

# Study on the Possibility of Raw Seawater into Beverage

## —Using Ethanol as a Renewable Resource

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### Abstract

In COVID-19 pandemic in the world, alcohol (ethanol) can be listed as a sterilizing disinfectant. It absolutely played a Messianic function on the sterilization effect. And it is said that it has one more function called “salinity reduction” but that function is not widely known. The two functions (Sterilization & Salinity Reduction) mentioned above are extremely important regarding the theme of “raw seawater into beverage” in this study. It is thought that if the two functions are achieved other water quality items such as  $\text{NO}_2^-$  and other items can be cleared with comparative ease. To put briefly the feature of modern waterworks in a word, it can be said that “source of water is river water and its sterilization is chlorine”. In this study, we set up it with a completely new sanitization method (great reset), that is, “source of water is mixtures (seawater and rainwater) and its sterilization is ethanol”. And it can be also expected that the capture and storage of ethanol as a renewable resource is basically possible by utilizing sunlight as a natural power. Therefore, we think 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. Based on the viewpoint mentioned above, we examined the possibility of raw seawater into beverage using ethanol as a renewable resource to create humankind’s wisdom to the settlement (breakthrough) of the water scarcity in the world including Asia and Africa. As a result, we have obtained the new findings that suggest the possibility of raw seawater into beverage using ethanol as a renewable resource.

### Keywords

Raw Seawater, Beverage, Ethanol, Renewable Resource, Great Reset

## 1. Introduction

At present, one of the most important issues is a beverage issue in consideration of the “water scarcity” for humankind. The developments in technology have made it possible to have the safe beverage. However, at the same time, they have destroyed the natural environment. And these developments have been bringing about rises in the standard of living for women and children who have been responsible for securing the water as a subsistence one. However, it does not mean that one can obtain easily the safe water in many countries and regions. Goal 6 (Clean Water and Sanitation) in SDGs [1] has been set out to obtain the safe “drinking water” cheaply for people all over the world. From the viewpoint of “the water of life”, this goal is actually a very important issue affecting many other SDGs such as goal 5 (Gender Equality), goal 4 (Quality Education) and goal 3 (Good health and Well-Being). The conservation of the waters (“rainwater” and “seawater”) which are origins of “the water of life” which has not been done in nature (ecosystem) on the earth is important in order to ensure the safe drinking water. Therefore, we need to aim for the sustainable style among the natural environment and its development. On the other hand, clean water and sanitation as an infection control which prevents a pandemic due to the coronavirus infection, etc. are also becoming important.

As “the water scarcity problem” is directly concerned with people’s lives in the world, it ought to be essentially treated as a matter of public commons. Only for the wealthy countries and people it should never be something to enjoy. If we think of it on a global scale, the water (“rainwater and seawater”) as a circulative resource has abundantly existed at earth’s surface for the mass of about 4 billion years. At present, it has been seriously recognized that the COVID-19 pandemic is closely related to many environmental issues and also the establishment of a sustainable society in the future. And the most remarkable one in global risk that threatens the world is the water issue. It can be said that this issue exactly suggests the importance of the viewpoint not “with corona” but “with human beings”. That means “Risk  $\leq$  One’s viewpoint < Crisis”.

There does not exist an owner in the life as a natural environment. The water is also common, and the owner does not inherently exist. That means that we must take great care of nature, for it is the common property of all mankind. Therefore, it is necessary for us to have a better “illusion” in the world to cope with this problem. That is, life is not one’s possession. It is necessary to capture it from a perspective of “stewardship” that human beings are in charge of conserving all the creatures. Metaphorically speaking, it could be said that “we are living in a rented apartment named the planet earth as a tenant” (Kenyan proverb). This way of thinking can be practically applied to thinking about water scarcity. Only for the wealthy countries and people, this way of thinking should be never shared in the benefit.

By the way, the complaints of the enormous damages have been happening one after another from the developing countries at the UK hosted the 26<sup>th</sup> UN

Climate Change Conference of the Parties (COP26) in Glasgow on 31 October-13 November 2021 [2]. Maldives consisting of the small islands expressed a sense of impending crisis because this country is submerged by the rise of the sea levels. And the battle of the water resources has occurred in Kenya in which the effects of the drought are recently serious.

Prof. Manabe S. (Nobel Prize Winner in Physics 2021) has warned against Global warming that the growing divide of the water resources becomes extremely a serious adversity at Nobel Prize lecture, “Physical Modeling of Earth’s Climate” Dec. 8, 2021. That is, he has warned that as the amount of moisture evaporation increases with the increase of the greenhouse gas, the drought can easily occur on the parched land. On the other hand, a flood can easily occur on wet land [3].

Looking at the present situation (ratio) in which the access to safe drinking water is assured, the ratio in Kenya is 27%, and that in Taiwan, China as an island having various water environments is unknown [4]. It is thought that this value may be closely tied to the cultural issues concerning “water”. Therefore, when thinking about “The water of life” as global commons in this article, we first examine the culture concerning the “water” (giving significance to the water by the people). Taiwan, China in which numerous water storage tanks have been traditionally installed on rooftops of buildings, etc. so far is picked up here as an example. Incidentally, it is anyway fundamental to store the “water” in many countries and regions (including isolated islands) that have been facing water scarcity around the world. As mentioned above, in Taiwan, China, the tap water sent from the public works bureau of water has once been stored in the storage tank on rooftop of the building, etc. and then used as domestic water (including drinking water) for quite a long time ago. And at countryside areas in Kenya, the rainwater has once been traditionally stored in the storage tanks (wells, etc.) and after purifying it the water can be used as domestic water (including drinking water).

However, there is a problem with them, too. One of the biggest problems is a deterioration of water quality (including the increase of chlorine concentration) due to the degradation of the “pipes” and “wells” which supply the water for daily life. This problem is directly connected to the issue of “cost”. Therefore, it becomes a matter of life and death for especially developing countries. Accordingly, the concerned persons have been researching the ideal way of “storage of water”. They do depend on the “pipes” and “wells” in the countries and regions with water scarcity.

We consider that one of the answers to this unlearning is “The Possibility of Raw Seawater into Beverage—Using Ethanol as a Renewable Resource”. To put the feature of modern water supply system in one word, the points are consolidated into two basic stances in the following. That is, the resource of the water is intaking from “river water” and the sterilization is disinfecting water with “chlorine”. In this study, we greatly reset the system to a new face in the following.

That is, the resource of the water is intaking from “seawater and rainwater” and the sterilization is disinfecting water with “ethanol”. In addition, storing the rainwater is also one of the most important keywords in this study. Therefore, the practical use of the numerous water storage tanks becomes effective in actual operation in Taiwan, China. Although tens of thousands of water storage tanks have been probably installed on the rooftop of the building, etc. so far in Taiwan, China, we think that it is important to divert the installation of the storing in the tank (rounded stainless steel at rooftop) of “tap water” to the same tank of “rainwater”. On the other hand, in Kenya, the change from the storing in the tank (tube well at underground) of “rainwater” to the tank (rounded one at rooftop) of “rainwater” will be required.

Based on the culture concerning water mentioned above, in this study, we will examine the possibility of raw seawater into beverage using ethanol as a renewable resource to open up a road to resolution (breakthrough) of the water scarcity issue in the world including Asia and Africa.

## **2. Water Situation in Taiwan, China in Terms of a Historical Perspective—Centering on the Viewpoint of “Drinking Water”**

First of all, we express a history briefly. This is classified as one’s view (historical view). Therefore, we cannot avoid the interpretation issue. However, this field is one of the most important academic ones that are officially accepted in the humanities. For example, even oral history has currently become an international movement in historical research [5] [6].

By the way, there is a book named “Kankyo no Kaishakugaku (Hermeneutics of the Environment)” in Japan [7]. We consider that this suggests that the stance (Homo Environmentics) to continue to ask the meaning of “fact” and “truth” in an environmental field at any time is very important [8]. The tap water in a water tank meets standards on the safe drinking level [9]. That is, it is at least possible to drink the tap water at the point of water purification in Taiwan, China at the point of water purification plant. However, there were many people saying that we cannot drink it as is.

Regarding this, there is a little different viewpoint in the situation between Japan and Taiwan, China. Japan has a drinking water standard as tap water. It is said that the Japanese standard is the strictest in the world. However, many Japanese people do not actively accept it, probably because they are reluctant to drink tap water containing chlorine.

It is said that as the above-mentioned verbal evidence regarding the facilities, the large-scale water and sewage system was laid earlier than Tokyo at that time. When it comes to the water works, a huge amount of the water tanks have been laid on the rooftops of not only detached houses but the buildings or apartments, etc. in Taiwan, China. It has become iconic scenery nowadays. However, it is said that the reason why the water tanks have been used is unclear. One

thing they say for sure is that as they made buildings high in Taiwan, China, especially Taipei they had no choice but to set up the water tanks. That is based on the weakness of supply pressure of the tap water from the waterworks bureau along with the measures of the water scarcity.

In addition to that, as is commonly said, Taiwan, China has a number of earthquakes hit and geographically contains more ups and downs on the whole. And the tap water is supplied to the districts with many hills such as Keelung using pressure. As above-mentioned, the buildings are getting higher in Taipei, etc. with the times. Then, the supply pressure of the tap water supplied by the waterworks bureau is weak, and it is difficult to supply it instantly to the upper floors of the buildings. It is therefore said that they needed to install the water tanks on the rooftops of the buildings, etc. and the tap water is pumped up from the pumping-up pump, and the water is put in the tanks. The situation is almost the same as Japan. In Taiwan, China, the rounded stainless steel tanks are set up in an exposed manner on the rooftops of the buildings, etc. We exactly do not know why the water tanks are set up in an exposed manner.

The following are the four general points on that.

**1) In Taiwan, China, the people do not really have a culture of drinking the tap water supplied from the water pipe.**

First, what can be seen from the viewpoint of the drinking is the drinking culture, that is, the relevance between both the climate (geographical location) and the culture that rejects [alleviates] the heat.

They had drunk the “Herbal Juice” containing the traditional Chinese medicine. The ingredients of the tea include several kinds of medicinal herbs which have the antipyretic action (Releasing the heat in the body). As Taiwan, China is a place with high temperature and humidity in summer, it tires them out. Therefore, the juice is drunk to compensate (mitigate) it as an effective drink. It seems that the various kinds of juices based on the efficacy (cold prevention, normalization of gastrointestinal function, improvement of sleep, etc.) had been sold at the specialty stores of it.

The several indigenous drinks have been developed. It is said that quite a bit of tea made from the guava leaves had been drunk. After World War II (1945~), it seems that they have drunk what was made by squeezing the sugar cane (only one species of brown). Because sugar is the best ingredient to regain one’s health, in this era, the unboiled water had been recognized as an undrinkable one in Taiwan, China. Then, it seems that the sugar cane juice developed from the sugar cane farming which had been established by the incorporation of early capitalism had been drunk.

Given these trends, the cider (carbonated drink) was imported from Japan in 1925. However, it was not almost spreading because of a high class item. In the 1960s, the beverages as industrial goods such as vegetable juice, fruit juice, Coca-Cola, Pepsi-Cola, mix fruit juice, etc. have appeared in the beverage market. And in the late 1980s, the demands for the natural water, distilled water and

health drink have expanded due to the progress of the environmental pollution. The agriculture (production of tea leaves) had been declined due to the expanding of the beverages developed by the industrial means, and the traditional tea drinking culture was forced to decline by the modernization [10] [11].

Therefore, it seems that the unbalance between “traditional knowledge (wisdom)” and “modern knowledge” is one of the causes of the “struggle for the water resources”. This is why the real interaction between the two is required.

Next is the environment of the land, that is, the relevance between the geological features and the culture under which hard water is rejected [12].

In general, the water quality depends on the detention time for which the precipitation (rainfall, etc.) flows over the land. The longer the detention is, the more the quantity of the minerals (Magnesium and Calcium, etc.) becomes increases even in the water of the same area, *i.e.*, the water becomes the hard one. On the contrary, the shorter the detention is, the more that of the minerals decreases, *i.e.*, the water becomes the soft water. Thus, the hardness of the river water flowing over the land is closely related to the geological features and the ground-waterway. It is thought from this point of view that one of the reasons why the culture of drinking the tap water has not been nurtured by the residents is the hard water which is necessarily connected with the geological features in Taiwan, China. However, we consider that the circumstance which could also say a culture that hard water is rejected is found universally in the world.

Here, we would like to see the hardness of the tap water in some countries [13] [14]. In Japan, Okinawa ringed with coral reefs is the medium hard water (84 mg/L) and the Kanto loam area that consists of the volcanic ash containing the calcium carbonate, etc. is also the medium hard one (75 - 100 mg/L) due to the accumulation of the mineral components. However, except those areas, Japan is not the area containing a lot of the limestone, and there are many volcanic strata with both low density and high permeability. And then, the river flows into the sea in an instant because of the narrow plot of land and the short river with the steep grade. From the reasons mentioned above, Japan is regarded as a country with soft water (50 - 60 mg/L) that does not involve many minerals.

In Europe, there are many strata consisting of the limestone including much calcium, and then the minerals are accumulated in the water. And the detention time is long because of the large land. Then the water in Europe becomes that with high hardness (hard water) in which many minerals are dissolved. Therefore, it is understood that the hard water (220 mg/L) flows in London, the capital of the United Kingdom. However, the UK is also a country where the soft water comes out, which is unusual in Europe. For example, the “soft water” is flowing in the areas such as the northernmost Scotland (22 mg/L), Edinburgh, the capital of Scotland (35 mg/L), and the northwest Cumbria (27 mg/L), etc.

In the USA, this country seems to be a country of “hard water” because of the large area of land just like Europe. To be sure, Las Vegas in the western part, Nevada is 400 mg/L (super hard water), Chicago in the central part, Illinois, is

120 mg/L (hard water), and Washington in the eastern part, capital of the USA, is 110 mg/L (medium hard water), respectively. However, there is an area of “soft water” in some areas. The major examples are Northeast New York (30 mg/L) and West coast San Francisco, California (55 mg/L). The area where soft water comes out seems to be the stratum that does not contain lots of minerals in a coastal region.

In Kenya, there are also regional differences. The “Soft water” is drinkable in the south region benefiting from the abundant water of Mt. Kenya which is located in about 120 km north of Nairobi, capital of Kenya. For examples, Nairobi is 20 mg/L (Soft water), and Masai Mara is 50 mg/L (Soft water), respectively. On the other hand, even in the same southern region, there are also the regions having a high hardness. Amboseli is 110 mg/L (Medium hard water) and Namanga is 150 mg/L (Hard water). And Naivasha 2 in the southwest is also 220 mg/L (Hard water) because of the region having a lot of lime. Thus, the hard water areas having a lot of lime can be seen in the southwest region. It is said that as this is the hard water, it is better to boil the water when drinking it.

By the way, the water source and the geological features have a significant influence on the water quality in Taiwan, China. The southern region (Chiayi, Tainan, Kaohsiung) is 120 - 230 mg/L (Hard water - Super hard water), and the eastern region (Hualien, Taitung, Ilan) is 64 - 240 mg/L (Medium hard water - Super hard water). These areas have very high hardness. And the central region (Taichung, Chunghua, Nantou) is slightly lower than the southern one, *i.e.*, 100 - 150 mg/L (Medium hard water - Hard water). That is, the southern and western regions have the value of the high hardness (Hard water - Super hard water). The northern region (Taipei, Keelung) except for the areas mentioned above is 35 - 43 mg/L, and this region becomes the only “soft water” area in Taiwan, China.

Summarizing the above, the water quality on the hardness in the river is divided into two parts, *i.e.*, “Soft water” and “Hard water” depending on the area in the world. This is because the amount of the minerals (Mg and Ca, etc.) included in the water varies from region to region. Therefore, it follows that Japan is a country having many soft water areas.

By the way, it is considered that the magnesium ion ( $Mg^{2+}$ ) in the “Hard water” combines with the water in the intestinal tract, and then the absorption of water is obstructed. Therefore, if people drink a lot of “hard water”, the diarrhea (stomach ache) may sometimes happen. For example, if the people who are familiar with the soft water (50 mg/L) drink suddenly the hard water (220 mg/L) in a country with high hardness, they will be suffering from diarrhea until getting used to that. One of the ways to convert the hard water into the soft one is “boiling”. This is the way to sediment and remove the minerals included in the hard water by boiling it. This one is possible if the degree of the hard water is low. However, when the hardness gets extremely high, the boiling time for more than 30 minutes is needed. If considering the time savings, an apparatus called

“water softener (technological capability)” is currently required. However, it costs us too much money (Ex: three hundred-thousand-JPY/KES [domestic version]).

Therefore, it is thought from the view point mentioned above that the state of the “Hard water” has exactly nurtured the culture under which the hard one is rejected, *i.e.*, Cold water = Unboiled water (tap water) = Risky in Taiwan, China. Under these circumstances of the quality (Hard water/Soft water) of the source water in the world, the modernization of the water supply system in which the water flows from the source of a river starts centering on the Europe and the United States in the 18<sup>th</sup> century. And the early modern and modern water supply systems (Slow sand filtration → Rapid sand filtration → Advanced water purification method) might have been engraved in a long modernization history of over 200 years with unceasing effort using one’s enormous wealth and combining the best technologies until today.

However, ironically, it seems that it is not actually like that people drink positively the tap water in the world. It is thought that one of the causes is an excessive dependence on technology for the water purification. This is a matter of “the essence of one’s humanness” as humankind has survived using the “technology” and “culture” until now. Therefore, it is thought that making the river water a source of water is to be an underlying cause of the culture under which hard water has been rejected (Beverage Culture). Then the various kinds of technologies to purify the water quality (water purification technology) have been developed for that so far. However, it is thought that the users have examined it under their sense of values of three factors, *i.e.*, benefit, risk and the cost as if they were to be opponent. As a result, they finally made “the choice (a fusion of culture and technology)” that “Not drinking tap water” is really smart.

## **2) The water in Taiwan, China has a high hardness [15].**

As mentioned above, we confirmed the hardness in several countries and regions. The water in Taiwan, China had a high hardness.

By the way, the general hardness (USA Standard) is as follows. Soft water: 0 - 60 (mg/L), Medium-soft water (Medium-hard water): 61 - 120 (mg/L), Hard water: 121 - 180 (mg/L) and Super-hard water:  $\geq 181$  (mg/L). The hardness of the water in Japan is soft water ( $\leq 120$  mg/L) in whole. However, that of the water in Taiwan, China from a regional perspective is as follows. The northern part is: Soft water - Hard water [80 - 160 (mg/L)] (Especially Taipei: Soft water [35 mg/L]), the central part: Hard water - Super-hard water [160 - 300 mg/L], the southern and eastern parts: Super-hard water with more than 300 mg/L. Especially, around Kaohsiung at the southern part of Taiwan, China that of the water is the highest (600 - 700 mg/L). In addition, the water quality standard on “hardness” in Taiwan, China is less than 300 mg/L. In relation to this, the hardness in mainland China is 360 mg/L. This value is exceeding Taiwan, China’s standard (300 mg/L). This means Super-hard water. “Super-hard water” contains a lot of magnesium which has a laxative effect. If people had too much wa-



ter and one's stomach does not feel too well. Then, it is, in general, said that this is not very suitable for drinking.

We utilize the "rainwater" as one of the mixtures we are proposing this time. As is well-known, the value of hardness (Quantity of Mg and Ca) of the rainwater is very low, and it is about one-twentieth ( $\approx 3$  mg/L) of that of the Tokyo's tap water ( $\approx 60$  mg/L). In comparison with the mineral water (Evian [304 mg/L]) which is famous for hard water the value of hardness of the rainwater is about one-hundredth ( $\approx 3.04$  mg/L). This means "Super-soft water". On the other hand, in general, Mg in the seawater is about 1300 mg/L, and Ca, about 400 mg/L. This means that those values are relatively large in quantity. Therefore, as we are mixing seawater and rainwater to make the mixtures, it is thought that when utilizing it the mixtures' hardness settles down to the suitable one. In an experimental example of the mixtures we tried this time (Volume Ratio  $\rightarrow$  6 (EtOH): 4 (SW)), the values (Soft water) such as Mg:  $\leq 5$  mg/L, and Ca:  $\leq 5$  mg/L are obtained, respectively. That means "Soft water". In addition, in an experiment on mixed water (Volume Ratio  $\rightarrow$  1 (RW): 1 (SW)) in our previous paper [16], the values (Soft water) such as Mg: 0.03 mg/L (estimated), and Ca: 0.4 mg/L (estimated) were obtained, respectively.

### **3) Deterioration (worsening) of the tap water pipes which are buried under the ground.**

As mentioned above, Taiwan, China has many earthquakes and the rough undulating landscapes. For example, in 921 huge earthquake in 1999 (M: 7.6, This occurred at Nantou County Jiji, central part of Taiwan, China in 1999.), many water pipes have been damaged. The restoration work has been carried out, but they say that there are still many water pipes that leak. This seems to be connected to the poor hygiene of the tap water. And as mentioned above, the water pressure is important, but the damage of the pipes is ironically becoming more progressed due to that pressure itself. Moreover, the deterioration of the pipes is also necessarily connected to the increase of the chlorine concentration for disinfection.

In addition, this phenomenon is in general a common scene in developing countries [17] [18] [19] [20].

In connection with this, it is considered as a possibility in the near future that if the water pipes under the ground are gradually being broken, the water leakages occur. And the sediments are carried with the leakage of water. Due to that, big cavities are made in the ground. This is connected to the occurrence of the sinkholes. As a result, one day it suddenly collapses by the weight of the people and cars, etc. and leads up to the frequency of accidents.

### **4) Dirtying (poor hygiene) of the water tanks installed at houses and buildings**

As mentioned above, they are taking a way to install the water tanks on the rooftops of the buildings, etc. and the tap water is pumped up with the pumping-up pump, and the water was put in the tanks. After that the water is used for

domestic and commercial water (including drinking water). It is said that the drinking water standards were met, but it seems not many people clean their water tanks on closer inspection. And as is known, the water quality of tap water in the tank is getting worse as time proceeds. For example, the disinfection effect of the tap water which once entered to the water tank is wearing off even if the “chlorine” was thrown in the water the effect probably lasts from one to two days. Moreover, if the water source is river water it is also the cause of the occurrence of the putrid odor due to the remaining organic matter. Therefore, it is necessary to sterilize in boiling water (more than 5 minutes) when drinking the water like this. In relation to this, it is thought that if people use the ozone generator such as an ozone buster for disinfection one can drink the tap water without any problems. However, it will probably become costly to set up this buster.

As mentioned above, the tap water as a drinking water may not be appropriate emotionally for drinking water in the current way of using the tank. However, it is thought that if people use the tap water as domestic and commercial water such as facial wash, shower, laundry, dishwashing, tooth brushing and so on there are almost no problems. When looking at Taiwan, China’s water situation as mentioned above, it is thought that our research stance this time is the possibility of raw seawater which is used as beverage (including drinking water) of the mixtures (seawater and rainwater). That is, we are thinking no pipes in a fundamental manner. If we replace the stance with changing the content of the water tank from “storage of the tap water” to “storage of good quality rainwater”, it is possible to store the mixtures in the tank. By replacing the content with mixtures, it is not necessary to worry about the substantial water quality deterioration due to the worsening of the water pipes. And in general if people use the tap water, the water source is fundamentally “river water”. As a result, a smell of decay from bacteria resulting from the failure in hygiene control in the tank occurs. In case of using the “mixtures”, the users do not have to worry about the smell issue. In addition, the “rainwater” is originally pure water or distilled water, and the ethanol becomes a disinfectant instead of “chlorine”. Therefore, if the mixtures are used, an anxiety on the management of the water pipes and water tanks is basically no longer needed. Moreover, the installation of water purifier to remove the smell of decay is not needed. As a result, the cost-related worries are basically unnecessary.

It is thought that when looking at the viewpoints of the historical, cultural, geographical and technical situations, etc., in Taiwan, China the adoptability of this technique is quite possible. The issue regarding the “drinking water” is remaining. It is how the users balance out with three factors, *i.e.*, cost, risk (safety) and benefit. That is, it depends on a big issue called “user’s choice”.

By the way, Taiwan, China has a warm climate all year around. The northern part is a subtropical climate, and southern, a tropical one. The annual season is divided into two parts: a rainy and a dry one. The rainy season is from May to October, and the rainy one is from November to April, respectively. The average

annual temperature is 23°C. The annual precipitation, which is relatively large, is around 2200 mm (Japan: ≈1800 mm). The precipitation of the southern part is a little larger than that of the northern one from June to August, but except for these months that are relatively small. Especially, the precipitation as for the period from December to February is significantly low value and the amount is around 45 mm [21]. On the other hand, the climate in Kenya is an inland tropical one, and the average annual temperature is 20°C. The annual precipitation is around 630 mm. There is a big difference in rainfall between the dry area of the northern part where there is almost no rain and the western area where they have 1800 mm in rainfall [22].

Therefore, in the water scarcity regions in Taiwan (China), and Kenya, we consider that it is usually very important to store water by installing the “water storage tank” on the rooftop or around the building, etc. From the mentioned above, in Asia and Africa, it is thought that the sanitation (hygiene management) is not possible if humans do not understand the culture based on society, history, sense of value, etc. including the characteristics of the weather in each region and show empathy for the local residents. Therefore, we consider that imaging and creating a system that produces a new added value (benefit) in each region is very important regarding sanitation.

### 3. Ethanol as a Renewable Resource

To put the feature of modern waterworks in a word briefly, we have considered that “Source of water is river water and its sterilization is chlorine”. In this study, we set it up with a completely new sanitization method (Great Reset), that is, “Source of water is mixtures (seawater and rainwater) and its sterilization is ethanol”. And it can be also expected that the capture and storage of the ethanol as a renewable resource is basically possible by utilizing the sunlight as a natural power. Therefore, we think that this resolves itself into a question of the choice (sense of value/culture) of the users. It means how users finally balance out with three factors *i.e.*, cost, risk (safety) and benefit.

#### 3.1. Pros and Cons of Ethanol Viewed from the Viewpoint of Raw Seawater into Beverage

We here treat the possibility of raw seawater into beverage using ethanol as a renewable resource as a theme, so first of all, we think of the pros and cons of the ethanol in the following.

##### Pros

1) Because of the pandemic of the infectious disease which threatens human-kinds, it has been revealed that a proper concentration of ethanol (≈50% - 80%) has a disinfection effect, that is, coronavirus (SARS-CoV-2) can be destroyed by the ethanol [23].

2) The ethanol molecule has a structure that ethyl group  $\text{CH}_3\text{CH}_2-$  (hydrophobic) bonds with hydroxy group  $-\text{OH}$  (hydrophile). Therefore, when mixing the

ethanol with the seawater which has appropriate ratio, the salinity (NaCl) in the seawater separates and settles out. By utilizing the physical properties (separation and settling → removal), a diluted seawater (DSW) which has appropriate concentration (physiological saline:  $\leq 0.9\%$ ) and high beverage potential is obtained.

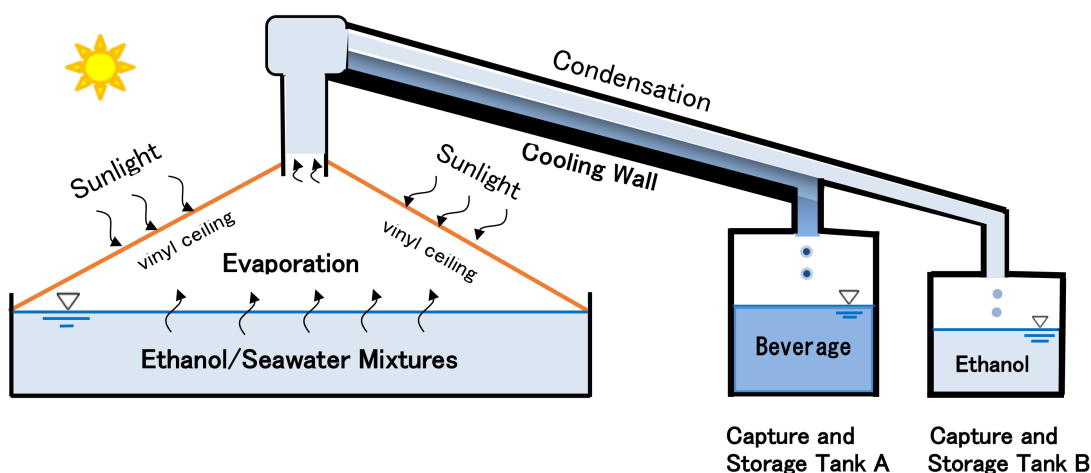
3) The ethanol is sufficiently affine with seawater which keeps basically good for any length of time because it is basically like pure water with low organic concentration. That is, two simultaneous effects, that is, the proper reduction of the salinity ( $\leq 0.9\%$ ) and the disinfection (sterilization) can be expected. It is said that General bacteria [24], Colitics Germ Logions [25], *Vibrio vulnificus* (Vv.) [26] and SARS-CoV-2 [27] can be die out and be inactivated. It is said that Vv. is the same bacteria belonging to Family Vibrionaseae as *Vibrio parahaemolyticus* and *Vibrio cholerae*, etc., and the ethanol has momentary sterilization ability against the bacteria of the Family one (food poisoning bacterium).

4) The used ethanol can be utilized as a renewable resource through the circulation by the distillation.

To accomplish this (capture and storage), we need a proper solar still. **Figure 1** shows an image of solar still to collect the ethanol and beverage as a renewable resource. By utilizing the solar still equipment, it is possible to separate the ethanol and beverage, respectively.

By the way, one of the key words is “evaporation”. The vapor pressure is a specific physical property of the substances, and is determined by the temperature. And that of the pure substance is approximated by the Clausius-Clapeyron equation. However, as this formula has several assumptions, it does not match well the experimental data. Therefore, the Antoine equation (empirical equation) with which the relatively wide-range pressures can be well expressed is commonly used for practical applications. The vapor pressure ( $p$ ) can be calculated by using the Antoine’s equation in which the temperature is abbreviated to  $T$  in the following.

$$\log_{10} p = A - B/T + C \quad (1)$$



**Figure 1.** Image of solar still to collect the ethanol and beverage.

where  $p$ : Vapor pressure;

$A, B, C$ : Antoine constant;

( $A$ : 1.07 KPa,  $B$ : 227.40 KPa,  $C$ : 30.85 KPa for water);

( $A$ : 1.08 KPa  $B$ : 213.14 KPa  $C$ : 30.23 KPa for ethanol);

$T$ : Temperature ( $^{\circ}\text{C}$ ).

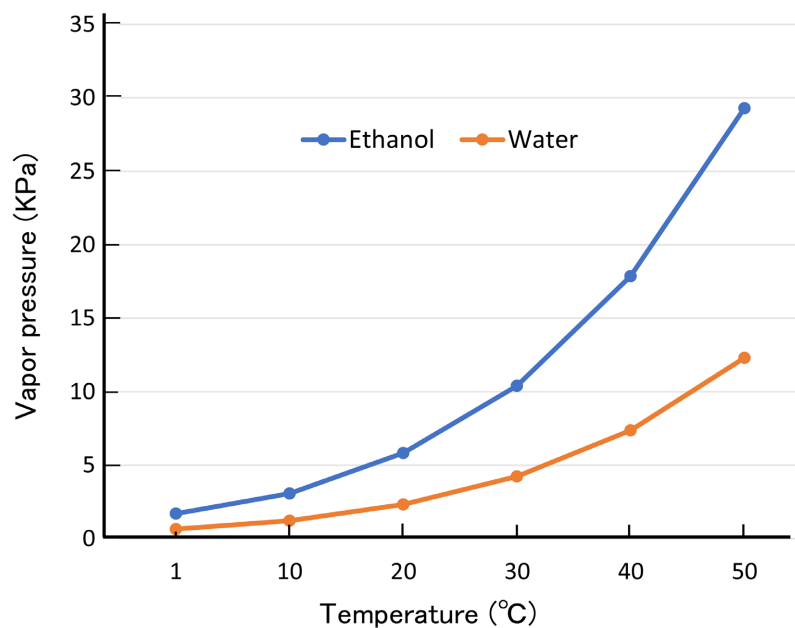
If it is the solution then the depression of the vapor pressure occurs. And this is approximated by Raoult's law.

We here see the evaporation speed between water and ethanol. Regarding this, it is said that the evaporation is almost proportional to the vapor pressure if each vapor is not completely contained in the phase (in the air). According to the Raoult's law, the values of the vapor pressures of ethanol and water at each temperature (1, 10, 20, 30, 40, 50 [ $^{\circ}\text{C}$ ]) calculated by Antoine equation (empirical formula) are 0.65, 1.22, 2.33, 4.23, 7.36, 12.30 [KPa] for water and 1.68, 3.07, 5.83, 10.40, 17.86, 29.33 [KPa] for ethanol, respectively. **Figure 2** shows the pressures of ethanol and water calculated by Antoine equation [28].

Therefore, if the rate on a weight basis held in solution at  $20^{\circ}\text{C}$  is 1:1, the vapor speed is also 5.83 (ethanol):2.33 (water) on the same condition. Therefore, the evaporation rate is different between the ethanol and the water, respectively.

It is understood from the above reasons that the evaporation speed of the ethanol is faster than that of the water under the sunlight (constant). That is, the vapor of the ethanol first seizes the upper part of the cooling wall, and after that that of the water seizes the lower one, respectively. As a result, the water is first stored to the capture and storage tank A through the cooling wall, and after that the ethanol is also stored to the tank B, respectively.

In addition, regarding the solar distillation, although the global warming issue is now featured in the world, the influence of the warming (or the cooling) is



**Figure 2.** Vapor pressures of ethanol and water calculated by Antoine equation.

basically unaffected as long as the sun has not disappeared if the planet earth will be changed to the cooling (world's average temperature is less than 10°C) in the future. This means that the winter in Japan comes early at present. Then although Kenya looks now like the land of endless summer, winter may come to Kenya in the future, too. Incidentally, it is said that the sunlight is based on the nuclear fusion reaction by gas called Hydrogen, and the reaction will last around five billion years. Now is the time of 4.6 billion years since Earth's formation.

5) As we mentioned in the previous paper [29], the merit of the hydrogen water is to remove the reactive oxygen (oxide stress) which is one of the causes of aging and disease [30]. Similar to the removal effect of reactive oxygen by the hydrogen water, It is similarly said that the ethanol has an effect which controls and removes the reactive oxygen which obstructs the human's lifespan [31].

6) Based on the evaporation due to the sunlight which is a natural resource, we can get the diluted seawater (DSW) [32] with appropriate salinity concentration (physiological saline:  $\leq 0.9\%$ ) and mineral balance for human beings. And an effect of the DSW will be expected as water for hydroponics (optimum salinity conc.:  $\approx 1\% - 2\%$ ) [33].

7) In a world where global warming is progressing faster than it was thought, we can now see a research to contribute the resolution of the world's food crisis by using the ethanol [31].

Therefore, we consider that the possibility to contribute the resolution of the world's food crisis can be also expected by using the DSW obtained by this method. We do not think that the merit mentioned above can be obtained by just only both the operation of the evaporation and the distillation.

### Cons

1) The existence of the amount of alcoholic beverage (conc.) and risks for health is mentioned as cons. There is a "dilution" as a solution to this issue. It is thought that the "rainwater" is one of the dilution mediums with affinity to that. As the rainwater is distilled water there are no difficult problems which are caused by using it. That is, the pure water or diluted water has basically a low organic concentration. So this will keep good fundamentally for any length of time. In a word, it is just a matter of "how to use". It is listed as an example that people do not basically use it for the first five minutes from the beginning of the rainfall because there may contain an organic matter which becomes a source of pollution during the initial stage of the rainfall. By the way, in the process of making the mixtures through the dilution by charging the rainwater, the nitrogen (N) component which is one of the air pollutants included in the rain is decreased depending on the area. We could say that this is merit by dilution.

2) However, on the other hand, the artificial rainmaking experimental methods such as a) silver iodide, b) dry ice, c) spray, d) liquid carbon dioxide have been actually developed and tried so far. The "silver iodide" which has been used in China out of four methods requires attention, because it has a trace of poison. Then a bad influence on the ecosystem due to it is now worried in the water environment. Incidentally, the issues such as cost-effectiveness, greenhouse gas,

problem of constraints, and changes in the distribution of rain frequency and intensity due to global warming, etc. have been pointed out as other pending issues regarding the four methods mentioned above [34].

3) By the way, there are several cases that can be received with “Pros” in the “Cons”. The first is a report that people can be reduced the possible risks of the ischemic heart disease (myocardial infarction, etc.) by drinking a small amount of alcohol [35]. The second is an advisory that alcoholic drinker can reduce the risk of dementia [36]. The third is as follows. That is, there is a possibility that a proper alcoholic beverage is good for the heart [37]. However, there is also a paper that points out the risk of a small amount of alcoholic beverage in a recent study [38] [39].

In short, it is wise to set a proper upper limit on one’s drinking capacity based on the latest research data. A recent report says that the risk does not particularly rise if one takes an amount of alcoholic beverage of less than 10 g/day [40]. And then, it is thought that there is no problem at all if we could clear the drinking water quality standards such as WHO, etc. We consider that it is fully possible to handle that using the current technology of high-efficiency water purification just in case the water quality issues occurred.

By the way, it is consistently assumed during modern times that the water source of the tap water is thoroughly river water. That is, after taking water from the river it is cleaned by the modern purification technology. And then people drink the purified water which filled the safety standards. Therefore, if the premise changes, the water quality standards of course will change. That is, there is a possibility that the current check items of the water quality will be decreased significantly. The water source is, so-called, the mixtures (seawater and rainwater) in the new attempt this time. And if the source water is the river water, the chlorine is used for the disinfection. But if the source is the mixture (seawater and rainwater), not the chlorine but the ethanol is used (we use not the chlorine but the ethanol) to disinfect it. That is, it can be said that the purification system will become a different form called “great reset”.

Therefore, based on the understanding of the relationship between benefit and risk of the ethanol, it is important to open up the way of the possibility of raw seawater into beverage connecting the three liquids such as seawater, rainwater and ethanol in a good manner. In addition, there are energy drinks containing the alcohol a little bit. Now they are being marketed in Japan. As some examples, there are products such as Tough-Man (0.84%), Lipovitan D (0.34%), Oronamin C (0.76%), Scup (1.06%). Furthermore, the major beer manufacturers in Japan are starting to put a great effort into the micro alcoholic beverages (less than 1% such as 0.7%, 0.5%, etc.) in recent years. It is like one of the turning points that an adverse effect on the health of a human body due to the alcohol came to be seen as a problem.

4) If seen globally, there are few researchers in the field of “induced seismicity” [41]. In the same way as this, there are few people who are engaged in the

field regarding the “study on the possibility of the seawater into beverage” from a viewpoint of their environmental thinking. We could point it out as one of the disadvantages. When we see current flowing from the viewpoint mentioned above, it is thought that the users should ultimately choose how they balance the three factors, *i.e.*, cost, risk (safety) and benefit. The “choice” mentioned here does not mean negative attitude such as “if anything A or B”. This is a word that shows one’s power of will opening the future resolutely. We use it as a word which replaces the great challenge that the human can do for the future.

### 3.2. Dilution of Ethanol Concentration

There are basically no problems with the diluted seawater (DSW) containing ethanol if drinking water quality standards (including salinity conc. and disinfection, etc.) are met and the usage is correct. However, if people are concerned about the concentration, some water is needed to dilute the ethanol. There is of course a tap water to dilute it. However, there are no problems in using the “rainwater” in the region where the waterworks facility is not satisfactory. Needless to say, the rainwater in general contains NO<sub>x</sub> (a generic term for the nitrogen oxides such as NO, NO<sub>2</sub>, NO<sub>3</sub>, N<sub>2</sub>O, N<sub>2</sub>O<sub>3</sub>, N<sub>2</sub>O<sub>4</sub>, N<sub>2</sub>O<sub>5</sub>, etc.) as air pollutants especially in urban areas. The NO<sub>x</sub> caused by the increase of nitrogen oxides due to human activities becomes the nitric acid (NO<sub>2</sub> and NO<sub>3</sub>, etc.) due to the influence of acidification of a portion of the atmosphere called troposphere. The nitric acid (NO<sub>2</sub> and NO<sub>3</sub>, etc.) blends into the rainwater and the acid rain (pH ≤ 5.6) occurs. The nitric acid is melted in the form of ions in the water.

In general, Cl<sup>-</sup>, Na<sup>+</sup>, etc. derived from sea salt particles are abundantly included in the ion component in the rainwater (including acid rain), and SO<sub>4</sub><sup>2-</sup>, NO<sub>2</sub><sup>-</sup>, NO<sub>3</sub><sup>-</sup> as other ion, etc. originated in air pollutants are also included in that. In addition to that, the ion concentration of the rainwater is affected by the amount of the precipitation [42]. Incidentally, looking at the recent data, the value of NO<sub>3</sub><sup>-</sup> is about 0.3 mg/L, and meets the water quality standard (10 mg/L). On the other hand, that of NO<sub>2</sub><sup>-</sup> is 0.05 mg/L and does not meet the standard (0.04 mg/L) [43]. Therefore, we pay attention to this point. However, fortunately, the elements such as N, O, Na, Cl existing in the rainwater and ethanol/seawater bring about chemical reactions by using the “rainwater” as diluted water.

By the way, it is said that there are two types of the formation reaction on the nitric acid (HNO<sub>3</sub>). That depends on the daytime and the night-time. One is a photochemical reaction in the day-time, the other, a chemical reaction with ozone in the night-time, and the reaction occurs mainly in the vapor phase [44]. N<sub>2</sub>O<sub>5</sub> (dinitrogen pentoxide) is an important compound generated in the process (N<sub>2</sub>O<sub>5</sub> + H<sub>2</sub>O → 2HNO<sub>3</sub>) of a chemical reaction of HNO<sub>3</sub> which occurs in the night-time outside. This is generated due to the chemical reaction between NO<sub>3</sub> and NO<sub>2</sub>, that is, NO<sub>3</sub> + NO<sub>2</sub> → N<sub>2</sub>O<sub>5</sub> [45]. When the salinity (NaCl) reacts to N<sub>2</sub>O<sub>5</sub>, the following reaction occurs [46].





In the above formula, [ClNO<sub>2</sub>] (Nitryl chloride) as the first term on the right hand of Equation (2) has been definitely regarded as a pollutant containing the nitrogen contaminants, that is, a pollutant that has been detected in the lower atmosphere [47]. However, this is dissipated into the atmosphere in gaseous form at standard conditions. And only NaNO<sub>2</sub> (Sodium nitrite) as the second term on the right hand of Equation (2) becomes a nitrate of Na, and remains in the ethanol/seawater in the form of ions (Na<sup>+</sup>, NO<sub>2</sub><sup>-</sup>). Therefore, the concentration of NO<sub>2</sub><sup>-</sup> is decreased by the contact with the salinity (NaCl) as a result. In connection with this, if the NO<sub>x</sub> is gradually decreasing with the spread of the electric vehicle (EV), etc, the reaction (circulation) is becoming weaker and weaker in the near future.

Incidentally, it is said that the main compositions of seawater viewed from the main ions are 11 kinds such as Cl<sup>-</sup>, Na<sup>+</sup>, SO<sub>4</sub><sup>2-</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>, K<sup>+</sup>, HCO<sub>3</sub><sup>2-</sup>, Br<sup>-</sup>, Sr<sup>2+</sup>, B<sub>3</sub><sup>+</sup>, F<sup>+</sup>, and they account for about 99.99% of all the contents (salinity: 3.5%) [48], and a lot of ions are contained little by little in the remaining ones (≈ 72 kinds [just under 0.01%]). Looking at N<sub>3</sub><sup>-</sup> of the Nitrogen (N), it is said that the concentration is 0.000872% and the content rate is about 0.026% [48]. From the mentioned above we understand that the component of Nitrogen (N) in the state of ion (N<sub>3</sub><sup>-</sup>) is extremely few in the seawater. As we confirmed earlier, this is possibly caused by the reaction between the temperature and the salinity in the seawater. In addition, looking at the origin of the word “thermohaline circulation”, “thermo” means a temperature, and “haline”, salinity, respectively, and the density of seawater is determined by the temperature and salinity.

Incidentally, the Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Physics 2021 to the three persons, that is, Manabe S. (Princeton University, USA, He is from Japan), Hasselmann K. (Max Plank Institute for Meteorology, Hamburg, Germany) and Parisi G. (Sapienza University of Rome, Italy). They won for their contribution to developing the climatic model that predicts definitely the global warming and so on. In connection to this, they say there is a possibility that the “thermohaline circulation” mentioned above is a trigger for the occurrence of cooling (Mean Temp: Go down 4°C), not warming in Europe in decades [49]. If so, it is thought that a possibility of correlation between global warming and thermohaline circulation comes out.

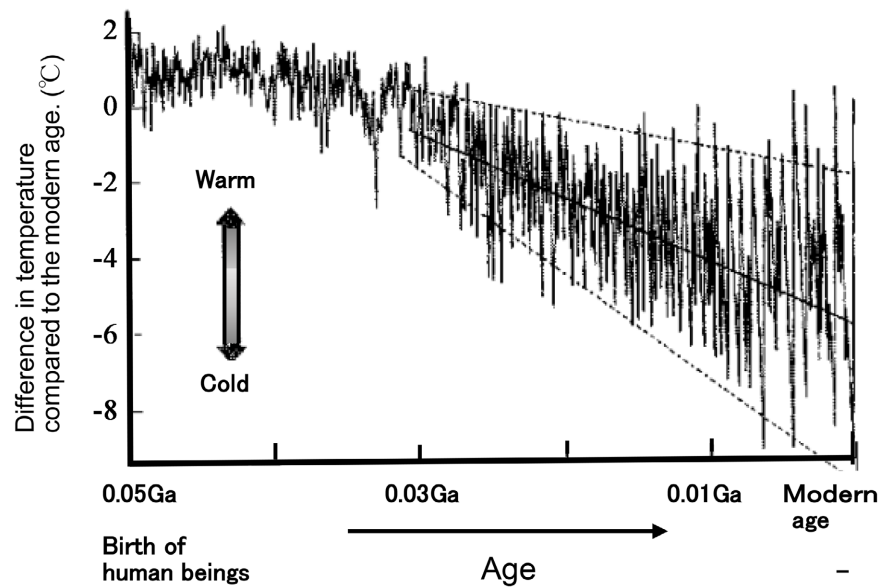
According to the sixth assessment report of the IPCC [50], the world’s mean air temperature is as of this moment rising 1.0 degree Celsius compared to before the Industrial Revolution, and it is said if the temperature rise continues at this pace, that will reach 1.5°C around 2040 years. Although it seems that the temperature rise of 1.5°C is not a big deal, that of the seawater is unbearably hot for creatures living in the sea. Figuratively speaking, it can be said that it is the same thing as the temperature of the bath. That is, if we make the temperature of around 41°C (optimum) 42.5°C (1.5°C rise), the bathing will be impossible because it is too hot. It is thought that if the factor of “thermohaline circulation” is

properly inserted into the climatic model Dr. Manabe (Nobel prize winner) *et al.* developed, the accuracy of global warming (cooling) prediction model, *i.e.*, coupling model between the ocean and the atmosphere) will be more increased.

By the way, the highest temperature was recorded at 35°C in Siberia due to the global warming in 2020. When permafrost in Siberia, etc. melts due to the warming a great amount of CO<sub>2</sub> is released. It is said that the temperature rises are explosively caused by that, and is also pointed out a possibility that the unknown viruses are released by that is also pointed out. Furthermore, as Prof. Dr. Shimamura, H. (geophysicist) who has served as president of the international society [41] pointed out, a possibility of the unexpected risks due to the “induced seismicity” is also considered. For example, the CO<sub>2</sub> which has been pressed into the underground so far has a possibility to cause “induced seismicity” newly by the technology called CCS (Carbon Capture and Storage) which has been used mainly in Europe and the United States since the 1990s for the purpose of decarbonization. Be that as it may, it is considered today that the cause of such a “global warming” is that the human kinds have drastically increased the CO<sub>2</sub>.

On the other hand, it is said that the warming occurs even in the natural system, too. In connection to this, Milankovitch, a geophysicist in Serbia has first pointed out that there exists a relationship between the earth’s orbit and the climate. This a theory with which the factors of the orbit and the climate are associated, and this one is called “Milankovitch cycle”. According to this theory, if one takes the long-range view that the earth has historical years of 4.6 billion since Earth’s formation, it is understood that the earth has repeated the warming and cooling every one hundred thousand years. Therefore, the problem is that the current speed of the warming at the present time (the latter half of the twentieth century, especially, about 1970~) is ten times faster than that of the natural one. As a result, the risk due to the frequent occurrence of the large scale disasters which have not been experienced so far on earth will be increased. Consequently, if one looks at this situation as a cycle of the nature from a higher perspective, one has adequately thought that the prediction that the Europe mentioned above is heading towards the cooling in decades (See **Figure 3**) [51].

In addition, we here would like to see about the sterilization effect of the salinity (NaCl). There is no chemical disinfectant in itself (NaCl). However, if the salinity contacts with the water (H<sub>2</sub>O), the osmotic pressure occurs to the microorganisms such as General Bacteria and Colitics Germ Logions that exist in the water. By the osmotic pressure, the decrease of the water comes from within the cell of the microorganisms. It is called water reduction by osmotic pressure. As a result, it is said that the bacteria, etc. become unable to grow and will gradually die out. And, the bound water can be obtained by the salinity. That means that the part of the free water combines with the salinity (NaCl). The trend of the “inactivation” increases by the decrease of the rate of the free water that is necessary for the activity of the microorganisms (bacteria, etc.) It is called the reduction of the water activity. As mentioned above, the salinity especially has



Source [51]: Nakagawa T. (2017) Jinrui to Kikou no Jyu-mannen shi (100 ka in History in Humankind and the climate), p. 32, Kodansha, Japan (with some additions).

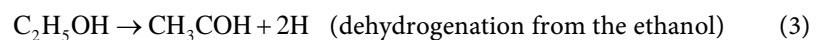
**Figure 3.** Climate Change of Last 5 Million Years (0.05 Ga).

property of the “osmotic pressure”. According to a research, it is said that the salinity concentration (0.1 wt% - 0.6 wt%) is almost proportional to the osmotic pressure (maximum osmotic-flow) [52]. It is considered from the reason mentioned above that there is a possibility that the “ethanol/seawater” is also effective as sterilization.

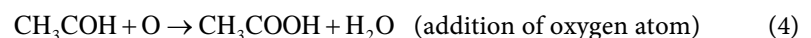
### 3.3. Oxidation of Ethanol

In general, it is said that when the ethanol is oxidized, the order of the chemical reactions is as follows, *i.e.*, ethanol → acetaldehyde → acetic acid. And then it is known that when the oxygen (O<sub>2</sub>) is supplied to the acetic acid it finally proceeds to the “CO<sub>2</sub> + H<sub>2</sub>O”. In addition, it is considered the reaction between the acetic acid and NaOH, that is, 1) sodium acetate + water and 2) sodium acetate + NaCl) in case of the seawater. The general chemical reactions are as follows [53].

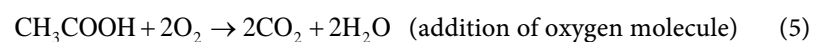
Ethanol → Acetaldehyde



Acetaldehyde → Acetic acid



Acetic acid → Carbon dioxide + Water



It is thought at the same time that the following reaction occurs in the reaction with sodium hydroxide (NaOH) in acetic acid because of the seawater [54].

Sodium hydroxide under acetic acid → Sodium acetate + Water



Furthermore, in the process of the reaction between the salinity concentration in each ratio under the mixtures (seawater and ethanol) it is thought that the reaction between the acetic acid and the salinity (NaCl) occurs in the form shown in Equation (7).

Sodium chloride under acetic acid  $\rightarrow \text{CH}_3\text{COONa} + \text{HCl} \uparrow$



The hydrochloric acid (HCl) is released to the outside of the solution in the form of the free of volatile acid. Therefore, only the sodium acetate ( $\text{CH}_3\text{COONa}$ ) remained. In addition, it is thought that there are no problems in the sodium acetate (light-colored) because it can be used as food additives.

## 4. Experimental

### 4.1. Experimental Procedure

In the previous paper (JWARP, 2021) [29], the mixed water less than 0.74% (blood concentration) has been prepared first, and then divided into five kinds of the mixing rate of mixed water. And we have compared them 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. As a result, we have obtained the new findings that suggest the possibility.

This time we have examined the possibility of raw 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, we mainly considered the next two factors as an important issue, *i.e.*, 1) Reduction of the salinity and 2) Sterilization of seawater. And, the residual ethanol concentration and nitrous acid concentration ( $\text{NO}_2^-$ ) were added in association with the two items. And we have compared and examined the characteristics of the seawater from the viewpoint of the relationship between a) Salinity Concentration, b) Effect of Sterilization (Ethanol + Rainwater), c) Residual Ethanol Concentration and d) Nitrous Acid Concentration ( $\text{NO}_2^-$ ) and examined the possibility of the raw seawater into a beverage using ethanol as a renewable resource.

### 4.2. Experimental Condition

This time, the experimental condition used in the previous paper (JWARP, 2020) [16] was basically followed. The 9 kinds of the ratio [V/V] of the “ethanol/seawater mixtures”(1: 9, 2:8, 3:7, 4:6, 5: 5, 6:4, 7:3, 8:2, 9:1) were set up and used in the experiment. In this experiment, the volume of the mixtures was 100 ml, the temperature, 26°C - 27°C and the humidity, 70% - 83%. We focus on the “sterilization” of the mixtures more in strong consciousness with/after the coro-

na (COVID-19) as a whole. 13 kinds of water quality items such as pH, Salinity,  $\text{NO}_2^-$ ,  $\text{NO}_2^-$  &  $\text{NO}_3^-$ , the number of General Bacteria, the number of Colitics Germ Logions, the number of *Vibrio vulnificus*, Bisphenol A, Hg, Cd, norovirus, 2019-nCoV, SARS-CoV, ERS-CoV, Sterilization(ethanol + rainwater) and “residual ethanol concentration” were selected as the analytical object items of the quality of the mixtures. This time, two kinds of the quality of the mixture items such as “the effect of sterilization (ethanol + rainwater)” and “residual ethanol concentration” were added. And like the last paper [29], the several water quality items were used as the reference values which have been published in the previous papers. And the rain water used in this experiment was sampled in August 14<sup>th</sup> at home (Sakyo ward) in Kyoto city, and the seawater, in July 17<sup>th</sup> at Awaji Island, Ikuha fishing port (Awaji city) in Hyogo Pref., Japan 2021, respectively. The reason why we sampled the rainwater in Kyoto, Japan is that this area forms a natural basin. So we can sample standard rainwater. On the other hand, the seawater in Awaji Island, Hyogo is sampled because is there are no factories nearby. So we can sample relatively clean seawater. Perhaps due to the “thermo-haline circulation” caused by global warming, the salinity concentration of this year was slightly low compared to that of the last year. And the selected sample has not represented the situation of the whole population clearly. In addition, this study was mainly carried out in July-August, 2021, in Kyoto, Japan.

### 4.3. Analytical Method of Water Quality

The way of our previous paper (JWARP, 2020) [16] is basically followed regarding the basic things on the water quality. In addition, this time Vv. and BPA were used as estimated values again. Furthermore, the seven items such as Hg, Cd and five items on the virus (norovirus, 2019-nCoV, SARS-CoV, MERS-CoV, Flu Virus) out of the new nine items were also used as estimated values again [24].

In addition, we conducted a measurement of magnesium (Mg) and calcium (Ca) at the volume ratio (6[EtOH]:4[SW]) as a confirmation of the hardness in this study. At this time, a simplified water inspection product called pack test was used.

## 5. Results and Discussions

In this study, the possibility of the creation of the beverage which includes 1) appropriate fresh water, 2) suitable salinity (NaCl) and 3) proper mineral was examined when based on the “ethanol” as a renewable resource. **Table 1** shows the result of mixing ration, salinity concentration, sterilization effect and residual ethanol concentration and so on of the ethanol/seawater mixtures.

We this time set the mixing ratio of the ethanol/seawater mixtures to nine kinds (9:1, 8:2, 7:3, 6:4, 5:5, 4:6, 3:7, 2:8, 1:9). The salinity concentration of the seawater used in the experiment is 2.4% (Initial Conc.). This one is a little low compared to the normal concentration of the seawater. It is thought that one of

**Table 1.** Mixing ratio, Salinity concentration, Sterilization effect and Residual ethanol concentration of Ethanol/Seawater Mixtures.

Mixing Ratio (EtOH:SW)*	Salinity Conc. (%) (Initial Conc.:2.4%)	Sterilization Effect	Approximate Conc. of Residual Ethanol (%) (Under Sunlight)	Approximate Time required for Evaporation (Boiling)	
				Sunlight** (day)	Heater (min.)
9:1	0.31	△	23	7	55
8:2	0.55	△	30	6	48
7:3	0.72	○	28	5	43
6:4	0.81	○	30 (35)	4.5	30
5:5	1.10	○	23	3	25
4:6	1.21	△	23	2.5	23
3:7	1.42	×	19	1.7	18
2:8	1.51	×	20	0.6	12
1:9	1.70	×	15	0.3	5

\*EtOH: Ethanol, SW: Sea Water; \*\*Measured values in daytime (except night-time). Seeing the mixing rate (6:4), the irradiation by the sunlight is somewhat lower than the heating using IH (Induction Heating) regarding the residual ethanol concentration. (35 → 30 [%]). It is thought that there may be some reaction between the ethanol/sea water mixtures and the evaporation in the night-days (≈10 hrs). Experimental period: Aug.-Sept., 2021).

the reasons is the influence of the thermohaline circulation (ocean general circulation on a global scale) which occurs in the mesopelagic zone (deeper than a few hundred meters) along with the recent global warming.

Needless to say, the check of the water quality is of course the most important thing. Other than that, there are three key points when thinking about the possibility of raw seawater into beverage using ethanol as a renewable resource. The first one is “Salinity concentration”, the second one is “Sterilization effect”, the last one is “residual ethanol concentration”. The most important one in the key points mentioned above will be an issue of “salinity concentration”.

Here we first take a look at the salinity (NaCl). The ethanol molecules have a structure that the ethyl group  $\text{CH}_3\text{CH}_2$  (hydrophobicity) has bonded with the hydroxy group -OH (hydrophilicity). Therefore, when we mix the ethanol with the seawater that has an appropriate mixing ratio, the salinity (NaCl) in the seawater separates and settles. By using the property (separate and settle → removal) we can obtain the seawater with a high possibility as a beverage and an appropriate salinity concentration (conc. of physiological salt solution:  $\leq 0.9\%$ ).

Incidentally, the salinity (NaCl) in the seawater exists divided into the ionic form such  $\text{Na}^+$  and  $\text{Cl}^-$ . This state is called “hydration”. This phenomenon oc-

curs because the water molecules have the polarity. When mixing the water with the ethanol that has the same polar molecules as the water, the hydroxyl (OH) bonds with the water molecules and separates the ions that exists around the water ones. In the process,  $\text{Na}^+$  and  $\text{Cl}^-$  (ions naked) bonds with other ions by the power of “static electricity”. As a result, the molecules of the sodium chloride (NaCl) occur. The molecules of NaCl bonds with multicore and gradually grows, and settles down in the visible shape (crystallization).

Regarding the “static electricity”, the origin of all the substances is “atom”, and it consists of the “atomic nucleus” with a positive charge and “electron” with a negative charge. When the electron is stripped off from the atom the positive-charged ion remains, and also the stripped electron is given to another atom, the negative ions are formed. Such those positive ions, negative ions or the electrons are the origin of the “static electricity”. However, the charges of positive and negative are balanced under normal conditions. And as they are becoming neutral as a whole, “static electricity” is invisible. However, when a biased charge is developed due to some sort of causes, the electrification of positive (+) and negative (-), they become visible from the outside. Such bad - balanced state is the one charged with “static electricity”. In order to break down the balance, it is necessary to move the electric charge to another place by unplugging it from somewhere. One of the measures used for that is a “contact (mixing)”.

Here we take a look at the chemical reaction (principle) when mixing the three substances, *i.e.*, water, sodium chloride (NaCl) and ethanol [55]. In general, sodium chloride (NaCl) dissolves well in water ( $\text{H}_2\text{O}$ ), but not in ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ). On the other hand, the benzoic acid ( $\text{C}_6\text{H}_5\text{COOH}$ ) does not dissolve in water ( $\text{H}_2\text{O}$ ), but dissolves well in ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ). This is because the water ( $\text{H}_2\text{O}$ ) is a molecule with a strong polarity. The polarity is the different property which corresponds to the both extremes along a certain direction. The ethanol also has the polarity a lot but, not so much as water. It means that the polarity separates into the electrification of positive (+) and negative (-) within the molecules. The water ( $\text{H}_2\text{O}$ ) binds with a hydroxyl group (OH), and the oxygen (O) acts on minus (-) charges of the static electricity and the hydrogen (H) on plus (+) charges of the static one.

The molecules bends into a folded-line shape (bond angle of water:  $104.5^\circ$ ). And the electrification of positive (+) and negative (-) of the hydroxyl group (OH) does not cancel each other out, and they seem to be a molecule which has the positive (+) and negative (-), *i.e.*, water molecules ( $\text{H}_2\text{O}$ ). At the same time, the ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) has the hydroxyl group (OH). However, as there is only one for size of the molecules, the polarity does not increase much. In addition, “electronegativity” that shows the spin polarization of electron (electronic pulling [polarity]) is as follows. That is, Carbon(C):  $\approx 2.5$ , Oxygen (O):  $\approx 3.5$ , Hydrogen (H):  $\approx 2.1$ . That is, the difference of the electronegativity between the carbon (C) and the oxygen (O) is around 1.0, and that of it between the oxygen (O) and the hydrogen (H) is around 1.4 respectively. Therefore, it is understood that the

electronic pulling (polarity) is made from the direction H toward the direction O. It seems that the dissolving of the NaCl in water occurs because the oxygen atom (O) of the water molecules ( $\text{H}_2\text{O}$ ) crowds round  $\text{Na}^+$ . On the contrary, it seems that the water molecules ( $\text{H}_2\text{O}$ ) crowds round  $\text{Cl}^-$ .

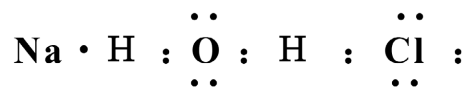
We here introduce “Lewis structure”. This is a diagram that shows the bonding between atoms of a molecule and the ion pairs of electrons that may exist in the molecule ( $\text{H}_2\text{O}$ ).

**Figure 4** shows the molecular structure using the Lewis structure regarding the mixtures of water ( $\text{H}_2\text{O}$ ) and salinity (NaCl).

Regarding the ethanol, as the electrification of positive (+) and negative (-) is very weak, the water can not sufficiently cling to the sodium chloride (NaCl). At this time, the sodium chloride (NaCl) is more comfortable for the remaining as crystallization than the dissolving out in the ethanol. Therefore, this is not soluble in ethanol. The structure of the water is very similar to that of the ethanol. That is, the water has a structure of the hydroxyl (-OH) [O charged to plus (+) and H to minus (-)]. As there is only one on the size of the water molecules, the polarity does not increase much as mentioned above. By the way, it is said that the water ( $\text{H}_2\text{O}$ ) is about 26 times as soluble as the sodium chloride. The interaction attracting each other works in the molecules of the polarity such as a sodium chloride (NaCl). Such interactions work like they bring together only the polar molecules and eliminate the non-polar ones. As a result, the polar compounds do not dissolve in the nonpolar solvent. However, the polar compounds like a sodium chloride (NaCl) are soluble in polar solvents like water. It is because they are able to get familiar with polar solvents which have the same property. The ethanol is bigger than the sodium chloride (NaCl exists in the forms of  $\text{Na}^+$  and  $\text{Cl}^-$  in the aqueous solution) regarding the strength of polarity. Therefore, it has a high affinity for the water molecules ( $\text{H}_2\text{O}$ ). Thus, the ethanol molecules ( $\text{C}_2\text{H}_5\text{OH}$ ) are more soluble in water than the sodium chloride (NaCl). And then, the ethanol molecules are soluble in water, and at this time, the function of the binding with the water molecules ( $\text{H}_2\text{O}$ ) stops. As a result, the only eliminated sodium chloride (NaCl) precipitates and deposits as crystallization.

**Figure 5** shows the molecular structure using the Lewis structure regarding the mixtures of water and ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ).

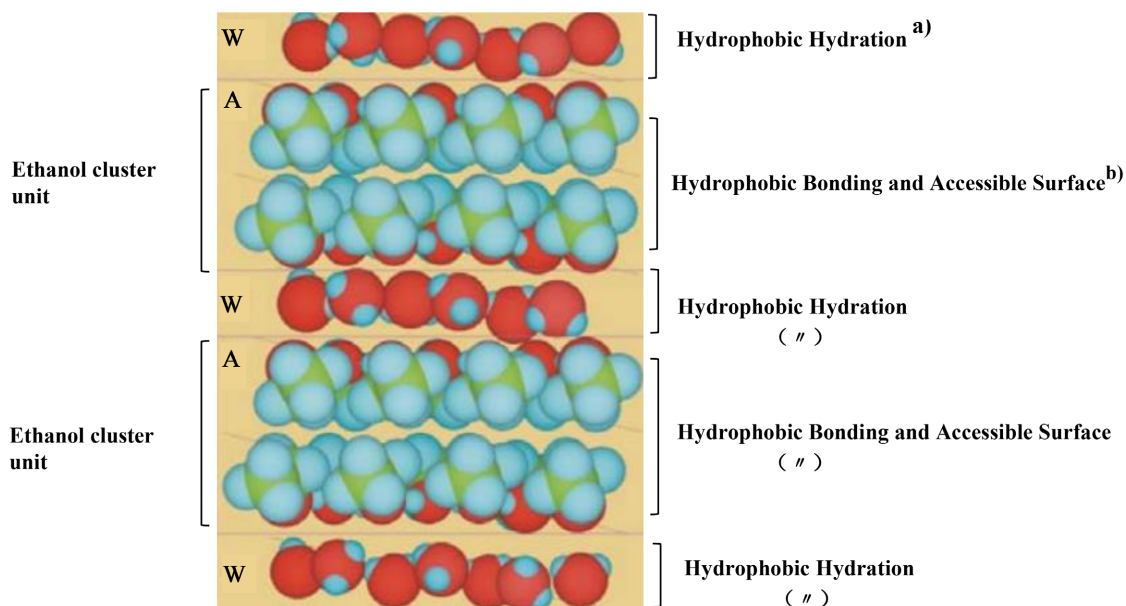
In general, the polar compound is easy to dissolve in polar solvents. As an example the ionic compounds are easily soluble in water (electrolyte), and they are also hard to dissolve in non-polar molecules. The non-polar molecules, etc. are easy to dissolve in the same kind of molecule (non-polar molecules). The oil is soluble in petrol, etc., but hard to dissolve in “water” with polar solubility. The



**Figure 4.** Molecular structure using the Lewis structure regarding the mixtures of water ( $\text{H}_2\text{O}$ ) and salinity (NaCl).







(Note A: Ethanol cluster W: Water Molecule)

Source: [57] N. Nishi, Bull. Cluster Sci. Tech., 2(1), 3-7 (1998) [Some information is added in the original figure].

**Figure 6.** Structure model of the ethanol water solution presented by Prof. Nishi.

Hydrophobic Bonding and Accessible Surface. That is, it can be seen in such a way that “Hydrophobic Hydration” → “Hydrophobic Bonding and Accessible Surface” → “Hydrophobic Hydration” → “Hydrophobic Bonding and Accessible Surface” → “Hydrophobic Hydration”, sequentially. And we also understand that the water molecules (H<sub>2</sub>O) [Hydrophobic Hydration] take the form of enclosing the outside of the ethanol cluster. By the way, it is thought that the water molecules (H<sub>2</sub>O) [Hydrophobic Hydration] has become more interactive than the normal water and that they are in a more structured state.

In addition, it is thought that the normal group of the water called the bulk water exists in the outside of the layer of the water which forms the hydrophobic hydration and that the amount are also increasing or decreasing according to the quantitative ratio of the water [56].

a) and b) in **Figure 6** are explained in the following. That is, a) shows that the water molecules (H<sub>2</sub>O) [Hydrophobic Hydration] take the form of enclosing the outside of the ethanol cluster, and when the water molecules contacts with the hydrophobic coupling surface, they have the property to gather each other to avoid it. And b) shows that the oxygen elements (O) [red] are located just only outside the ethanol cluster (C<sub>2</sub>H<sub>5</sub>OH) [yellow green-light blue], and the ethanol molecules meet each other by the hydrogen bonding. Furthermore, it becomes the state in which the structure was reinforced.

**Table 2** shows the result of the water quality of ethanol/seawater mixtures (ratio of the Mixtures [6:4]) as an appropriate example. This time we took up the 23 items as water quality check items. By the way, the cells that compose our body are nourished by the supply of the nutrients such as protein, lipid, carbohydrate,

**Table 2.** Result of the Water Quality of Ethanol/Seawater Mixtures [Ratio of the mixtures (6:4)].

Water quality Items	Measured value including estimated ones [29] [58]	WHO Standard (including proposal)	Judgement	Remarks
Na <sup>+</sup> (mg/L)	2900 (Estimated)	—	○	
Mg <sup>2+</sup> (mg/L)	1290 (Estimated)	—	○	
Ca <sup>2+</sup> (mg/L)	412 (Estimated)	—	○	
K <sup>+</sup> (mg/L)	399 (Estimated)	UnConfigured —	○	New
Sr <sup>2+</sup> (mg/L)	7.9 (Estimated)	UnConfigured —	○	New
Cd <sup>2+</sup> (ng/L)	0 - 82 (Estimated)	<3000	○	
Hg <sup>2+</sup> (ng/L)	0 - 16 (Estimated)	<500	○	
Br <sup>-</sup> (mg/L)	0.673 (Estimated)	≤2.4	○	
F <sup>-</sup> (mg/L)	0.013 (Estimated)	≤1.5	○	
pH	7.5	—	○	
Cl <sup>-</sup> (mg/L)	5200 (Estimated)	—	○	
TOC (mg/L)	1 - 7 (Estimated)	—	○	
NO <sub>2</sub> <sup>-</sup> (mg/L)	≈0	≤0.04	○	[provided] Rainwater addition
NO <sub>2</sub> <sup>-</sup> + NO <sub>3</sub> <sup>-</sup> (mg/L)	0.3	≤10	○	
No. of General Bacteria (CFU/mL)	13	≤100	○	
No. of Colitics Germ Logions (CFU/mL)	ND	ND	○	
No. of Vibrio vulnificus (CFU/mL)	0 - 100 (Estimated)	ND	○	
Bisphenol A (μg/L)	0.045 (Estimated)	125	○	
Norovirus (copy/L)	6 - 170 (Estimated)	ND	○	[provided] Ethanol addition Ref. [59]
SARS-CoV-2 (copy/L)	9 - 41 (Estimated)	ND	○	" Ref. [23]
SARS-CoV (copy/L)	"	ND	○	" Ref. [60]
MERS-CoV (copy/L)	"	ND	○	" Ref. [60]
Flu Virus (MPN/mL)	5 - 79 (Estimated)	ND	○	" Ref. [61]

vitamin and mineral. One of the nutrients is mineral and it is said that the minerals whose essentiality is proven as nutrients of the mammal are 22 kinds such as Na, K, Mg, Ca, P, Si, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Mo, Sn, I, Pb, F,

Rb. And, although the essentiality is not still proven, the ones that may be essential are 15 kinds such as Li, Be, B, Al, Ge, Br, Sr, Ag, Cd, Sb, Cs, Ba, W, Au, Hg. That is, 37 kinds of minerals are pointed out as the important ones [57]. Here we took up the 9 kinds such as  $\text{Na}^+$ ,  $\text{Mg}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ,  $\text{Sr}^{2+}$ ,  $\text{Br}^-$ ,  $\text{F}^-$ ,  $\text{Cd}^{2+}$ ,  $\text{Hg}^{2+}$  as major minerals included in the seawater [58]. In addition, the two literatures are used at base regarding the measured values in **Table 2** [29] [58]. Incidentally, when looking at the ratio of  $\text{Cl}^-$  (1.9354%) and  $\text{Na}^+$  (1.077%) which are the principal component ions, that becomes 1:0.56. Therefore, when looking at the ratio of 0.81% (4:6) of the salinity (NaCl) in the seawater, although it is presumed that the value of  $\text{Cl}^-$  is 0.52% (5200 mg/L) that of  $\text{Na}^+$  is 0.29% (2900 mg/L) respectively.

**Table 3** shows  $\text{NO}_2^-$ , residual ethanol concentration and salinity concentration at each volume of rainwater poured into the ethanol/seawater mixtures (Ratio 6:4). We put the rainwater (0 mL, 40 mL, 1000 mL and 2500 mL) into the ethanol/seawater mixtures] (ratio 6:4) to pay attention to the change of the nitrite ion ( $\text{NO}_2^-$ ) especially due to the rainfall dose. From **Table 3**, we understand that the values of “nitrous acid ( $\text{NO}_2^-$ )” and “residual ethanol concentration” decreases along with the increase of the rainwater dose. This time we use the plant-based fermented ethanol as the experimental ethanol (absolute ethanol [99.5% vol.]). However, when using the Spirytus [drinking alcohol] (96% vol.) which is world-famous vodka made in Poland, the almost similar tendency was

**Table 3.**  $\text{NO}_2^-$ , Residual ethanol concentration and Salinity concentration at each volume of rainwater poured into the Ethanol/Seawater Mixtures (Ratio 6:4).

Rainwater poured into the mixtures (mL)	$\text{NO}_2^-$ (mg/L)	Residual ethanol concentration (%) (Spirytus) <sup>b</sup>	Salinity concentration (%) (Spirytus) <sup>b</sup>	Beverage Degree	Standard drinks guide for Alcohol in the world	Possibility of sterilization effect due to the rainwater poured into the mixtures <sup>c</sup>
0	0.05	≈30% <sup>c</sup> (≈23%)	0.81% (1.10%)	Alcoholic Beverage	△	—
40	0.03	≈15% <sup>d</sup>	<0.81%	"	○	○
1000	≈ 0	<1% <sup>f</sup>	"	Non-Alcoholic Beverage	◎	○
2500 <sup>a</sup>	"	"	"	"	◎	○

Note: <sup>a</sup>According to the results of Western research, it is estimated that the water intake amount in one day of a human is around 2.3 - 2.5 L/day for a group with a low level of living activity, and is around 3.3 - 3.5 L/day for a group with a high level of one. [62] And, it is said that in Western countries the around 20% - 30% of water intake amount is derived from plants, and the rest, around 70% - 80% from beverages, so the beverages of 1.5L/day should be taken as a hydration [63]; <sup>b</sup>“Spirytus” [drinking alcohol] (96% vol.) is low concentration of about 4% compared with the absolute ethanol] (99.5% vol.) used in this experiment. So, there is ineluctably a little difference in the concentration values of both the residual ethanol and the salinity. <sup>c</sup>There are the 20% level and the high 30% level a lot regarding the alcohol content of “Liqueur” that is made by the cocoa beans and the coffee beans. <sup>d</sup>The alcohol content of “Japanese Sake” made from rice is about 15% - 20%. <sup>e</sup>It is thought that the possibility of the sterilization effect is increased due to the input of both the rainwater and the ethanol. <sup>f</sup>Here we would like to define the percentage of the “non-alcoholic beverage” as the value less than 1%. In addition, there is a legal standard as non-alcoholic beverage that is recognized as the alcohol content in the world, e.g., the value less than or equal to 0.5% in USA, 1% in Japan and 1.2% in EU respectively. In addition, it is thought that if the water intake amount in one day of a human is around 2.5 L/day, the mixtures(seawater + rainwater) using the ethanol at base can be sufficiently used as “non-alcoholic beverage (Def. < 1%)”.

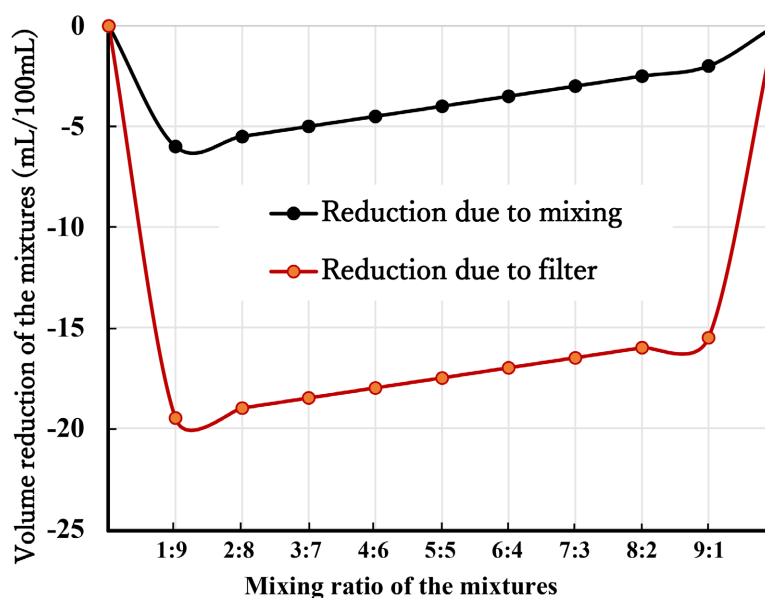
seen regarding the property of reacting even compared to the absolute one ([99.5% vol.]). The only difference between the two is if there exists the problem in the property ( $\text{NO}_2^-$ ) of the rainwater.

Therefore, we consider that it is very important for us that the preserving the state of the rainwater the natural one (distilled water). That is, we understand the nature as “life itself” to us. It is very significant that such one’s way of thinking [42] is launched on a global scale, because it means “Global Solidarity on View of Nature”.

**Figure 7** shows the result of the relation between mixing ratio and volume reduction of ethanol/seawater mixtures.

When mixing the seawater and the ethanol based on the mixed ratio at rotational speed of around 3 rps, the volume of the mixtures decreases first. It is said that when looking at the mixtures (seawater and ethanol) with the particle model, as the particle of the ethanol is bigger than that of the seawater, the space arises between the particles of the mixtures. Then, this is because the particle of the seawater comes in that of the ethanol [64]. The state (●) of the reduction due to the mixing, and the state (○) due to the filter are shown in **Figure 7**, respectively. In addition, the infrared light of 850 nm was irradiated with the mixtures for 30 minutes to promote the sedimentation of the salinity (NaCl). After that the filtration was carried out to remove the sedimented salinity (NaCl).

The two coffee filters in the marketplace were used in the filtration. The specification of the filter is as follows. Weight: 0.7 g, Quality of the material: Virgin Pulp 100% (Thickness: 0.15 mm, Roughness of mesh:  $\approx 20 \mu\text{m}$  (0.02 mm), Made in Germany. The surface area of volatilization increases by using this filter. Therefore, the filter is not only the removal of the sodium chloride (NaCl) as a portion of insoluble/sedimentation but also the promotion effect of the volatilization.



**Figure 7.** Relation between mixing ratio and volume reduction of ethanol/seawater mixtures.

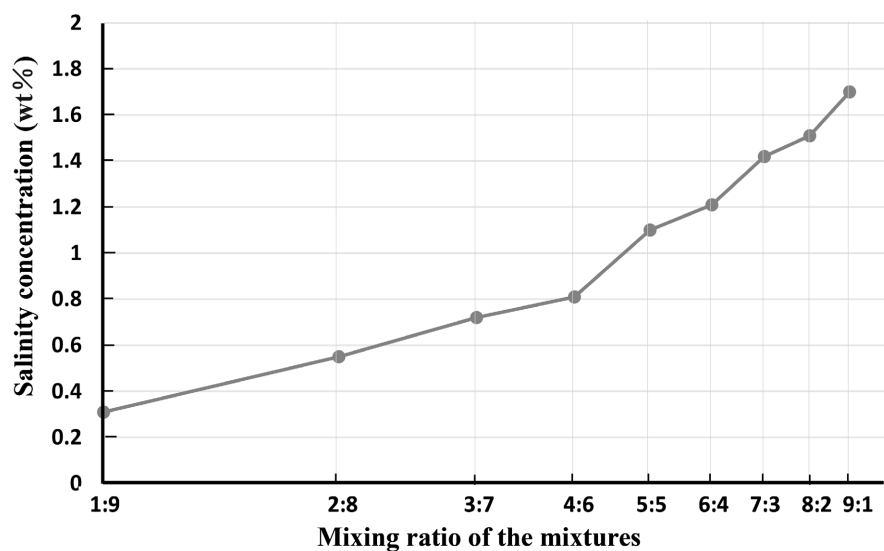
The sodium chloride (NaCl) and the attached ethanol-water are removed by using the filter. In addition, for example, when looking at the measured value (weight) in the mixing ratio (4:6), the value was around 4.5 g.

By the way, it seems like that the both (Mixing/Filtering) in **Figure 7** show almost the same decreasing tendency. And we understand that the volume reduction in overall mixing ratio is a range of around 16 - 19 mL. After filtering, the mixtures was irradiated by the sunlight (day and night) until the mixtures reach an amount of the each seawater (10 - 90 mL) due to the evaporation at the each ratio of the mixtures we set up first. The amount of the residual ethanol was measured at the time of obtaining a predetermined amount of the seawater. The alcohol concentration meter (0% - 80%) [RCYAGO company's product] was used in the measurement.

**Figure 8** shows the relation between mixing rate and salinity concentration of the mixtures.

We understand that the "salinity concentration" is increasing with the decrease in the ethanol of the mixing ratio. When the ratio is 4:6, a change-point appears. According to a publication regarding "science of whisky" [65], it is said that the ratio where the ethanol and the water mix well is 4 (water):6 (ethanol). However, they say that it is still a mystery how the ethanol is proceeding with the action to advance decomposition (Ethanolysis). And it is regarded that the degree of the progression of the decomposition due to the ethanol depends on its concentration. It is said that there are two reasons for this.

1) It is regarded that the optimum ethanol concentration to progress (get absorbed) the ethanolysis efficiently is about 60%. If the ethanol concentration is too high, it is easier to volatilize the concentration, and if, too low, it is rebuffed by a hydrophobic composition on the contrary. It is regarded that the optimal concentration of the ethanol is around 60%. That percentage is neither too high nor too low.



**Figure 8.** Relation between mixing rate and salinity concentration of the mixtures.

2) The balance between hydrophilicity and hydrophobicity of the ethanol solution (around 60%) is just good to dissolve the components such as hydrophilic minerals, etc. in the solution. On the other hand, the vitamin, etc. do not dissolve in pure water (hydrophobicity), but dissolve well in the pure ethanol (hydrophilicity) on the contrary. That is, the ethanol is an amphiphatic substance that has a balance between hydrophilicity and hydrophobicity. This is why it is truly said to be an unexpected piece of luck of “60% (ethanol)”.

In connection with the mixtures, Prof. Dr. Gerald Pollack (the University of Washington), who is founding Editor-in-Chief of the scientific journal, WATER and is recognized as an international leader in science and engineering, says the optimal ratio related to the viscosity of the ethanol (vodka) in the following [54].

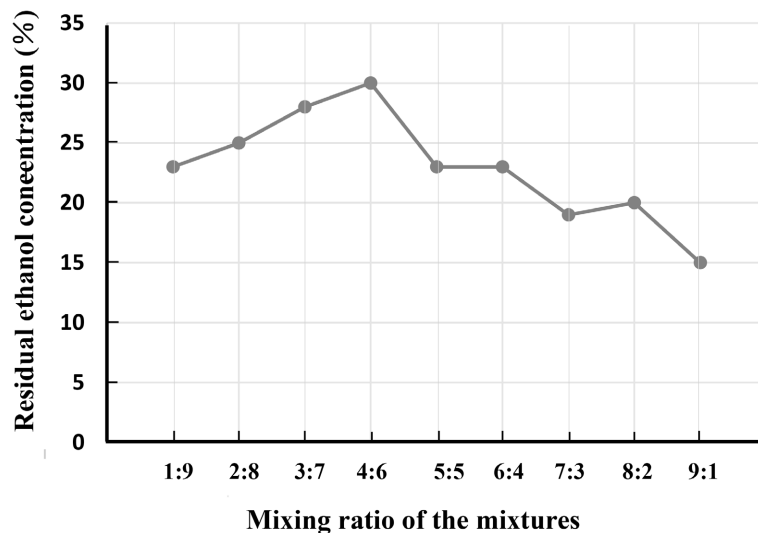
“Dmitry Mendeleev (1834-1907), the Russian scientist who brought us the periodic table, also studied the mixing of ethanol and water. Like most mixtures, this one produces heat and shrinkage. Mendeleev noted another attribute: an increase of viscosity, by as much as three times. The reason has remained obscure, but the EZ’s high viscosity might explain the result. Ethanol forms EZs much like water; therefore a mix of ethanol and water might produce intermingling EZs exhibiting substantially elevated viscosity. While that’s speculation, What’s beyond speculation is the practical result: because he found the highest viscosity at a 40:60 mixture of ethanol to water, Mendeleev considered that particular ratio ideal for making vodka. That’s the ratio used to this day. The high viscosity lends the drink a satisfying ‘body’, enough perhaps to explain Russians consume so much of it.”

In addition, they say that this book introduced here is “the most significant scientific discovery of this century”. It is said from the mentioned above that there are still many mysteries in the mixtures containing the ethanol and water. It is therefore exactly as Dr. Koga said [65] that we consider that it is very important to handle it based on the three key words such as a) Waiting actively, b) Imagining tremendous power on circulation (water and air) and c) Observing as a state, not a thing to truly confront the mixtures.

**Figure 9** shows the relation between mixing rate and residual ethanol concentration of the mixtures.

The mixtures are made based on the mixing ratios using the seawater and the ethanol, and each mixture is irradiated with the sunlight. And the residual ethanol concentration is each value when evaporated under the sunlight until the amount of the seawater becomes the each original one (10 - 90 mL). As is seen in **Figure 9**, a change point can be seen as is expected at the mixing rate of 4:6.

We understand from this that the degree of intensity of the mixing on the ethanol and the water has exerted its influence on the state of the residual ethanol in an unchanged condition. When we say here the state of the residual ethanol, we find that both water molecules and ethanol molecules exist in the most compact condition. In addition, when the residual ethanol concentration in the seawater of 10 mL becomes 23%, and that of the 40 mL becomes 30% respectively.



**Figure 9.** Relation between mixing rate and residual ethanol concentration of the mixtures.

And we understand that the residual concentration decreases little by little (30% → 15%) on the boundary of the point of 30%. This may be brought by the “structure of ethanol water solution”. Dr. Nishi [56] advocated. It is said that a stabilization of the ethanol cluster that is called “hydration cell” and means a state in which the water caused by the hydrophobic hydration encloses the surrounding of the ethanol cluster.

## 6. Conclusions

In SDGs, safe drinking water is defined as the water managed and provided via piped networks. However, at present one-third of the world’s population—or 2.2 billion people—are in a situation where they cannot use safe drinking water. Looking at “Drinking water” from the point of view of “The water of life”, this issue affects some numbers of SDGs such as “Gender Equality (Goal 5)” and “Quality Education (Goal 4)”, furthermore, “Good Health and Well-Being” (Goal 3), etc. is the most important subject.

Regarding the safe drinking-water supply, this time we have examined the possibility of raw seawater directly into 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 divided into nine kinds of the mixing rate of ethanol/seawater mixtures.

Ethanol/seawater mixtures (the ratio of 6:4) were selected in terms of the balance among the salinity concentration, the sterilization effect and the residual ethanol concentration. And we have compared and examined the characteristics of the seawater from the viewpoint of the relationship between the salinity concentration, the nitrous acid concentration ( $\text{NO}_2^-$ ), the sterilization effect (ethanol and rainwater) and the residual ethanol concentration and studied the possibility of seawater as a beverage.



As a result, we have obtained the new findings that suggest the possibility of raw seawater in beverage using ethanol as a renewable resource. We are convinced that the result is very logical and the content is very rich and the analysis is very detailed. As for the issues to be solved from now on, to say nothing of doing a detailed check of the quality in the mixtures, the next case study can be pointed out. That study includes the bioassay using killifish for checking the safety of the mixtures as a beverage in developing countries and isolated islands.

We consider that the technique in this study will be a basement (The first Attempt on the Earth) to lead “A Road towards Raw Urine into Beverage” that plays a Messianic function in the global water shortage.

## 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 in the water. So here we would publicly like to express our deepest appreciation for his help and support. And we also would like to express sincere appreciation to Dr. Sugimoto R. (Part-time lecturer, Osaka Sangyo University) for providing the information of drinking culture in Taiwan, China.

## Conflicts of Interest

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

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