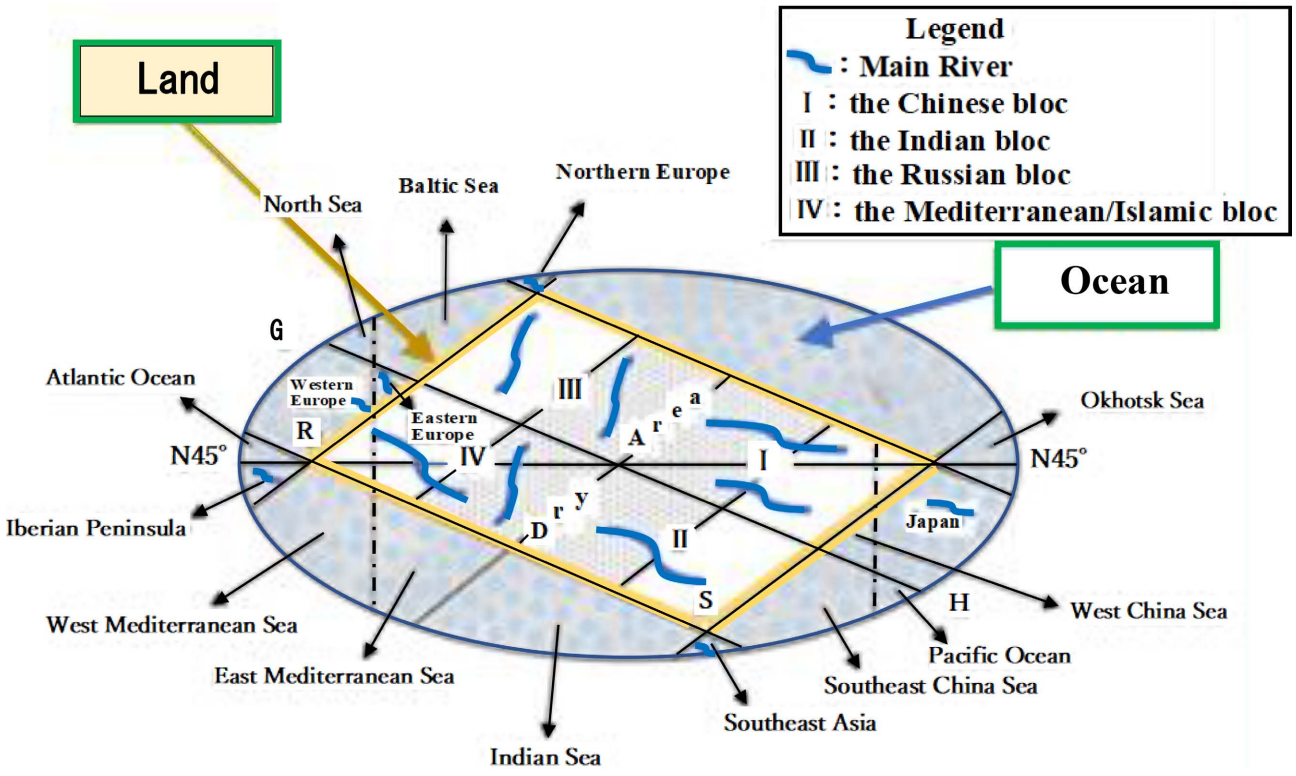
As is seen from the above, although both Marx's historical materialism and Umesao's ecological view are discussing thoroughly the historical facts on the ocean (sea), the model of civilization is just a secondary thing and then it is not an essential requirement. In that sense, it can be said that the ecological view is also the same "Geographical perspective of Civilization" as historical materialism is. That is, we cannot see the ocean (sea) on the map. Therefore, Kawakatsu has reconsidered **Figure 1(A)** and **Figure 1(B)** from the viewpoint of several oceans (seas) which surround with the Eurasian continent [9] [10] [11].

3.3. H. Kawakatsu's Bunmei No Kaiyo-Shikan (a Maritime View of Civilization)

Kawakatsu describes that it is important to change the perspective from "Geographical perspective of Civilization (Anthropocentrism [Vulgar historical materialism = De-Marx]/Environmental Centricity [Vulgar Ecological View = De-Umesao])" to "Maritime View of Civilization" (Natural Thought [Authentic historical materialism]) in this section.

His "A Maritime View of Civilization" is here outlined. He thinks highly of Umesao's map in the sense of genius drawing outlined the civilization of Eurasian continent. He says that it should be placed the starting point of the regional theory. He has drawn the revised figure regarding the Umesao's map three times. **Figure 2** is drawn based on the revised drawing 3 (**Figure 1**).

As mentioned in Section 2.2, North Sea and Baltic Sea are situated in the Eastern Europe, and the East China Sea and the South China Sea in the Southeast Asia in the revised drawing 1 (**Figure 1**). The important thing here is that Japan and western Europe have been floating in the ocean (sea) at both the eastern end and the western one in the three ecological areas such as "Dry area", "Semi-dry



Source: Sakamoto (2004) [9] (some information is added in the original figure).

Figure 2. Map of civilization presented by Sakamoto based on Kawakatsu's one.

area" and "Ocean (Sea)". We call it "First bloc (A) [so to speak, Sea Peoples]" (see Figure 2). The GH line which nothing is mentioned about in the revised drawing 1 (Figure 1) is described in the revised drawing 2 (Figure 1). The GH line shows the high range of mountains representing the backbone of the Eurasian continent. The slope of the GH line reaches a brilliant agreement with the real landform.

Although the GH line crosses the dry area road, the "Second bloc (B) [so to speak, Land Peoples]" has been divided into the four big civilization zones (China, India, Russia, and Islam·The Mediterranean Sea) by the line.

Tian Shan Mountains, Altai Mountains and Stanovoy Mountains, etc. reach from the central part (O-point) to the direction of the northeast, and Hindu Kush Mountains, Plateau of Iran, etc. to the southwest respectively on the KM line range from the north to the south. The KM line is no less high than the GH line. The GH line and the KM line are the high mountain ranges rising over the Eurasian continent and they have created a great landscape. The high rugged mountains including the canyon are divided into the four civilizations in the "Second bloc (R2: Inland side)" [so to speak, Land Peoples]. He says that this will make the traffic of people from one place to another difficult and become an ecological condition under which the great and unique civilization zones have been formed in the four areas. The great mountains are the source of the great rivers.

The old civilizations have been formed on the basins of huge rivers. He em-

phasizes that the role of the river is absolutely important and that the sources of the rivers are mountains. The rivers flow downward among mountains, that is, and in various directions of the north, the south, the east and the west.

That is, the Yellow River, the Yangtze River towards the east, the Rhine River towards the west, the Obi River, the Yenisei River, etc. towards the north, the Tigris·Euphrates River, the Indus River, the Ganges River towards the south, and the Irrawaddy River, the Menam River, the Mekong River, etc. flowing through the continent of the Southeast Asia. And, each river of course flows down to the sea in the end. Furthermore, the rivers flowing to the east and west flow down into the ocean (sea), which is drawn in parallel with the dray area and the semi-dry area. On the other hand, some rivers flow the north and the south. The ocean (sea) accepting the river flowing towards the north is the Arctic Ocean (the sea rejecting the humans).

The huge rivers in several strands flowing towards the south have created the ancient "agricultural civilization". The civilizations have been created in the basin of the great river facing the sea. The sea can be confirmed at the tip of the RS line (the line in which the river and the sea come in contact with each other.) And, the several seas appear at the south side of the RS line. And then, the Mediterranean Sea comes into view at the west side of the dry area, and the Indian Ocean at the east side respectively.

The Southeast Asia appears at the place in which the China Sea and the Indian Ocean come in contact with each other. Therefore, it can be said that "the Southeast Asia" is affected from the "sea" (Maritime View) rather than from the "land" (Ecological View). That is, the Southeast Asia is located at "Ocean (Sea)". For the above revisions, he has finished the work drawing the "sea" at the ends (the east, the west and the south) of Umesao's map.

It is finally looked at the revised drawing 3 (**Figure 1**).

The features of "First bloc (R1: Ocean side) [so to speak, Sea Peoples]" and "Second bloc (R2) [so to speak, Land Peoples]" have been made clear by the revised drawings 1 and 2. He says that the important point is the similarity and the difference between Japan and Western Europe belonging to the "First bloc (R1) [so to speak, Sea Peoples]".There are three points. First, the ocean (sea) is drawn in parallel with the dry area and the semi-dry area (similarity). Second, the ocean (sea) situated at the south is drawn using the RS line (similarity). Thereby, the ocean (sea) which spreads to the south of the Eurasian Continent is separated from that of the West and the East. Third, it can be predicted which ocean (sea) impact Japan and Western Europe are each exposed to at latitude 45 degrees north line (N45˚). The "Oceans (seas)" drawn in the map (Maritime View) are North Sea, Baltic Sea, The West Mediterranean Sea, The East Mediterranean Sea, Indian Sea (It is said that Kenya is a gateway of Eastern Africa facing the Indian Ocean), South China Sea, East China Sea and the Sea of Okhotsk. And then, the Atlantic Ocean and the Pacific Ocean (Japan is located around the Pacific Ocean.) which are not adjacent to the Eurasian continent are also located at both

ends of the map (difference). He especially focuses interest on the relationship between the Ocean (sea) and the rise of Modern Civilization (A diagram for understanding the modern age).

By the way, the new continents, especially "America" is hardly referred in both Umesao's ecological view and Kawakatsu's maritime view. However, it can be at present said that "Universalistic Challenge of America" exposes conversely "civilizational background" of the countries and regions mentioned above. Therefore, the modern age would be exactly the time of hoping the "new historical view of civilization" which is including the universalistic progressive view of history of America. And, it is thought that a new way of life under the "new historical view of civilization" (Literacy of Unifying One's Life Practice/To Learn the Wisdom like A Religious Water Literacy) will be exactly very important for humankind in the world. He summed up his results as follows. In Japan, there is a true view of history which literally means "seeing history based on the thing". However, it has not become aware of it so far (omitted). Japan is a country of the highest standards in Marx-studies (Ex. K. Uno's Marxian economics). Therefore, if "true historical materialism" is created from Japan, the heavenly Marx will become a peaceful passing. The Japanese can dissolve the Marx's materialism and establish a true view of historical materialism against the vulgar one [9].

4. A Brief Outline of Saito's Karl Marx's Ecosocialism

As mentioned in Section 2, Marx's materialism (Section 2.1) is first taken up in Kawakatsu's maritime view of civilization in view of the importance of seeing the things. Kawakatsu's historical view has also affinities with Marx in the sense of taking good care of things. Therefore, he adapts the "maritime view" to the "geographical perspective" and also the "natural theory" to the materialism respectively. That is, he states that the former (the "maritime view") includes the lands which are made to look like the islands, on the other hand, the latter (the materialism) enfolds the people in the things.

The "natural theory" focuses on the things. It states that the things humans produced exist in a space between "nature" and "human beings" and the humans are "animals making the things" and also "animals using the things". The produced things are no longer natural and not even humans, of course. The produced things are "Intermediate Existence" intervening between the two. They (produced things) surely exist in human society. Such collection of things is called "the product complex of society". The core of the metamorphose into the product complex is "new combination".

The "Natural theory" takes a stance that things as well as humans are important. The humans exist with the things, *i.e.* "人物: Jin-Butsu (Character)". The thing is the load in the "物語: Mono-Gatari (Story)". "語部: Katari-Be (Storyteller)" supplies the place of the thing. It is a substitute of the "thing". There is a different worldview from "Humanism (Anthropocentrism)". A maritime view of

civilization is a historical view where the metamorphose of "the product complex of society" in accordance with the natural theory is stated. In short, it can be named "A Natural Historical View of Civilization".

4.1. Water and Salt as Common (Wealth: Non-Violent Public Goods) for Humankind

It is here outlined the contents of Saito's "Karl Marx's Egoodscosocialism". He is a famous scholar on history of economic thought in the world. His book entitled "Karl Marx's Ecosocialism" has received the award of Deutscher Memorial Prize in 2018.

In his book, he has comprehensively discussed the "capitalism" and the "environmental crisis" and created a concept of the new social system. This book has an affinity with the two books (H. Uzawa, 2005): Economics of Social Common Capital/K. Miyamoto (2009): Environmental Economics) in terms of what it is aiming for transcending Capitalism. To put the difference between Saito and Uzawa/Miyamoto in one word, it can be said that Saito is not subject to the "Capitalism". Saito says that the Capitalism (Market Economy) is after all the system of pursuing the economic profit infinitely. As a consequence, Roudousha (Humans who have been doing the labor of "life") and Nature have been sacrificed. Therefore, it is necessary that the principle of the pursuit of profit is evaluated relatively and slowed down to enable the systemic transformation from the capitalism. And the important thing is to manage democratically the water and the salt, etc. as common (Wealth = non-violent public goods/Commons = public goods·common property) for humankind. We neither commercialize everything like a market fundamentalism nor also specialize it like a former Soviet Union. That is, it means aiming for the third way. It can be said that Saito's Karl Marx's Ecosocialism is a latest attempt with strong will that people (they) consider humans through being with nature. His starting point is not the nature itself. It is the "human labor" as a process of the substance metabolism (a universal substance metabolism [Substance Exchange]) between the humans and its natural surroundings. Then the labor is fundamentally regarded as the raw material processes of the exchange in which the humans are placed in a wider context of the natural processes. He finds out the roots of the environmental crisis in the space between the substance metabolism in our life process and the cracks occurred by the autonomous logic (the reproduction of the capitalism as a threat).

4.2. A Cooperation between the Two Blocs (Inland Side [R2] and Ocean Side [R1]) [Both Sides Are 而二不二: Two but Not Two as Oneness of Body and Mind]

To put his way of thinking mentioned above in context of "Raw Seawater into Drinking Water", it will be like the following. 1) The people of the bloc (A) belonging to the Ocean (Sea) directly go to the high seas (both territorial waters and EEZ are OK, of course) to sample the cleaner seawater. 2) The people of both the bloc (A) and the bloc (B) belonging to the Continent (Land) have

cooperatively purified the seawater using the purification method (Freezing-Thawing-UV method) proposed this time. And 3) the "Brine" as a final product coming out of the method has been returned to the original sampling location by the people of the bloc (B). In addition, as the chemicals are not used at all, there is no need to worry about the pollution of the seawater. By doing this, the Brine goes around following the great oceanic circulation on Earth over the years.

Therefore, the subject is how the "seawater (common)" can be democratically managed between the two blocs [(R1) + (R2)]. It is thought that a way of the democracy in Japan (Japanese democratic style) can be one of the good references. As it has already been known, Japan is a Nation-state where "the Imperial family and common people were united with each other and have not been interrupted for twenty-six centuries so far". Japan and other countries differ greatly in historical backgrounds. That is, Japan possesses a unique nationality which means the oldest and state-of-the-art in a sense in the world [12].

By the way, when looking at the current situation regarding the seawater in a global scale, there are also places in which the "Seawater" is polluted by the plastic wastes, etc. depending on the sampling areas. Therefore, it will be at present purified using the modern-advanced water treatment technologies ("physical" treatment starting with filtration, and "chemical" & "biological" treatments) to the maximum leaving the cost out of account for the time being. If we can think of the "seawater" as the "common", and have the strong will (Ex. Promotion of "The 3.5% rule" [13] advocated by Prof. Erica Chenoweth, Harvard Univ.) to clean the polluted seawater, it will be absolutely and permanently purified.

The modern technologies to purify the "seawater" are gradually becoming unnecessary due to the "solidarity of goodness". By doing this, the principle of the pursuit of profit in current capitalism is evaluated relatively and slowing down to enable the systemic transformation from the capitalism. It can be said that this is the same phenomenon in which the types of occupations are gradually going down due to the progress of AI, etc. It is though that the constructing of "Real Ecosocialism" is surely required now in the world.

It is necessary to enhance the value of the "high seas" as originally one of the global commons to lead it toward "Paradise in the sea" (based on A Maritime View of Civilization). The construction of ITER (International Thermonuclear Experimental Reactor) has been at present progressing under International Cooperation {(Japan, USA, Russia, China, South Korea, India and 1 region (EU)} in France first in the world. This is an attempt of obtaining the source of the clean energy. This is a reactor to create the nuclear fusion artificially on the Earth (Completion: late 2020/Implementation planned: 2035).

4.3. Potential for Seawater as an Energy Source

The "nuclear fusion" is the exact opposite reaction to the "nuclear fission" at the current nuclear power plants. This "nuclear fusion" is what gives the Sun its ener-

gy. Therefore, it is said that this is intrinsically safe/safe in principle and also have nothing on security issues (Fear of diversion to military use). Not the Uranium and Plutonium which have been used in the "nuclear fission" but almost the Hydrogen (Deuterium, Tritium) will be used in the "nuclear fusion". In other words, the "atomic bomb" which was used in Japan (Hiroshima/Nagasaki) and the "hydrogen bomb", in America (Bikini [former Japan's territory]) are different from this "nuclear fusion". Certainly, even in the "nuclear fusion", as "Nuclear reaction" is essentially occurred the radiation is emitted from a radioactive material. However, it is not the reaction (Explosion) by the nuclear fission. Therefore, it is in general thought that little radiations are extremely emitted.

And, it is said that as the hydrogen can be taken out of the seawater it can be an inexhaustible source of energy. Therefore, if the higher the breakthrough of the technology of the "nuclear fusion" will be, the greater the value of the seawater will significantly be [6] [14].

Based on the mentioned above, what is required of us now is the raising of the following three points to a higher level. That is, 1) the ideal way of de-growth communism to lead the sea of sorrow polluted by the plastic waste, etc. toward "Paradise in the sea" in itself, 2) further deepening of "International Law of the Sea" to boost it and 3) the "solidarity of goodness" (strong human's will [mind]) for that [15].

5. Drinking Water Source Viewed from the Ocean—A Religious Water Literacy

5.1. A Proposal of a Seawater Purification Method (Freezing-Thawing-UV Method) Derived from Kawakatsu's "a Maritime View of Civilization" and Saito's "Marx's Ecosocialism"

As the last year (2022) was still under the situation in the COVID-19 pandemic in the world, the alcohol (ethanol) has been taken up as a sterilizing disinfectant for the seawater in previous paper [1]. Judging by the results in the paper, we are convinced that it absolutely played a messianic function on the sterilization effect. And it has turned out that it has one more function called "salinity reduction". Then, the two functions (Sterilization & Salinity Reduction) mentioned above are extremely important regarding the theme of "raw seawater into drinking" in this study. As mentioned in previous paper [1], it is in general thought that if the two functions are achieved other water quality items can be cleared with comparative ease.

In this experiment, it was focused only on the "raw seawater" without using the "solvent" such as ethanol used in the previous paper. The freeze-thaw method for the raw seawater was used this time. And, the impurities have been removed from the raw seawater by utilizing the "Hydrogen bonding" as physicochemical forces inside the ice. After that, the irradiation of the UV-A&B was tried on it for the sterilization. The experiment on the possibility of changing the seawater into the drinking water has been carried out by following the steps de-

scribed above. It is here called "freeze-thaw-UV method".

There are so many water treatment techniques such as physical, chemical, and biological processing since long before. Regarding the seawater desalination technologies, there are three methods such as 1) "Evaporation method (Multi-stage flash method, etc.)", 2) "Membrane method (Reverse Osmosis/Electrodialysis)" and 3) "Crystallization method (Freezing method, etc.)". Among those, two methods (1), 2)) have been used in practical plants [16].

Although the method used in the experiment is based on the "physical processes" starting with the "filtration", etc. It has been intended to pursue the possibility of the "raw seawater into drinking water" by utilizing the only "natural force" in the end. It is thought that there is a novelty in this experiment. In short, there are two processes. First, it is removed the impurities (salinity reduction, etc.) from the raw seawater by freeze-thaw method, and second sterilize it by irradiating UV-A&B (Sunlight). It is a very simple way.

5.2. A Brief Outline of the Drinking Water Source (Inland Waters, Mainly River Water & Sterilization) and the Purification Technologies in Recent Times and Today

In this section, it is first outlined the "source (mainly river water)" of the water supply briefly in the world. And next, the water purification technologies focusing especially on the separation are described.

When it is first briefly described the feature of modern waterworks originated in Western Europe, it can be said that "The source of water has mainly been the river water and its sterilization has been mostly chlorine". It is thought that this would be based on a geographical perspective of civilization (Ordinary historical materialism) which is based on the dogma (Humans make history = Anthropocentrism) when viewing "a Maritime View of Civilization".

In this study, a completely new sanitization method is set up, that is, "source of water is only raw seawater itself and its sterilization is UV-A&B (UV irradiation)". Based on the viewpoint mentioned above, it is examined the possibility of raw seawater into drinking water using the new purification method (Freeze-Thaw-UV method) to create humankind's wisdom to the settlement (breakthrough) of the water scarcity at the two blocs (inland and ocean) in the world viewed from the exchange form as an economic base.

Next, the separation technologies regarding the water treating can be roughly divided into 2 types, *i.e.* I. Physical separation method and II. Physico-chemical separation method. The former is the mainstream in the world. There are two types in the former. One is a Membrane Filtration type (A) which can separate the solvents and the solutes with the separation membranes depending on the particle sizes, and the other, Non-membrane Filtration type (B) without the separation membranes.

There are 6 types regarding the Membrane filtration. That is,

1) Natural Filtration by Gravity: NF (Use Standard membrane pore size: Paper, Cloth, etc. > 10 μm);

2) Pressure Filtration by Positive pressure: PF (Use Standard membrane pore size: Cloth, etc. > 10 μm);

3) Suction Filtration by Negative pressure: SF (Use Standard membrane pore size: Cloth, etc. > 10 μm);

4) Micro Filtration by Positive pressure: MF (Use Fine membrane pore size: 0.05 - 10 μm);

5) Ultra-Filtration by Positive & Negative pressure: UF (Use Ultra-fine membrane pore size: 1 nm - 50 nm);

6) RO-Filtration by Positive pressure: ROF (Use Super-fine membrane pore size: <1 nm [semipermeable membrane]). In this method, RO membrane which has characteristics of not transmitting impurities (Ions, Salts, etc.) is used. At present, this method is used to produce desalination of seawater, high-purity industrial water and so on. These 6 types mentioned above are based on the "separation with pressure".

On the other hand, the latter [II "Non-membrane Filtration" (B) also conduct the separation with pressure similar to the former I. This is the method which can separate the solvents and the solutes without all the separation membranes. The separation with centrifugal force is the most popular method in the latter [II]. This method (Rotation: thousands [rpm]) is used for the "water and sludge treatments", etc. and for the "enriched uranium" with rotation of tens of thousands [rpm].

As the experiment for this time is based on the separation with electronic force (Hydrogen Bonding), it is relevant to the latter [II].

The mentioned above is the overview of the "Water Purification Treatment Technology" focusing on the "separation". This method [I(A) (Separation by pressure with membrane)]is a standard way which is generally used in current water treatment field. However, as this method uses the expensive "membranes", its cost reduction becomes the subject. And, if the pre-treatment/post-treatment on "Solvents" when applying the positive pressure is conducted in the system of [I(B) (Separation by centrifugal force without membrane)] it may promote the treatment efficiency. However, the cost issue in regards to the treatments (pre/post) will be also caused in this case. The method of [II(B) (Separation with electronic force (Hydrogen Bonding) [without membrane]] is simple and its cost is also comparatively lower, and it is also easy to put it to practical use. The disadvantage of this method [II(B) Use Hydrogen Bonding] is that it has just only required the "waiting" for the time to freeze the seawater.

By the way, in a recent study it has been understood that the "Tritium" can be quite removable by the "freezing process" [the latter II(B)]. As it is already known, it has been said that it cannot be removed by ALPS (Advanced Liquid Processing System) so far [17]. This is a separation method by "Hydrogen Bonding" (freezing process). The research regarding the "Ice conditions (freezing mechanism of 14 types: Ice I*h*, Ice Ic, Amorphous Ice, Ice II, Ice III, Ice IV, Ice V, Ice VI, Ice VII, Ice VIII, Ice IX, Ice X, Ice XI, Ice XII)" has at present proceeded. Therefore,

it can be said that this research is an experiment under the situation of the "Ice I*h*". And then, we think that this type of research will be significantly spreading in the future. With the progress of these researches, we think that the possibility of this research for separating and removing the uranium, etc. will be expanded in place of the "centrifugal separation method" [18]. Anyhow, it is impossible to satisfy all one's demands. The "waiting" for the time to freeze the seawater is the greatest fault in the freezing method. Therefore, if this "waiting" has just been allowed it has hidden potential which means "Hydrogen Bonding" is more than "Centrifugation". Therefore, it is thought that this method will be one of the promising methods in the future. Then, it is thought that the most important point is to unlearn the "meaning of the waiting" which modern ages have forgotten [19].

In addition, if the research of "Separation method on seawater" based on the "Ice conditions (freezing mechanism of 14 types)" has been progressed, it will definitely motivate the Ice Stupa project. This ice tower project centered on Mr. Sonam Wangchuk (Indian Engineer) has been progressing at Ladakh in Northern India. A conceptual illustration of it at high altitudes is shown in **Figure 3**

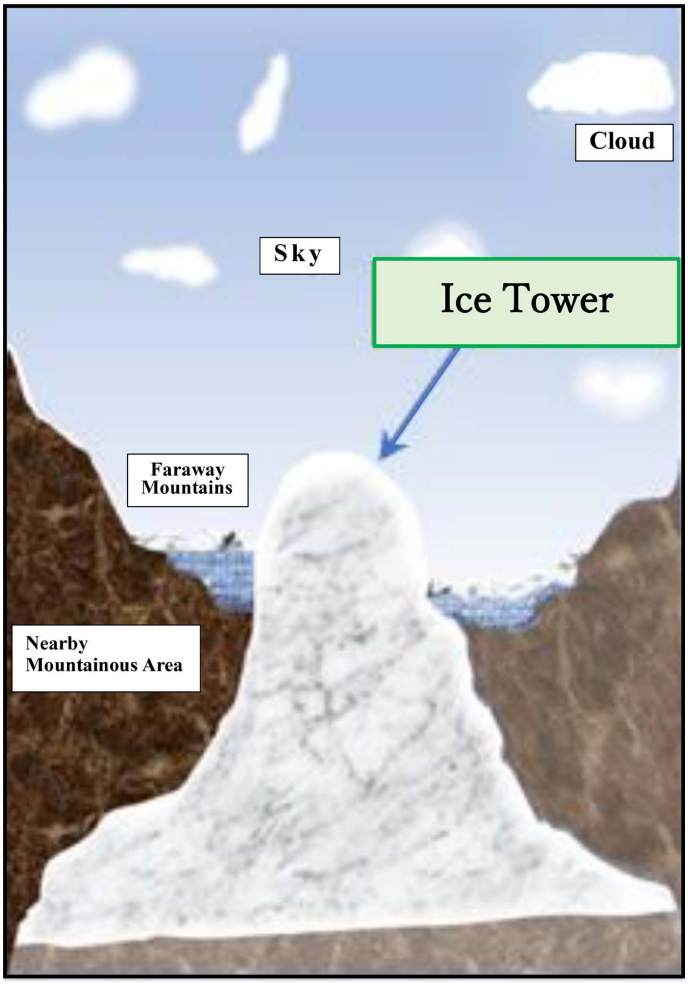


Figure 3. Conceptual illustration of ice tower at high altitudes.

for your reference. The conversion from "Tragedy of the common river water" to "Comedy of the common seawater" has surely hidden potential to open the hopeful future.

5.3. An Ideal as a "Degrowth Communism" on the Seawater (Common) between the Two Blocs (Inland and Ocean) Viewed from the Exchange form as an Economic Base

The seawater, especially "high seas" can be accessed by all the people in the world. In that sense, there is no doubt that the seawater is a luxurious "wealth" for all humankind. However, it would be very inconvenient "thing (物)" for the current "capitalist" society in the sense that it cannot be commercialized. This research is a trial to propose a methodological analysis to solve the water shortage between two blocks (inland and maritime) in the world. This research aims to progress "Raw Seawater into Drinking Water" by bilateral collaboration using the seawater (common: 物) as a luxurious "wealth". Specifically, the way of economic thinking found inside a book entitled "Power and Modes of Exchange" written by K. Karatani (Renowned Japanese Economist & Philosopher, Honored with 2022 Berggruen Prize for Philosophy and Culture) was applied to the issue of "Raw Seawater into Drinking Water" [20].

It is briefly described not only the outline of "Power and Modes of Exchange" as an economic mode but also its application to the "Raw Seawater into Drinking Water". As mentioned above, in the process of it, first the people of the block belonging to the ocean (sea) side samples more clean seawater at the "High Seas". Because it is said that the surface water in the offshore is nice and very clean. And next, the purification under bilateral (regional) cooperation is tried using the new purification method named "Freeze-Thaw-UV method" proposed in this time. And next, the people of the bloc belonging to the land side return the "Brine" as a final product which is drained physically when using this method back to the original place (offshore). In addition, as no chemicals are used, it is not necessary to worry about polluting the "seawater". By doing this, the "Brine" goes around the world along the flow of the great global circulation of the ocean (seawater).

By the way, if we can take the seawater as a "common" of humankind and expect the strong will that the ocean should be clean (True Realization of "Real Eco-socialism"), the "high seas" will be more clean. Then we expect that the modern technologies used to purify the "seawater" will become unnecessary gradually. By doing this, the principle of pursuit of profit in the current capitalism is relativized and results in the slowing down. It can be said that the same phenomenon happens.

The types of the occupation are gradually decreased due to the progress in Artificial Intelligence (AI), etc.

Therefore, what is required of us now is the raising of the following three points to a higher level. That is, 1) the ideal way of de-growth communism to lead the sea of sorrow polluted by the plastic waste, etc. toward "Paradise in the

sea" in itself, 2) further deepening of "International Law of the Sea" to boost it and 3) the "solidarity of goodness" (strong human's will [mind]) for that. Accordingly, the point is how "seawater" as a common can be managed with fairness between the two blocs (Inland and Ocean). The consideration regarding the ideal way of "Water management" of the "High seas" with fairness is given below (see Section 6.1: Importance of Learning in Nature).

6. Experimental

6.1. Importance of Learning in Nature

Rachel L. Carson (American marine biologist and conservationist) who is famous as a book entitled "Silent Spring (1963)" has written the book entitled "Sense of Wonder" just before she died [21]. According to her, this word ("sense of wonder" as a full of sensitivity) means the true and intrinsic ability which children have by nature and that is not the ability which is found. Before knowing by learning something or learning through the knowledge of the books, it is intrinsic as an aprior character. Any child first knows the world, and has a moment to be surprised at its finesse. That is, she calls the curiosity for the nature which all children have from the time of birth and the wide-eyed sensitivity for the beautiful things, strange ones or mysterious ones "Sense of Wonder". It is thought that they all have awe for the nature (life) that underlies it. Her sensitivity resonates with the world-renowned biologist Dr. Fukuoka's "Theory of Dynamic Equilibrium" [22].

Dr. H. Shirakawa (Co-winner of Nobel Prize in Chemistry for his research on ICPs, 2000) has featured Carson's "Sense of Wonder" in his essay entitled "Shizen ni Manabu (Learn from Nature)" [23], and described the importance of cultivating the sensitivity (Jocho).

By the way, a translation of "jocho" by a Japanese mathematician is as follows.

The usual connotation of the Japanese term "jocho" is that of emotion of feeling triggered by the atmosphere, or the atmosphere itself. However, Oka states in his essay "Kokoro" that "I made up the term jocho in order to study the human mind" and since this is the key term to understand Oka's philosophy, I will leave this term understood throughout. The problem is that Oka never clearly defined what he means by this word, and he even stated clearly in an essay titled "Inochi" that "jocho is a word that has no definition in the first place". Instead of trying to define the term, he shows how this concept works in several different contexts. In a way, all of his writings were attempts to clarify the meaning and depth of the concept jocho.

The term jocho written in Japanese, consists of two ideographs "情 [jo]" and "緒 [itoguchi]". The former carries various meanings such as feeling, sentiment, attachment, passion, love or emotion which in any case connotes the motion or flow of the mind which penetrates between individuals or between a person and the environment. The latter ideograph "緒" implies a beginning, a trigger or a clue. In Oka's thinking, based on Buddhist philosophy, the mind is latently om-

nipresent in the universe, and jo, which is an aspect of this omnipresent mind, moves or flows between a person and his/her surrounding. Each existence of a being (not necessarily human) acts as a trigger [=緒] to actualize the latent mind into a personal mind, and realizes the flow of jo in the form of a personal feeling or sensation. Jocho, in Oka's original sense, so far as I understand it, refers to this cognitive capacity (which he thinks can be cultivated through education) to localize and actualize the global flow of jo into a particular feeling or sensation. But it is in his later writings in which he begins to clarify these ideas, and in his earlier essays, including this one, the connotation of the term jocho is still quite vague [24].

And, Prof. Emeritus, Dr. Kang Sang-Jung (University of Tokyo) has described "Inochi no Mizu (Water for life)" which is made by dissolving the salt in hot water in the book entitled "(Ikiru Imi, Meaning of Life)" [25]. This salt is produced on Miyagijima Island, Uruma-shi, Okinawa, Japan. He puts the hot water with the sea salt in a pot and carries it around. The impurities including harmful substances in this hot water based on the tap water are removed by a stone like a granite porphyry and boiled for 15 minutes. The reason for carrying it is that this "salt" includes a variety of minerals which are essential for the maintenance of life. However, even if you say sea "salt" in one word, it is not the one like a "table salt" with 99% of the sodium chloride (NaCl). It is pointless to just conclude the minerals such as Magnesium, Calcium and son on. And he says that there is no doubt that he "Inochi no Mizu (Water for life)" has been the reassuring helper in the midst of the Corona disaster.

Here, we delve into the importance of the Japanese term "情緒 (Jocho)" in terms of a dialogue between "人 [Kanji (Japanese)]/Hito [Roman letter]/People [English])/Persone [Italian]/Leute [Germany]/Peuple [French], etc." and "水 [Kanji (Japanese)]/Mizu [Roman letter]/Water [English])/Acqua [Italian]/Wasser [Germany]/Eau [French], etc..". We think that the meaning of the Kanji (Japanese) of 情緒 (Jocho) is as follows. The things which are in some positions are to let the water (environmental resource) know the one's own feeling and to create the connection as a kind of mission. In general, there are three factors governing business, that is, "人 [people]", "物 [goods]" and "金 [money]" as the things. However, we here settle "人 [people]" the protagonists. We express the performance of one's mission (To get ready for one's mind), namely, 費用 [Kanji (Japanese)]/Kosuto [Roman letter]/Cost [English]/Costo [Italian]/kosten [Germany]/Cout [French], etc. in the fields of Economy and Management.

Therefore, both the "intention" of the protagonist and the "understanding" of the counterpart are necessary regarding the 費用 (Cost). Dialogue as a means of communication is required as a necessary and sufficient condition for that. Therefore, a concept and its utilization, that is, a way of thinking of "Costing" which means the reach of an agreement between "Protagonist side's preparation" and "Counterpart side's expectation toward it" for the 費用 (Cost) of "情

緒 (Jocho)" is here revealed. As a result, "Benefitto [Roman letter], Benefit [English], Elemento prezioso [Italian], Vorteil [Germany], Bienfait [French], etc." is generated by the "Counterpart side's empathy" as an agreement for the "費用 (Cost)" in which Protagonist divides.

Therefore, a way of thinking on the utilization of the "費用 [Cost]" in the "Mode of Exchange" which many economists including Prof. Karatani (Famous Philosopher & Economist) have debated is to be restricted to just only the situation on the assumption that Dialogue between "People" (Protagonist) and "Water" (Counterpart [Environmental resource]) is can be conducted. In addition, regarding the "Mode of Exchange" there are four modes such as A: "Nation/Reciprocity (Donation and Return)/Magical power], B: [State/Obey and Protection (Plundering and Redistribution)/Authority], C [Capital/Goods Exchange (Money and Commodity)/Capital Power], D: [Recovery Power of A with C in mind]". And, the mode D (≒Natural) is especially taken seriously as a "function of the controlling idea" in all [21] [26].

The Goal 17 of SDGs is "Partnerships for the Goals". It is the concept of "ESG" which means the acronym for Environment, Social, and Governance. This is the key focus of the "Process" of the corporate activities that led up to the "Goals". Regarding the Environment, Social and Corporate Government Investment, the ideal way of the right investment has been pursued based on the clearing of the communications requirements mentioned above. However, there is a big pitfall here. The reason is as follows. The dialogue which has been effected completely between the two is just only the situation "G: Governance" in the "ESG". This is because that the "Protagonist" and the "Counterpart" are "People". Then "natural language" (English by world standards) is used in the dialogue mentioned above. Therefore, the mutual 情緒 (Jocho) can be understand.

Next is "S:Social". Regarding the "S", it is slight possible to settle the "People" for "Protagonist" and "Counterpart" respectively. However, speaking of "People", it is "Government (politician, official)". Therefore, it is unknown whether it is going to get the "Empathy" or not. That is, it is difficult to understand the 情緒 (Jocho) against one's will. Then, there are sometimes quite a few results which brought about the understand of "情緒 (Jocho)" against one's will through the irrational/hostile exchange. Therefore, it is hard to say that the dialogue has been effected completely in the situation of "S:Social". Then, the Protagonist (People) side' attitude towards "Costing" has been becoming important.

And, a final term is "E:Environment". Regarding this "E", it is also slight possible to settle the "People" for "Protagonist" and "Counterpart" respectively. The dialogue between the Protagonist "People" and the "Counterpart" ["Water" (Environmental resource)] is basically impossible. Therefore, it can be said that the establishing of "Dialogue" based on the "Mode of Exchange" which has been advocated by many economists including Prof. Karatani, so to speak, "Fake Dialogue" made by the "Protagonist (People) side" on one's own from the perspec-

tive mentioned above.

Therefore, so to speak, "Costing for Environment" is necessary considering the "Dialogue" with "Water" [Environmental resource]. Here, the "Protagonist (People) side" regards all the "Cost" including both visible and invisible as a "Cost for Environment". And the "Protagonist (People) side" puts them in one's "Counterpart (Water) [Environmental resource]" regardless of the "Mode of Exchange". It is necessary to understand the "情緒 (Jocho)" with the "Counterpart (Water) [Environmental resource]" by paying attention to the consciousness which is related to not only quantitative cost for environment (visible costing) but also qualitative one (invisible costing). And, we think that this should be grasped as an obligation of "Protagonist (People) side". Therefore, looking at the connection mentioned above, it is important to expect the "Costing for the environment" by "Protagonist (People)", that is, setting of expecting only the realization of the "Counterpart (Water)'s satisfaction" regarding the understanding of the "情緒 (Jocho)" without any expectation in return is essential. It is possible to have a "dialogue" between "Protagonist (People)" and "Counterpart (Water)". And, as a result, the sustainability between the two is naturally guaranteed. From this point of view, the ideal way of "Mode of Exchange" which Prof. Karatani *et al.* have put forward is not necessary for "Costing for Environment". It is because this is included within the 情緒 (Jocho) mentioned above.

By the way, Famous philosopher, Immanuel Kant (1795) regarded the social history as obscurity plan of "Nature/Physis/自然 (Shizen)" in the twilight of his life. And, he argues that the "Nature/Physis/自然 (Shizen)" should be "A Something of Great Power" which is neither human being nor God [26].

As mentioned above, the "requirement of efficiency" is unnecessary (useless stuff) as a mode in which "Protagonist (People)" is related to the "Counterpart (Water)". This could be one of the causes which have disturbed "A Something of Great Power" which Nature itself originally has. Therefore, we think that there is a great meaning in "Costing for Environment" under the situation to enjoy inefficiency (to think benefits of inconvenience). It might be actually better for the "Nature/Physis/自然(Shizen)". The contents we considered through ESG this time has made us realize the importance of the "Dialogue" with "People and Water" in two countries (Maritime Countries and Landlocked Countries in the world). As for Kant's way of thinking, it can be suggested that the strong mind (will [vow]) which is infinitely kept to "Perpetual Dialogue with Nature/Physis/自然 (Shizen)" is the most important point. The contents mentioned above could resonate with a series of our studies (JWARP 2020-2022) so far [1] [27] [28]. In addition, the outline of the Ref. No.29 is as follows. In this study, the mixed water (seawater and rainwater) less than 0.74% (blood concentration) has been prepared first, and then divided into five kinds of the mixing rates of mixed water. And we have compared and examined the characteristics of the mixed water from the viewpoint of the relationship between salinity and pH, ORP and that of Dissolved Hydrogen, and examined the possibility of mixed water as a

drinking water.

By the way, the realization of the "Low Entropy Society" is essentially requested to resolve the global issues. In general, seeing the increasing order of the entropy regarding the three states of a matter, the highest is Solid (Ice), followed in order by Liquid (Water), and Gas (Vapor). It is thought that the entropy could be decreased by the sound and the rhythm.

The entropy based on the sound and the rhythm is generally expressed by the following equation.

$$E_S = K_S \ln C_S$$

where

E_S: Entropy based on the sound and the rhythm;

K_S: Constant;

ln: Natural logarithm;

C_S: Number of elements for the conscious decision.

We decrease C_S as much as possible by using the sound and the rhythm. Ultimately, we aim for "1". That is, E_S will be "0". Therefore, the decrease of the E_S based on the sound and the rhythm is the key to determine the fate of the "life" of all humankind.

This issue is also related to "Quantum mechanics·Water quality·Phase transition (Freezing/Thawing)".

When pursuing the possibility of "Raw Seawater into Drinking Water" this time, the two techniques were used, that is, "Freezing for Reduction of Salinity" and "UV-A&B for Sterilization".

It is considered on the extension of our studies that this study also resonates with a "Sense of Wonder" in the sense of utilizing a maximum power (Sunlight and Its Temperature on the Earth) which exists originally in Nature/Physis/自然 (Shizen).

Prof. M. Yuki (Aoyama Gakuin Univ. Japan) in her recent work says that there exists an important/valuable clue to think about the environmental issues in the "literature world". And she pushed her way through the literary works such as Henry D. Thoreau, M. Ishimure, K. Nashiki, Svetlana A. Alexievich and K. Ishiguro *et al.* by using a way of "Ecocriticism (study of literature and ecology from an interdisciplinary point of view)". Through the challenge of "Ecocriticism" she states the importance of "practice" to unearth the power of imagination for the future [29].

6.2. Quantum Mechanics·Water Quality·Phase Transition (Freezing/Thawing)

There is a concept in quantum mechanics that every particle or quantum entity may be described as either a particle or a wave (Wave-particle duality). **Figure 4** shows the directions of the particle (number) and the wave (swaying) in the interior space. In this figure, the arrow of the straight line represents the characteristic as a "particle", and rotation direction, as a "wave" respectively. It is said

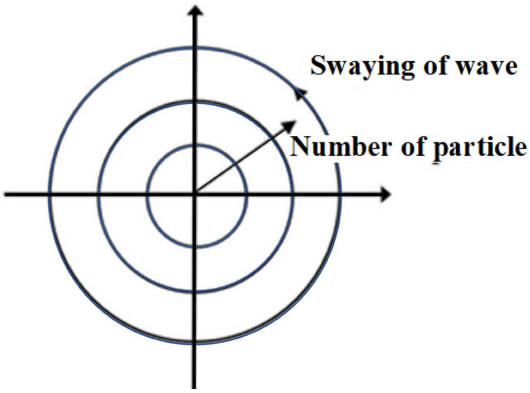


Figure 4. Conceptual diagram of two directions of the internal space with symmetry.

that the characteristic of the "particle" is decided according to both of the size of the waves and the directions [29].

As is well known, the water quality refers to the chemical, physical and biological characteristics of water. The most common standards used to assess water quality relate to health of ecosystems, safety of human contact and drinking water.

Therefore, likening the way of thinking to the seawater from the viewpoint of water quality, this will be shown as wave conditions including Natrium (Na), Chlorine (Cl), Oxygen (O), Hydrogen (H), etc. when no measurement. Because no one has ever seen them and cannot sort just Oxygen (O) only from them and so on. On the other hand, Sodium Chloride (NaCl), Dihydrogen Monoxide (H_2O), etc. will be shown as particle conditions when measuring (Observer effect) respectively. That is, it can be said that the conditions are mysterious existences which the common man cannot image at once.

By the way, Hydrogen (atomic quantity = 1.008), Oxygen (atomic quantity = 15.999) and Helium (atomic quantity = 4.0026), etc. are the vapors. In the atoms, Hydrogen (H) is the lightest atom, and Oxygen (O) is the atom which makes a lot of chemical compounds. Therefore, O seems to be good to become a standard of the atoms. However, there are subtle differences (inconvenience) on the atomic quantity (mass number) in the field of both physical and chemical. So at present, the standard of the atomic quantity is based on the carbon atom (atomic quantity = 12.011).

By the way, most of Hydrogen is made of the one proton and one electron. The atomic quantity is |1|. However, besides this Deuterium (atomic quantity: 2.01410222) which includes one neutron exists in Hydrogen on the Earth. And, only a very small amount of Tritium (atomic quantity = 3.0160497) which includes two neutron also exists in Hydrogen on the Earth. Regarding the other atoms, all the atoms with a fraction number have different number of neutrons.

It is said that although there exist 4 types of forces such as "gravity", "electromagnetic force", "strong force" and "weak force" in nature, the "weak force" among them has a power of changing the kind of "particle" [30]. Therefore, this one might be one of the factors which can affect the measured value itself ob-

tained from the modern water quality analysis instruments.

As it is said that pH which is an item of water quality is the abbreviation for "potential of Hydrogen", we have realized a deeper meaning in which this shows exactly its potential. Therefore, we think that quantum-mechanical considerations on the relationship between phase transition of water (Freezing and Thawing) and pH will be important in the future.

By the way, "Sugar" around us has a characteristic called "spontaneous symmetry", that is, chirality (laterality: whichever). It is thought that the chemical formula of sugar has two possibilities as shown in **Figure 5**. However, the sugar made by plants including the sugarcane is all "D-glucose (grape sugar)" in the left side in **Figure 5**. The "L-glucose" in the right side can be made artificially, and the "ingredients" are also the same as the glucose. In D-glucose, three OH groups and one H group are in the right side and the same groups (OH&H) are in the left one in L-glucose. That is, D-glucose is L-glucose or vice versa. Nevertheless, it is said that the creatures on the Earth cannot digest it [30]. And, there is a case in which this symmetry is broken due to the decrease in temperature. For example, when the vapor (gas) is less than 100˚C it becomes the water (liquid), and then is less than 0˚C the ice (solid). We call it "phase transition". Nanbu Y. (Japanese scientist: 1921-2015) won the Nobel Prize in Physics (2008) for the concept of the "Broken of Spontaneous Symmetry" [30]. Our research this time is related to the phase transition (Freezing and Thawing).

6.3. Experimental Procedure

In the previous paper (JWARP, 2022) [1], it has been examined the possibility of seawater directly into a beverage using ethanol as a renewable resource. In this study, the seawater less than 0.9% (normal saline) has been aimed at creating beverage first, and then divided it into nine kinds of the mixing rate of ethanol/seawater mixtures. In this experiment, the next two factors were mainly considered as an important issue, *i.e.* 1) Reduction of the salinity and 2) Sterilization of seawater. And, we used the estimated values in the past literature regarding the other water quality items. The estimated values according to the references

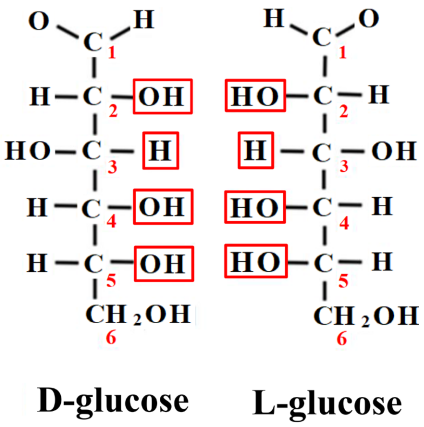


Figure 5. Chemical formula of sugar with symmetry.

were used regarding the other water qualities. And we have compared and examined the characteristics of the seawater from the viewpoint of the relationship between a) Salinity Concentration [by Electronic Force (Hydrogen Bonding)], b) Effect of Sterilization [by UV-A&B Irradiation] and examined the possibility of the raw seawater directly into a drinking water. As a result, it has been obtained the new findings that suggest the possibility.

In addition, the experimental procedures should be referred to Sections 6.4 and 6.5 and a series of our studies (JWARP 2018-2022) so far for more information.

6.4. An Outline of the Mechanism of Freezing

It is said that there are at present fourteen kinds as a phase space of the ice phases such as Ice I*h*, Ice Ic, Amorphous ice, Ice II, Ice III, Ice IV, Ice V, Ice VI, Ice VII, Ice VIII, Ice IX, Ice X, Ice XI, Ice XII. By the way, h of the "Ice I*h*" means the hexagonal crystal, on the other, c of the "Ice Ic" means the cubic crystal respectively.

In general, there are three kinds of ices, that is, "Ice I*h*", "Ice Ic" and "Amorphous Ice" under usual atmospheric pressure. It is said that the "Ice Ic" is formed at the temperature of −100˚C or less under the condition of the condensation to the frozen metal surface and the "Amorphous ice", −160˚C or less under the condition of the rapid condensation. It is considered that as the both Ices (Ih and Ic) are formed under a special situation the ices are irrelevant to the situation of our real life. The "Ice I*h*" is the only ice that is contact with in our daily life on the Earth. This one is formed at 0˚C or less under usual atmospheric pressure. Five Oxygen (O) line up in the "Ice I*h*" and form four H_2O with the tetrahedral structure (hexagonal crystal). In addition, the "Ice Ic" is a regular hexahedron (cube crystal) structure.

Figure 6 shows a schematic illustration of temperature-pressure metastable phase diagram of water on the "Ice I*h*". The marks (● & ▲) shown with the "Supercooled water" in the figure show the correlation (an example) of the "Temperature-Pressure" at both a ground (●) and a summit (▲) under the natural condition on the Earth. This position ("Supercooled water") can be expected to progress the new research areas as a "Newtonian mechanics region of interest", and other three positions such as "No man's land (LDL)", "Ultraviscous" and "Amorphous ice (LDA)" as a "Quantum mechanics (Quantum Biology) region of interest". It is thought especially regarding the latter that the measurement itself of the water qualities will be the issue of "State-of-the-Art research" under the conditions mentioned above (four types).

In addition, it is said in physical characteristics of the ice phase that the density of the Ice I*h* is 0.917 g/cm^3 and it is less than that of the liquid water. It is also said that t his is caused by the existence of "Hydrogen Bonding" which keeps the interatomic distances away in the solid phase [31].

Figure 7 shows the angle of H-O-H in the water molecule (H_2O) and its angle is about 105˚. By the way, it is said that as is seen in **Figure 8**, Oxygen (atom) of

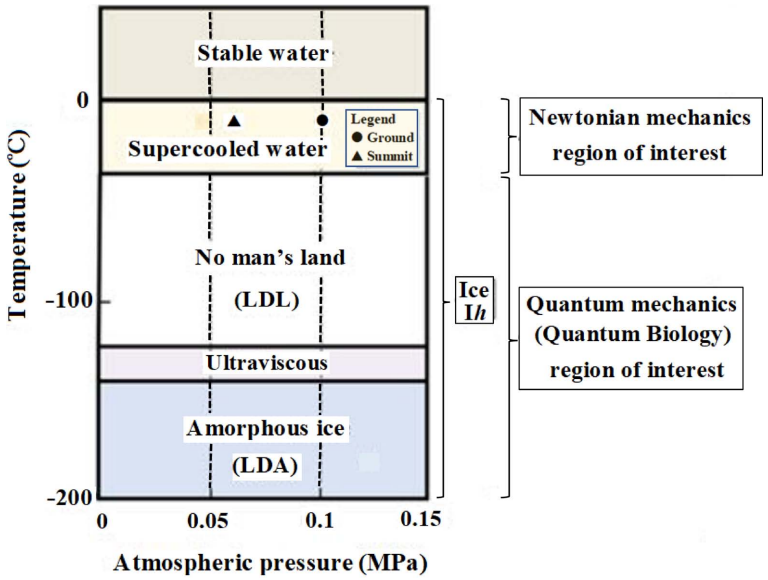


Figure 6. Schematic illustration of temperature-pressure metastable phase diagram of water.

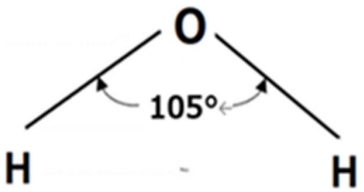


Figure 7. Schematic diagram of angle of water molecule.

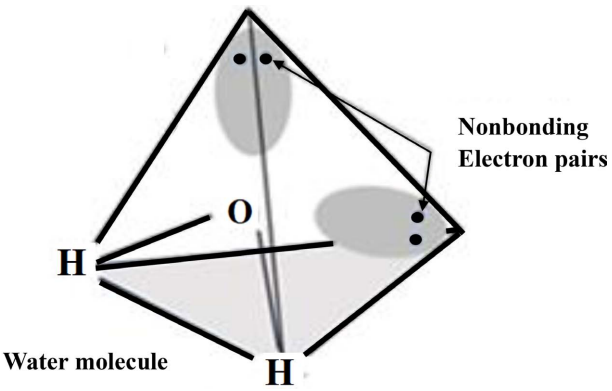


Figure 8. Schematic diagram of water molecule (H_2O).

the water molecule exists the center of a tetrahedron and the water molecule (H_2O) has two Hydrogen (atom) and two nonbonding electron pairs in the direction of the vertex of it [32]. The two electron pairs are protruding in the opposite direction to an H-O-H plane. This direction of it has a very important role to decide the characteristics of the water molecule (H_2O).

The structure of the "Ice" has a "regular tetrahedral structure" by forming the "Hydrogen Bonding" in which a single water molecule (H_2O) has a direction with other one (see **Figure 9**). And as the "Hydrogen Bonding" has a direction,

it can be combined only in a certain direction. Then the distance between molecules becomes partly the separated forms (see Figure 10). The feature of the structure of "Ice" is to have the gaps a lot.

The electro-negativity (EN) means a strength with which the atom pulls electron. The EN of Oxygen (atom) is overwhelmingly higher than that of Hydrogen (atm). Therefore, minus charge (δ^-) of Oxygen (atom) comes close to the nonbonding electron pair in fact. When having plural water molecules, the minus charge on the nonbonding electron pair of a water molecule and plus charge on the Hydrogen (atom) of the other one pull against each other. The force of two charges (δ^- & δ^+) pulling against each other (Electrostatic Interaction) is shown in the form of a broken line in Figure 10. The EN of Oxygen (atm) is much higher than that of Hydrogen in terms of the water (H_2O).

The electron used for the bonding of atoms (H & O) in the water molecules is pulled towards the Oxygen (atom) which has a larger EN. As a result, the Hydrogen (H) takes a charge of plus (δ^+) and Oxygen (O), minus (δ^-) respectively

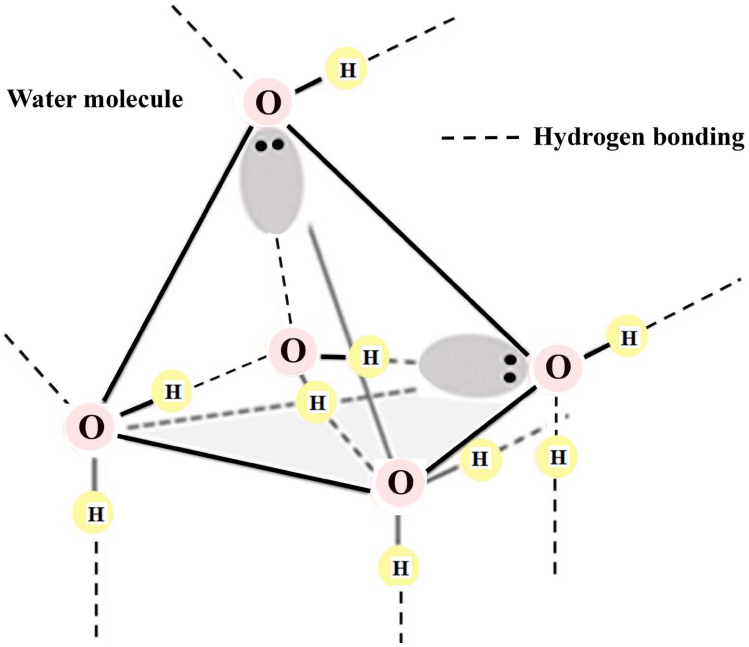


Figure 9. Tetrahedral structure of water molecule.

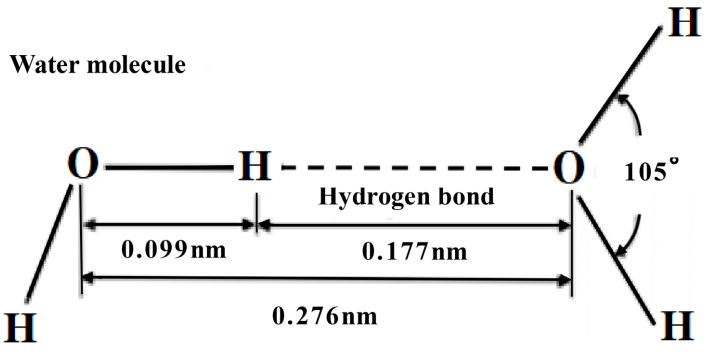


Figure 10. Schematic diagram of hydrogen bond of water molecule.

(Figure 11). Because of that, the bonding based on the "electrostatic attraction" is formed between the same molecules in the neighbor. The bonding based on the "electrostatic attraction" is called hydrogen bonding.

The Oxygen (atom) is involved in the "Hydrogen bonding" in this way. Except for the water molecule, the ethanol (C_2H_5OH) used in the former experiment has also a "Hydrogen bonding" because of having the "H-O" (hydroxy group [-OH]) (see Figure 12). By the way, the double helix structure of DNA is a "hydrogen bonding" based on the base-on-base.

By the way, the "Hydrogen Bonding" between Hydrogen (atom) and Chlorine (atom) does notoccur. It is because that the atomic radius of the Chlorine is larger than that of the Hydrogen. That is, the surface of the atomic radius of the Chlorine (δ^-) is larger than that of the Hydrogen (δ^+) and then the electron density becomes small. It is said that as the electron density (δ^-) of the Chlorine in the surface is weak the sufficient electrostatic force with Hydrogen (δ^+) does not occur.

When Hydrogen is bonding to an atom with high EN, the atom with high EN takes a minus charge (δ^-) and the Hydrogen, a plus charge (δ^-). And then, the electron which takes a minus charge (δ^-) gets closer there. The radius of the van der Waals force of the Hydrogen is small. Therefore, it is not complete coordinate linkage (covalent bond)but the "Hydrogen bonding" occurs between the two in the water molecules when getting close to a certain degree. That is, it means that the water molecules tightly form a scram to each other (see Figure 13) [32].

Figure 14 shows all possible "Hydrogen Bondings between the water molecules in which those are precisely and regularly situated side by side, back and forth, left and right and up and down. The three layers of the Hydrogen bonding are easily shown in this figure. Each Oxygen (atom) bonds through adjacent 4 Oxygens and 4 Hydrogen bonding. An Oxygen (atom) of the water molecule is situated just the center of the regular tetrahedron, and the Oxygens (atoms) from 4 water molecules occupy each of the vertexes of it. The structure of the

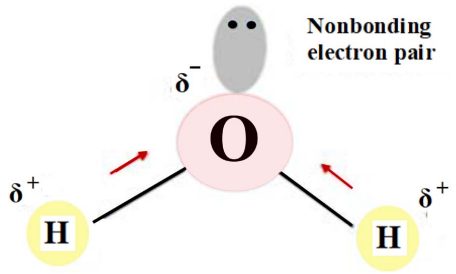


Figure 11. Electrostatic attraction by electronegativity.

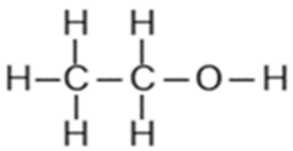


Figure 12. Structural formula for ethanol: CH_3CHOH.

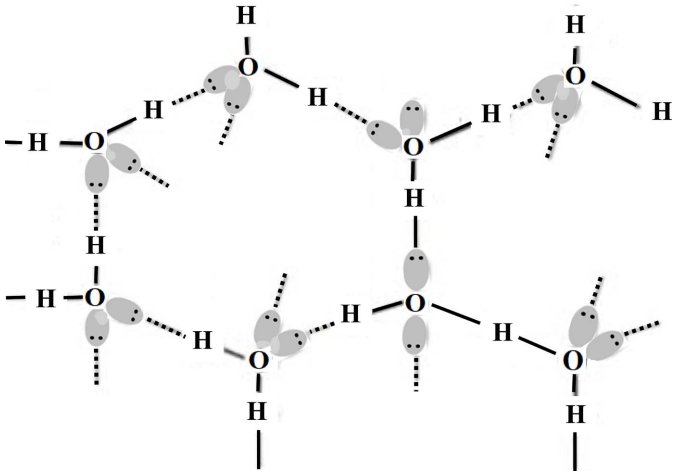


Figure 13. Schematic diagram of hydrogen bond of water molecule.

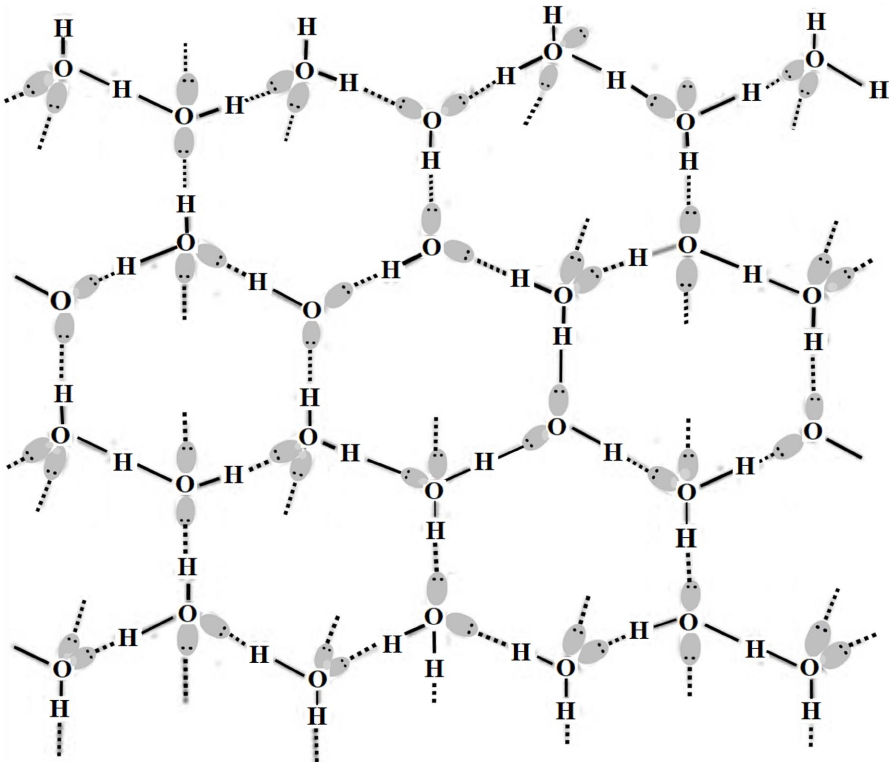


Figure 14. Hydrogen bonds (schematic diagram).

bonding in the ice has many gaps indeed (see Figure 8 & Figure 9).

When the water molecules become the ice they arrange properly. As a result, they become a structure with "many gaps". When the water becomes the solid it shows the characteristics of the expansion. It is said that most of the characteristics of the water like this are based on the "Hydrogen Bonding" (Characteristics of the freewheeling of the electron).

It is said that when the water becomes 0˚C (in case of seawater: ≈−1.8˚C [33]) the water molecules start to connect one after another with other ones. And when all the molecules connect with 4 pieces of molecules around, so-called "Jungle

Gym" of the ice has been completed. This is a form in which the water turned into ice.

The ice has a characteristic that it is regularly trying to connect with water molecules only.

We need two conditions to let the water join the group of the "Jungle Gym". One is that the size is the same as the water molecule with 2 arms and 2 legs (met.). The other one is that it must have a same angle (≈105˚C) with the same arms and legs (see Figure 7). The Air molecules and the impurities (Salinity, etc.) have been trapped inside the ice or pushed out outside it. It is said that it depends on the speed at which the ice is made.

If it is used the freezing by slow method (Freezing from upper side) which means the lowering of the temperature taking the time slowly, the water (seawater) has slowly turned into the ice (see Figure 15). On the other hand, if lowering the temperature in a short time, *i.e.* by rapid method (see Figure 16), the passing paths for the impurities (Air and Salinity, etc.) in the Jungle Gym made by the freezing are blocked. As a result, almost all impurities have trapped in the ice in the end. Therefore, when making the transparent ice rid of impurities from the ice, it is necessary to take the time (2 - 3 days) and do it slowly. Almost all impurities have been removed when it becomes ice. Therefore, it is said that the way mentioned above is the only way to make the transparent ice so far [34].

It will be expected that what could happen when we apply the 116 Hz frequency to the procedure described in this section.

6.5. Ultraviolet Irradiation for Sterilization of the Seawater

Regarding the UV irradiation in this experiment, we used the UV Lamp (Hyper Sun UV, 80 W, Product of VIVARIA, Japan) in the marketplace. The effective

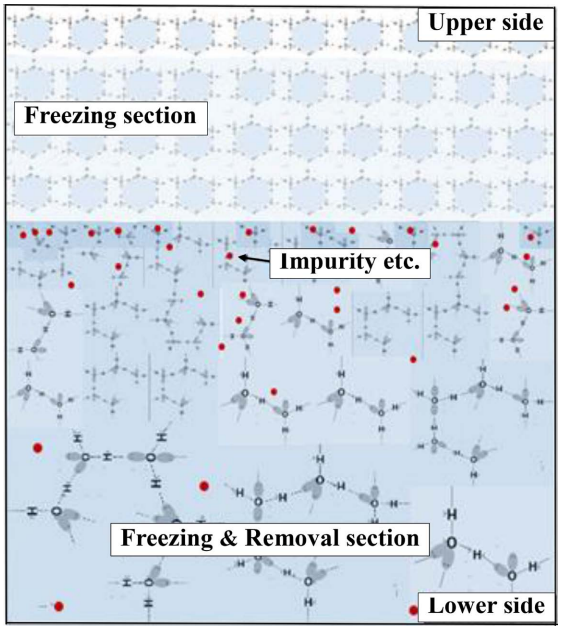


Figure 15. Conceptual illustration of freezing by slow method.

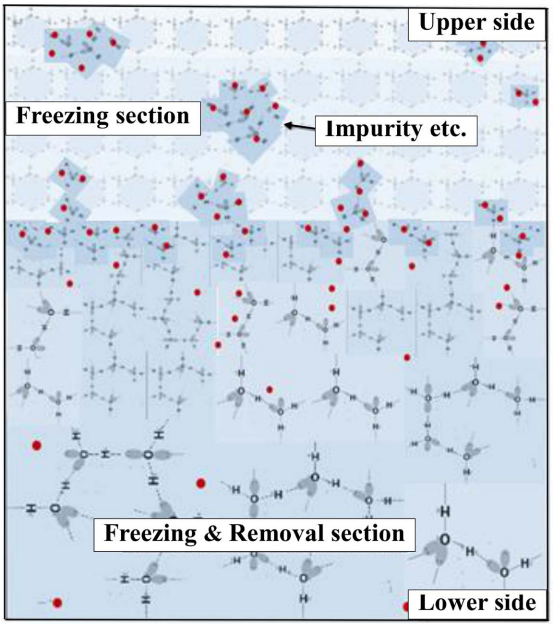


Figure 16. Conceptual illustration of freezing by rapid method.

radiation distance of the lamp is up to about 50 cm. General speaking, when irradiating the UV-A&B to the specimen (seawater),the O-H bond breaks in the water (seawater) and 2 electrons which has become the cooper pair are pulled away and isolated. And then, 2 free radicals are created. [·H]consisting of 1 proton (H^+) and 1 nonbonding electron pairs (·) are "Hydrogen (atom)" in itself. "Hydrogen (atom)" is originally a high-reactivity element. On the other hand, [·OH] is a hydroxy Radical (one of the reactive oxygens). When irradiating the UV, the electron (−) is beaten out of the water (seawater) besides the cut of O-H. And it is said that it becomes the superoxide anion (O_2^-) (one of the reactive oxygens) due to the acceptance of nearby oxygen molecule (O_2).

Regarding the relationship between the light wavelength (nm) and the spectral radiant intensity (μW/cm^2/nm) used in this experiment this time, the range of the wavelength of the UV lamp (UV-A & UV-B) is equivalent to that of reproducible natural sunlight. By the way, the radiant intensity at the distance from the specimen (surface of seawater: ≈5 cm) in this experiment is about 2200 μW/cm^2. In addition, under the same condition, the intensity (mean) of the UV (A&B) of the sunlight was about 2250 μW/cm^2 in Aug. 2022 (12:00-13:00) at Kyoto, Japan.

The effect range of UV-B by the lamp used in this experiment is about 280 - 310 nm and the radiant intensity, about 0 - 15 μW/cm^3/nm, and the wavelength at the peak intensity is about 310 nm. On the other hand, that of UV-A is about 310 - 400 nm and the radiant intensity, about 0 - 65 μW/cm^3/nm. There are 2 peaks regarding the radiant intensity. One is about 315 nm, and the other, about 365 nm. In addition, it has been confirmed the superoxide anion (O_2^-) under the irradiation in the experiment.

It is thought that the range of the wavelength of UV-lamp in this experiment

is suitable for the wavelength when we apply it under the natural conditions (Natural freezing: Removal of impurities/UV irradiation [Sterilization of seawater]) that the sun is shining on the Earth.

6.6. Experimental Condition

This time, the experimental condition used in the previous paper (JWARP, 2020) [27] was basically followed. The previous paper (JWARP, 2022) [1] was written under the circumstances in which the world still has been in the midst of a corona disaster. Therefore, the ethanol was used to conduct the 2 items (Decrease of salinity and Sterilization) simultaneously in the seawater as a specimen. However, Corona pandemic has been almost settled at present. Therefore, this time the freezing methods (Slow/Rapid) for decreasing the salinity and UV-A&B one for the sterilization of the seawater were utilized instead of the ethanol.

In addition, when freezing by the slow method using the freezer, the paper cup for a specimen and its bottom was boxed in the cooler box made of expanded polystyrene to be freezed slowly from the top of the specimen.

Figure 17 shows the conceptual diagram of the treatment process for "raw seawater into drinking water". As it is used the freezing method (Freezing & Thawing), the small impurities including Salinity, Suspended solids (SS) [0.1 mm (less than 100 μm)], etc. are removed at a lower place of the specimen after thawing. Therefore, we need a process to be removed. And the microplastics existing in seawater are very small (less than 0.01 mm [10 μm]) and almost invisible. Therefore, it is needed a filtration process (Rough filtration: Trapping for more than 1 μm) to remove it.

This is only a standard process that means 1) "Rough filtration" at the first stage to trap the impurities for more than 1 μm, 2) "Slow freezing" from the upper side of the specimen (paper cup)for Salinity reduction (2.4% → 0.6%) at the second stage, 3) "Thawing" at the room temperature (20˚C ± 15˚C) at the third stage, 4) "Sterilization" by UV-A&B irradiation at the distance of 5 cm between UV-Lamp and the seawater surface at the fourth stage and 5) "Microfiltration" at the final stage to trap the impurities for more than 0.22 μm carries out the capturing for two-time filtration to defend biological effect. Because of that, this time, only 2 coffee filters (commercially available) as a medium of the rough filtration were used. This type of the filter is for capturing relatively coarse particles (≥100 μm).

In addition, the experimental procedures should be referred to Sections 6.4

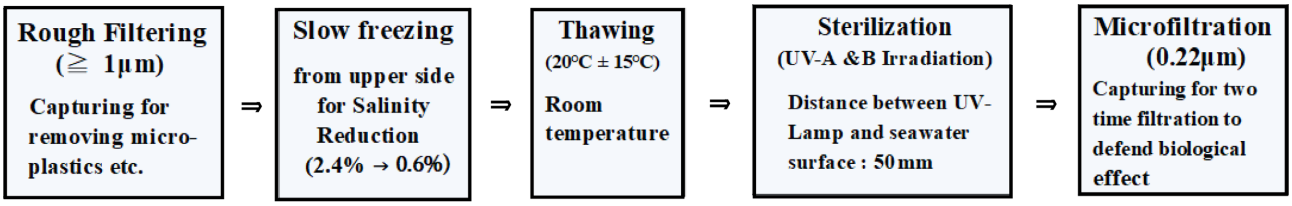


Figure 17. Conceptual diagram of treatment process for raw seawater into drinking water.

and 6.5 and a series of our studies (JWARP 2018-2022) so far for more information.

And after thawing at room temperature (20˚C ± 15˚C) and disinfecting through UV-A&B, it is additionally desirable that it is important to filtrate the seawater twice using a microfilter (0.22 μm) to defend against the biological effect. It has been referred to the literature written by Dr. Kimura I. (M.D.) regarding the necessity of the mesh size of the filtration at the final stage [35].

By the way, it is said that the difference between the "Deep Ocean Water (DOW)" and so-called "Surface Ocean Water (SOW)" is as follows. In general, the former has three important features such as 1) "Wealth Cleanliness" which means that the pollution due to the anthropogenic chemicals is almost nothing, 2) "Wealth Low Temperature Stability" which means that the water quality is fixed and stable and 3) "Wealth Nutrient" which means that the inorganic nutrients (NO_3^-, PO_4^-, Si) which are needed for growing the plankton is rich in comparison with the latter. In addition, the concentration of the salinity is the same in both.

The experimental technique this time is applicable to both DOW and SOW. Therefore, we think that the important point is how users finally balance out with three factors, *i.e.* cost, risk (safety) and benefit.

6.7. Analytical Method of Water Quality

The way of our previous paper (JWARP, 2020) [27] is basically followed regarding the basic things on the water quality. This time the main items of the water quality are the following three: Salinity Concentration, pH, and General Bacteria. In addition, the number of Colitis Germ Legions can be replaced with the number of General Bacteria. (*i.e.* Number of General Bacteria: 0 → Number of Colitis Germ Legions: 0.) At this time, a test paper for general bacteria manufactured by SIBATA Scientific Technology Ltd., Japan was used.

7. Results and Discussions

In this experiment, the volume of the raw seawater was 200 ml, the temperature was 18˚C - 20˚C and the humidity was 60% - 75%. It is focused on the "sterilization" of the seawater more in strong consciousness with/after the coronavirus (COVID-19) as a whole. This time, three kinds of water quality items of the seawater such as "Salinity Concentration", "pH" and "Number of General Bacteria" were selected as the analytical object items of the quality of the seawater. And like the last paper [1], the several water quality items were used as the reference values which have been published in the previous papers. In addition, this time, the seawater used in this experiment is the same as that of the last paper [1].

By the way, it is thought that regarding the standard of the water quality towards the "raw seawater into drinking water", the standards need to conform to the "WHO Water Quality Standards for Drinking Water (28 kinds)" for the time being at least until the standard for seawater is ready. There are so many purification techniques for that at present. Therefore, if the harmful substances exist

in the seawater, we should deal with it the same way we did it to the river water so far. The high seas are occupied with 60% or more of the world's sea and areas beyond national jurisdiction. If the humankinds can be seriously putting much effort into conserving the "high sea" (*i.e.* protecting high sea's ecosystems) as common goods with universal solidarity, the cost for the water treatment techniques should be able to decrease substantially.

In addition, "high sea" could be contaminated with the "plastic waste" and "unsymmetrical hydrazine", etc. disposed from the land areas, it is unpreferable for the creatures including the marine life. Then it is necessary to improve "Political & Economic System" (Humanitarian support) and tighten the regulations such as a "UN Convention on the Law of the Sea" (Strengthening the UN), etc.

This time, the experiment was carried out centering on the relationship between "freezing time" and "freezing temperature" of the sample seawater. There are 2 methods as a freezing way. One is a "Rapid one", and the other, a "Slow one". A consideration from six points of view was conducted. That is as follows. 1) Relationship between thawing time and affectors (Amount, Salinity, pH) at the thawing of the frozen seawater at Rapid freezing & Slow freezing. 2) Relationship between freezing time and freezing temperature at Rapid freezing & Slow freezing. 3) Relationship between thawing time and amount of the frozen seawater at Rapid freezing. 4) Relationship between thawing time and salinity conc. of the frozen seawater at Rapid freezing. 5) Relationship between thawing time and pH of the frozen seawater at Rapid freezing. 6) Relationship between irradiation time of UV-A&B and the number of general bacteria at Rapid freezing & Slow freezing.

There is a big difference in the experimental technique between this study and previous one (JWARP, 2022). That is to use the "Freezing-Thawing-UV method" as a new methodology for this parathion of the seawater quality (salinity reduction, etc.) and the sterilization, while the ethanol and the sunlight were used in previous one. The proposed technique this time has unique characteristics, such as being easily operated, making use of the forces of nature, and costs are also comparatively cheaper. This naturally includes the well-designed freezing methods. Naturally, it is thought that this resolves itself into a question of the choice (sense of value/culture) of the users. It means that how users finally balance out with three factors, *i.e.* cost, risk (safety) and benefit.

In addition, regarding the H_2O separation, Tushima K. (Toyama Univ. Japan) *et al.* have examined the possibility of glaciological technology for treatment of radioactive contaminated water and their efforts are starting to bear fruit [36]. Additionally, Yan Su (South China Univ. of Tech., China) *et al.* state that separating water isotopologues (Tritium) using diffusion-regulatory porous materials is possible in principle) [37].

1) Relationship between thawing time and affectors (Amount, Salinity, pH) at the thawing of the frozen seawater at Rapid freezing & Slow freezing

A general household freezer at this freezing method was used. The freezing

temperature has been set at about −20 - −18˚C to prevent the deterioration of food and bacterial growth.

In this experiment, the paper cup (specimen) was used to prevent bad effects of damage caused by the freezing to ice. The specification of the cup used in this experiment is as follows: Height is 95 mm, Diameter of the upper side is 75 mm and 50 mm for the bottom one. The capacity of the container is 250 mL. In addition, this is made of pulp, polyethylene laminate and polyethylene. In the slow freezing method, the around and the bottom of the specimen was surrounded by the cooler box made of expanded polystyrene to freeze the sample seawater slowly from the upper side in the freezer. And, when setting up the sample container to the freezer, it was wrapped with the silicone rubber (≈1 mm) with high oxygen permeability to cover the sample. The freezing under the standard temperature (−20 - −18˚C) was defined as the "rapid freezing" in this experiment. Table 1 shows the relationship between thawing time and affectors (Amount, Salinity, pH) at the thawing (at RT) of the frozen seawater.

The thawing time was four and a half hour from 40 min. (Salinity: 0.90%) to

Table 1. Relationship between thawing time and affectors (amount, salinity, pH) at the thawing of the frozen seawater (rapid method).

([Sample] Amount：200 mL, Salinity：2.4%, pH：8.2, Thawing：20˚C±15˚C)

Freezing by Rapid Method							
Thawed Seawater removed from the cup				Thawed Seawater left in the cup			
Thawing time (min.)	Amount (mL)	Salinity (%)	pH	Thawing time (min.)	Amount (mL)	Salinity (%)	pH
40	50	4.2	7.61	40	150	0.90	7.61
50	60	4.4	7.61	50	140	0.80	7.31
70	70	4.3	7.61	70	130	0.70	7.61
90	80	4.2	7.61	90	120	0.60	7.31
110	90	4.1	7.61	110	110	0.50	7.61
130	100	3.7	7.61	130	100	0.40	7.61
145	110	3.6	7.61	145	90	0.30	7.61
160	120	3.4	7.46	160	80	0.20	7.31
175	130	3.3	7.46	175	70	0.10	7.31
310	170	2.6	7.31	310	30	0.01※	7.16

※ Fresh Water [＜0.05 %]

310 min. (Salinity: 0.01%). Regarding the amount of the frozen seawater (upper side of the specimen [250 mL]), the holes (17 places) of the bottom of the specimen were concentrically opened by an ice pic (Φ: 2 mm, L: 5 mm). And then, the seawater including the salinity and minerals, etc. which was pushed by the freezing power (Hydrogen Bonding) was removed from the bottom (holes) of the specimen. In addition, the shape of the ice left in the specimen after removing the seawater into the bottom was hollow (half-ecliptic shape) inside (Φ: ≒ 15 mm, Height: ≒10 mm) for "the freezing by rapid method", and Φ: ≈8 mm, Height: ≈5 mm for "the freezing by slow method" respectively.

As it is mentioned in the previous paper [1], this is why the seawater less than 0.9% (normal saline) has been aimed at creating drinking water in this study. In addition, it is said that the salinity concentration of the seawater at the time of the birth of life of humankind was 0.7% - 0.8%. It is understood from Table 1 that the salinity concentration is gradually decreasing with the thawing time. The salinity concentration at the time of 310 min. was 0.01%, which is equivalent to the fresh water.

The thawing time was 40 min, the amount of the seawater at the upper side of the ice,150 mL, and pH, 7.61 (slightly alkaline) respectively, at the salinity concentration of 0.90%. On the other hand, the salinity concentration in the frozen seawater which was pushed to the bottom side by the freezing power (Hydrogen Bonding) when thawing (at RT) was 4.2%, and pH, 7.61 (slightly alkaline) respectively. In addition, the thawing time was 50 min, the amount of the seawater at the upper side of the ice, 140 mL, and pH, 7.31 (slightly alkaline) respectively, at the salinity concentration of 0.80%.

On the other hand, the salinity concentration in the frozen seawater which was pushed to the bottom side by the freezing power (Hydrogen Bonding) when thawing (at RT) was 4.4%, and pH, 7.61 (slightly alkaline) respectively.

Next, the experiment of "the freezing by slow method" was carried out to be compared with "the freezing by rapid one" mentioned above. The condition in the freezer is the same as the rapid method, that is, the temperature is about −20˚C - −18˚C, and was surrounded by the cooler box made of expanded polystyrene, but increased the thickness of the polystyrene to be frozen more slowly compared with the rapid one. Table 2 shows the relationship between the thawing time and affectors (Amount, Salinity, pH) at the thawing of the frozen seawater

Table 2. Relationship between thawing time and affectors (amount, salinity, pH) at the thawing of the frozen seawater (slow method).

([Sample] Amount：200mL, Salinity：2.4%, pH：8.2, Thawing：20˚C±15˚C)

Freezing by Slow Method							
Thawed Seawater removed from the cup				Thawed Seawater left in the cup			
Thawing time (min.)	Amount (mL)	Salinity (%)	pH	Thawing time (min.)	Amount (mL)	Salinity (%)	pH
150	60	5.0	9.18	150	140	0.60	7.76

through "the freezing by slow method". Here, the amount of 140 mL (thawed seawater left in the cup) just as an example is picked up to be compared with that of the rapid one. In addition, the salinity concentration at the same amount (140 mL) in the rapid one was 0.80%. As is seen from Table 2, the salinity concentration at the same amount (140 mL) was 0.6%. This shows a decrease of 0.2% in comparison with the rapid one. In addition, the thawed time was 150 min. (50 min. at rapid one), and pH, 7.76 (7.31 at rapid one) respectively. By the way, the salinity concentration which was pushed by the freezing power (Hydrogen Bonding) to the bottom side was 5.0% (4.4% at rapid one) and pH, 9.18 (7.61 at rapid one) respectively.

2) Relationship between freezing time and freezing temperature at rapid freezing and slow freezing

Figure 18 shows the relationship between the freezing time and the freezing temperature at rapid freezing and slow freezing. In the rapid freezing, the freezing temperature dropped to −17˚C in a day (24 hrs). After that, if the freezing time was taken more, the value of the freezing temperature did not change any more, *i.e.* that shows the constant one. Therefore, it (frozen object: Ice) was used as a specimen (sample).

On the other hand, in the slow freezing, the freezing temperature dropped to −17˚C in 3 day (72 hrs). After that, it showed the constant one. Therefore, it (frozen object: ice) was used as a specimen (sample). By the way, the freezing temperature at 1 day (24 hrs) at slow one was −11˚C (−17˚C at rapid one), at 2 days (48 hrs), −15˚C (−17˚C at rapid one) and at 3 days (72 hrs), −17˚C (−17˚C at rapid one) respectively.

In this experiment, a comparative experiment between the "Rapid freezing" and "Slow freezing" was conducted in a broad outline under a small amount of data. Therefore, based on a lot of data between the two an appropriate "statistical model (Ex: Weibull model)" will be selected and its verification is desirable.

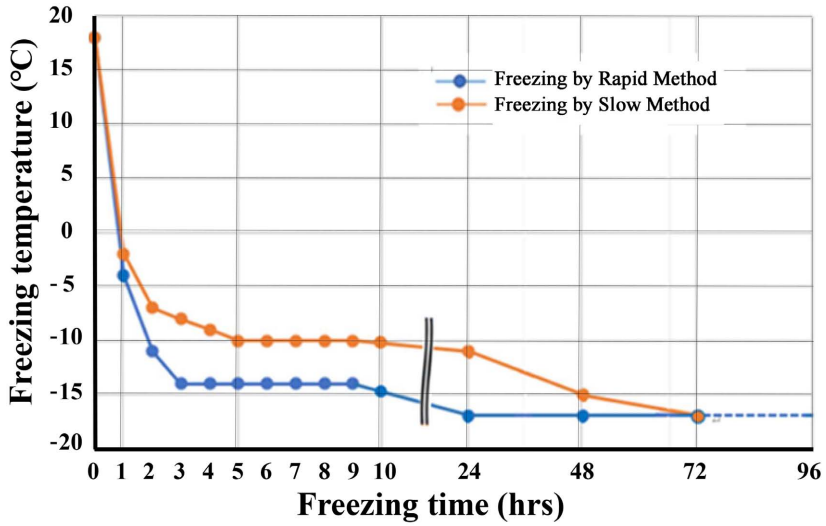


Figure 18. Relationship between the freezing time and the freezing temperature at the rapid freezing and the slow freezing.

3) Relationship between thawing time and amount of the frozen seawater at rapid freezing

Figure 19 shows the relationship between the thawing time and the amount of the frozen seawater at the rapid freezing.

It is understood from Figure 19 that the amount of the frozen seawater at the upper side of the specimen (paper cup) is decreasing with the thawing time. The relationship between the amount of the frozen seawater and the thawing time can be divided into three stages. One is 0 - 50 min., second one, 50 min. - 175 min. and last one, 175 min. - 310 min. respectively. At the last stage, the amount of the frozen seawater shows a relatively modest decline.

4) Relationship between thawing time and salinity concentration of the frozen seawater at rapid freezing

Figure 20 shows the relationship between the thawing time and the salinity concentration of the frozen seawater at the rapid freezing.

The relationship between the two is also divided into the three stages as Figure 20.The concentration of the salinity decreases from 2.4% (0 min.) to 0.90% (40 min.) at the thawing time of 40 min. And after that, 0.80% (50 min.), 0.70% (70 min.), 0.60% (90 min.), 0.50% (110 min.), 0.40% (130 min.), 0.30% (145 min.), 0.20% (160 min.), 0.10% (175 min.). These values that could be obtained show the raw seawater in which the salinity was reduced 0.1% in each measurement time. And, at the time of 310 min., the raw seawater with the salinity of 0.01% (*i.e.* Fresh Water [<0.05%]) was obtained.

5) Relationship between thawing time and pH of the frozen seawater at rapid freezing

Figure 21 shows the relationship between the thawing time and pH of the frozen seawater at the rapid freezing.

Although the pH is changing little by little throughout the thawing time, the values fall in the range of 7.16 - 7.61. The values show a weak alkalinity respectively.

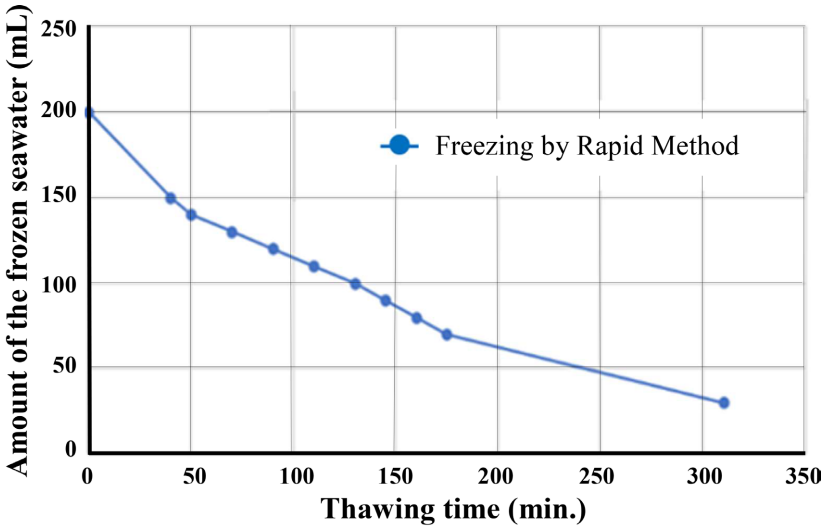


Figure 19. Relationship between the thawing time and the amount of the frozen seawater at the rapid freezing.

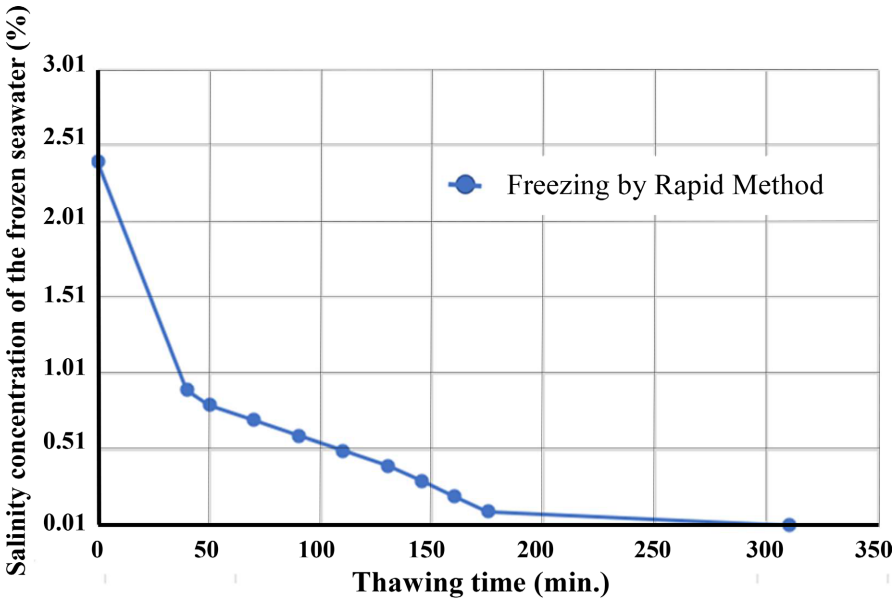


Figure 20. Relationship between the thawing time and the salinity concentration of the frozen seawater at the rapid freezing.

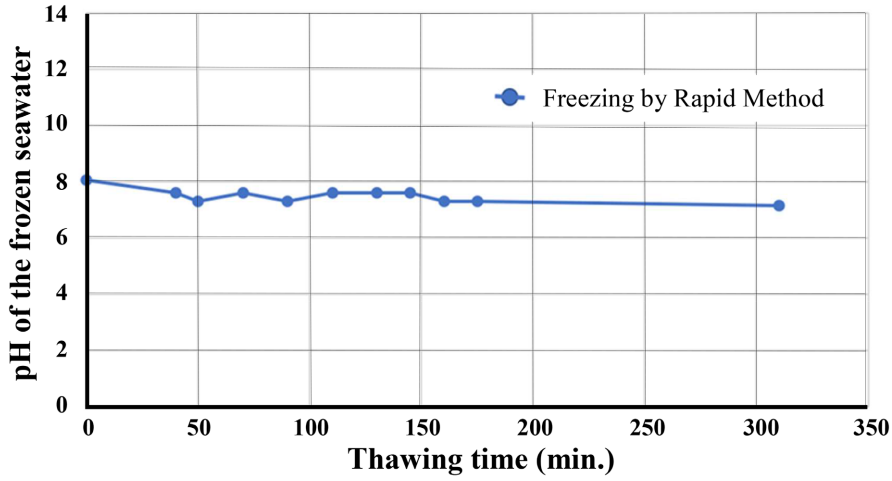


Figure 21. Relationship between the thawing time and pH of the frozen seawater at the rapid freezing.

These show an appropriate value as a pH for drinking water. As is well known, the concentration of the fluid of the human body has been maintained in weak alkalinity (pH: 7.35 - 7.45). It is said that this is because the cells of the whole body can fulfill one's function healthily within this range.

6) Relationship between irradiation time of UV-A&B and general bacteria at rapid freezing and slow freezing

In conducting the experiment, the distance of the irradiation of the UV-A&B lamp was about 5 cm from the surface of the seawater in the cup as a specimen. Figure 22 shows the relationship between the irradiation time of UV-A&B and General Bacteria at the rapid freezing and the slow freezing respectively.

Regarding the number of General Bacteria after the irradiation, it was "6

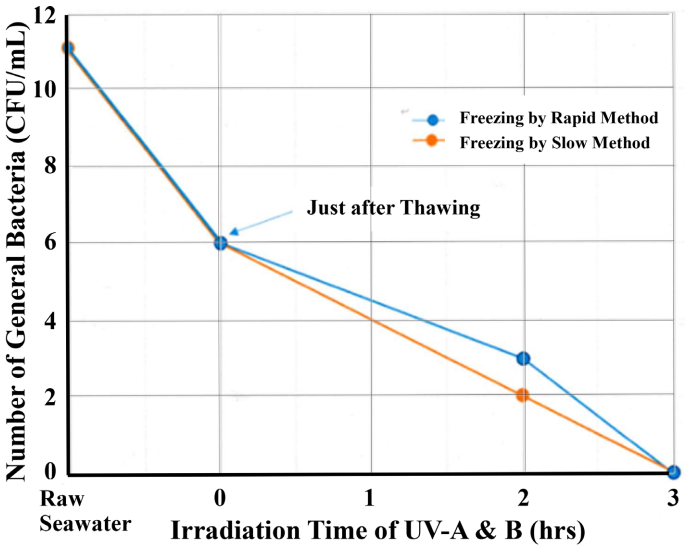


Figure 22. Relationship between irradiation time of UV-A&B and number of general bacteria at the rapid freezing and the slow freezing.

[CFU/mL]" immediately after freezing (0 hrs). After that, we have been waiting until the frozen seawater was thawed. After confirming the complete thawing, the irradiation of 2 hrs was conducted on it. As a result, the number of the bacteria reduced to "3 [CFU/mL]". Furthermore, at the irradiation of 3 hrs, it was "0 [CFU/mL]" (Complete Sterilization).

On the other hand, looking at the result of the "slow freezing", those values are "6 [CFU/mL]" (0 hrs), "3 [CFU/mL]" (2 hrs) and "0 [CFU/mL]" (3 hrs) respectively. It is understood from the results that the relationship between the irradiation time of UV-A&B and the number of "General Bacteria" are correlated and that a better result can be obtained with the slow freezing method than the rapid one as a sterilization. In addition, it means that "0 [CFU/mL]" in the number of "General Bacteria" is the same as "0 [CFU/mL]" in the "Colitis Germ Logions".

8. Conclusions

This paper explores the conversion of raw seawater into drinking water from a religious water literacy (RWL) perspective. RWL is here defined as a socially just water literacy that is based on the respect for the dignity of life of all living beings on the Earth. The importance of sustainable water sources is discussed and the purification methods are proposed by RWL. That is, the study aims to show a brief outline of the drinking water source (inland waters; mainly river water) and their purification technologies in recent times and today and propose the purification method (Freezing-Thawing-UV method) in case of taking the seawater as the source. And, it emphasizes the need for dialogue and cooperation between countries in order to proceed. The relationship among religion, culture, and civilization is discussed in the paper and the similarities between Marx's historical materialism and Umesao's ecological view are highlighted. The im-

portance of water purification technology, separation methods, and the potential for seawater as an energy source is further discussed. It is concluded that the paper shows the importance of dialogue, communication, and understanding in environmental decision-making. In order to carry them forward, it is convinced that citizens in the world are nothing but people with self-awareness of "Bodhisattvas of the Earth" as identities.

As a result, the new findings that suggest the possibility of raw seawater into drinking water from a religious water literacy perspective through the lens of Kawakatsu's maritime view have been obtained.

Although the evidence of the seawater quality obtained through this study is of obvious importance in understanding the water, it is thought that the dialogue (exchange between a subjective and a subjective) between water and humankind is more important. However, the evidence in the dialogue has only the ability to finish that. That is, the "morality/ethics" has not been led due to this. Therefore, it is thought that "a narrative-based water literacy" that puts emphasis on "a subjective" and "a narrative" will be one of the key values in the future.

Acknowledgements

In carrying out our study, Dr. Imamura A. (Osaka Sangyo University) supported us in doing experiments and also gave us valuable advice and comments regarding the electronics and the handling of the UV-lamp, etc. in the water. So here, we would publicly like to express our deepest appreciation for his help and support.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Hiratsuka, A. and Demizu, T. (2022) Study on the Possibility of Raw Seawater into Beverage. *Journal of Water Resource and Protection*, **14**, 349-384. https://doi.org/10.4236/jwarp.2022.144018

[2] https://cehub.jp/glossary/climate-risk/

[3] https://www.asahi.com/articles/ASR2T3GVHR2TUHBI007.html

[4] https://noharm.or.jp/news/glossary/

[5] https://www.oceanochemistry.org/publications/TRIOC/PDF/trioc_2007_20_3.pdf

[6] Sugiyama, T. (2023) Boukoku no Eco-Imasugu Yameyou Taiyoukou Paneru (Eco destroying Country—Let's Stop Solar Panel Now). In: Iwao, M., Ed., *Wani Books*, Wani Books Publishing Co., Tokyo, 211-217. (In Japanese)

[7] https://coralcap.co/2020/08/nuclear-fusion/

[8] https://www.hitachihyoron.com/jp/column/ei/vol07/index.html

[9] Kazuichi, S. (2004) Transitions at the Leading Edge of Civilization and the Fusion of Asian and Western Civilizations in the Asia Pacific. https://www.ritsumei.ac.jp/~kazuichi/profile/20047.pdf

[10] Umesao, T. (2001) Bunmei No Seitai-shikan wa ima [An Ecological View of Civilization Today]. *Chuokoron*, **1**, 56-57. (In Japanese)

[11] Kawakatsu, H. (2016) Bunmei No Kaiyo-shikan [A Maritime View of Civilization]. Chuokoron-Shinsha, Chuo. (In Japanese)

[12] Mabuchi, M. (2016) Wa no Kuni·Nihon no Minshushugi [Harmonious Country Japanese Democratic Style]. Best Sellers, Tokyo. (In Japanese)

[13] Chenoweth, E. (2021) Civil Resistance—What Everyone Needs to Know. Oxford University Press, Oxford.

[14] https://coralcap.co/2020/08/nuclear-fusion/

[15] Ishimure, M. (1969) Kugaijyoudo—Waga Minamatabyou [Paradise in the Sea of Sorrow: Our Minamata Disease]. Kodansha, Tokyo. (In Japanese)

[16] https://www.jstage.jst.go.jp/article/swsj1965/55/3/55_130/_pdf/-char/ja

[17] http://210.131.8.16/works/public/josei/data/18/08.pdf

[18] Maeno, N. (2006) Shinpan: Kori no Kagaku [New Edition: Science of Ice]. Hokkaido University Press, Hokkaido. (In Japanese)

[19] Washida, K. (1991) "Matsu" to iu koto [To Say "Waiting"]. Kadokawa Sensho, Tokyo. (In Japanese)

[20] Karatani, K. (2022) Chikara to Koukan Youshiki [Power and Modes of Exchange]. Iwanami Shoten, Tokyo. (In Japanese)

[21] Carson, R.L. (1956) The Sense of Wonder: A Celebration of Nature for Parents and Children. Harper & Row, New York.

[22] Fukuoka, S. (2023) Douteki Heikou 3 [Dynamic Equilibrium 3]. Shogakukan, Tokyo, 9-39. (In Japanese)

[23] Shirakawa, H. (2020) Shizen ni Manabu [Learn from Nature]. Hozokan, Kyoto. (In Japanese)

[24] Morita, M. (2019) Suugaku no Okurimono [A Present of a Mathematics]. Mishima-Sha Publishing Co., Mishima-Sha, 84-92. (In Japanese)

[25] Kang, S.J. (2022) Ikiru imi [Meaning of Life]. Mainichi Shimbun Publishing Inc., Tokyo, 116-120. (In Japanese)

[26] Kant, I. (1795) Zum Ewigen Frieden—Ein philosophischer Entwurf. Hofenberg, Berlin.

[27] Hiratsuka, A. and Imamura, A. (2020) Study on Reduction of Mixed Water Salinity by Sound Wave. *Journal of Water Resource and Protection*, **12**, 155-170. https://doi.org/10.4236/jwarp.2020.122010

[28] Hiratsuka, A. and Yasuda, Y. (2021) Study on the Possibility of Mixed Water as a Drinking Water—From the Viewpoint of the Formation of Hydrogen-Rich Water. *Journal of Water Resource and Protection*, **13**, 44-73. https://doi.org/10.4236/jwarp.2021.131004

[29] Yuki, M. (2023) Bungaku ha Chikyu o Souzou suru—Ecocriticism no Chosen [Literature Imagines the Earth—Challenge of Ecocriticism]. Iwanami Shoten, Tokyo. (In Japanase)

[30] Murayama, H. (2021) Uchuu wa Naze Utsukushiinoka [Why Is the Universe Beautiful?]. Gentosha Shinsho, Tokyo. (In Japanese)

[31] Atkins, P. and de Paula, J. (2010) Physical Chemistry. 9th Edition, W. H. Freeman, New York.

[32] Hirayama, N. (2022) Shintei-ban: Ankishinai de Kagaku-Nyumon [New Edition:

Introduction to Chemistry without Memorization]. Kodansha Ltd., Tokyo. (In Japanese)

[33] https://ja.wikipedia.org/wiki/

[34] Maeno, N. (2012) Ice Makes the World Go Around. Fukuinkan Shoten Publishers, Inc., Tokyo. (In Japanese)

[35] Kimura, I. (2018) Kiseki o Okosu Kinton Kaisui-Ryouhou no Subete [All of Quinton Marine Therapy to Make Miracles]. Hikaruland, Tokyo. (In Japanese)

[36] Tushima, K., *et al.* (2013) Possibility of Glaciological Technology for Treatment of Radioactive Contaminated Water. *JSSI & JSSE Joint Conference*-2013 *in Kitami*, Kitami, 17-21 September 2013, 1. (In Japanese) https://www.jstage.jst.go.jp/article/jcsir/2013/0/2013_143/_pdf/-char/ja

[37] Su, Y., *et al.* (2022) Separating Water Isotopologues Using Diffusion-Regulatory Porous Materials. *Nature*, **611**, 289-294. https://doi.org/10.1038/s41586-022-05310-y