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Global Warming can be Protected by Promotion of Plankton CO_2 Assimilation

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Abstract

The earth is warmed up by the heat evolved by the burning of fossil fuel releasing CO_2. CO_2 assimilation reaction is the reaction of CO_2 with water to produce carbohydrate absorbing heat. Burning reaction is reverse reaction of CO_2 assimilation. If we can compensate the generation of CO_2 and heart of burning with the absorption of CO_2 and heart by CO_2 assimilation, global warming can be protected. Plankton CO_2 assimilation reduced 95% CO_2 in Precambrian Eon to 400 ppm now in 35 billion years. It is said that 70% CO_2 assimilation is carried out at sea. Supply of nutrient N and P to sea is most important. Large amount of NOx is produced when fossil fuel is burned. This NOx should be released without elimination procedure as it is. Large amount of N and P is contained in drainage. The drainage should be released as it is. Deep sea water contain much nutrient N and P. Shallow sea water contain very little nutrient. Agitation of deep sea water with shallow sea water increases the plankton growth. These three points are effective methods to increase the plankton growth, to increase fish production and reduce CO_2 production and to protect earth warming.

Keywords: NOx; Carbon dioxide; Carbon dioxide assimilation; Global warming; Plankton

Introduction

The plant is growing by absorbing CO_2 and water making carbohydrate and oxygen absorbing energy. This reaction is called CO_2 assimilation and fix CO_2 and absorb heat. The earth is warmed up by the heat evolved by the burning of fossil fuels. Global warming can be protected by promotion of CO_2 assimilation, by promotion of plant growth, by promotion of CO_2 fixing and heat absorption by providing enough N and P [1-5].

70% of CO_2 assimilation is said to be carried out at sea. Plankton photosynthesis are studied by many investigators [6-67]. It is estimated that between 50%-85% of the world's oxygen is produced via plankton photosynthesis [9,10]. The rest is produced via photosynthesis on land by plants [10]. Furthermore, plankton photosynthesis has controlled the atmospheric CO_2/O_2 balance since the early Precambrian Eon [11]. The growth of plankton populations is dependent on light levels and nutrient availability. Supplies of nutrients are expected to have important impacts on future plankton productivity [20].

The agitation of deep sea water (rich N,P) with poor nutrient sallow sea water, and effective uses of NOx in burned gas and P in drainage are powerful support for the promotion of plankton CO_2 assimilation.

In this paper I will describe these two methods to protect global warming by increase of nutrients N and P in the sea.

Carbon dioxide assimilation

CO_2 assimilation produces carbohydrate (glucose) and oxygen absorbing heat 114 kcal.

$$CO_2 + H_2O + 114\ \text{kcal} \xrightarrow{CO_2\text{assimilation}} 1/6\ C_6H_{12}O_6 + O_2$$

$$CO_2 + H_2O \xleftarrow[\text{Burning}]{} \text{Fossil fuel} + O_2$$

When burning reaction, left going reaction <--------- is predominant, earth warming is predominant. When CO_2 assimilation reaction, right going reaction ------> is predominant earth cooling is predominant by enough absorption of CO_2 and heat by CO_2 assimilation, earth can be cooled down.

CO_2 concentrations increase annually, in 1950 278 ppm, in 1986 350 ppm, in 1996 357 ppm, in 2000 372 ppm, in 2010 390 ppm, in 2014 387 ppm, in 2015 400 ppm. This is due to the predominant production of CO_2. We must increase the absorption of CO_2 by CO_2 assimilation. To increase the CO_2 assimilation we must increase the concentration of nutrient nitrogen N and nutrient phosphorous P.

CO_2 assimilation, fixed CO_2 and absorbed heat.

At	Fixed CO_2	Absorbed heat (kcal)	Products
Laboratory	44 g	114	Carbohydrate 30 g, O_2 32 g
Rice field	1.47 t	38×10^5	Rice 1 t
Setoinland sea	69×10^6 t	5.3×10^{10}	Weed, Plankton
Earth	4.4×10^{10} t	7.4×10^{15}	-
Forest	7×10^8t	1.6×10^{13}	Wood
Land	1.6×10^8t	5.7×10^{13}	Plant
Ocean	20×10^8 t	1.1×10^8	Plant
Ocean	2×10^{10} t	5.6×10^{14}	Plankton

(A) At laboratory: The reaction of CO_2 1 mole 44 g and H_2O 1 mole 18 g absorbing 114 kcal giving glucose 1/6 mole 30 g and oxygen O_2 1 mole 32 g, 22.4 L, is called as CO_2 assimilation. This reaction is most important reaction for our all living biology. By this reaction, all biology could live for 50 billion years.

(B) At rice field: Rice plants grow by eating CO_2. How much amount of CO_2 is eaten at 0.1 hectare (1000 m^2, 300 Tsubo). Rice 430 kg

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is produced at 0.1 hectare. Plant 1 tone, 1000 kg is produced including rice straw in one year. To make 1 tone of plant, CO_2 1 tone×44/30=1.47 tone are necessary. Heat 38×10^6 kcal is absorbed. At the under of big tree, we fool cool. This is due to the absorption of heat by assimilation.

(C) At Setoinland sea: Area of Setoinland sea (sea between Shikoku and Chugoku in Japan) is 47000 km^2. 4.7 million times wider than 1 hectare. If assimilation efficiency is same as rice field, 1.47 $t\times47\times10^5=69\times10^6$ t of CO_2 will be absorbed and $114\times47\times10^6=5.3\times10^{12}$ kcal heat will be absorbed. And 47×10^6 t of fish will be expected.

(D) At earth: Fossil fuel 1.4×10^{10} t was burned at whole world in 2010 and about 4.4×10^{10} t CO_2 was released and about 4×10^{10} t CO_2 was fixed and 7.4×10^{15} kcal is absorbed.

(E) At forest: Total wood weight in the world is 700×10^8 tones. Tree grows 1-2% annually then annual CO_2 absorption is 7×10^8 tones. 1.6×10^{13} kcal is absorbed.

(F) At land: Annual CO_2 fix by land plant in the world is 10×10^8 tone and 5.7×10^{13} kcal is absorbed.

(G) At sea: Annual CO_2 fix by ocean plant in the world is 20×10^8 tones. And 5.7×10^{13} kcal was absorbed.

(H) At sea: Annual CO_2 fix by ocean plankton is 2×10^{10} tones. And 1.1×10^{14} kcal is absorbed.

(I) Prof Matsunaga, Tokyo Agriculture University studied the fixing of CO_2. Sea weed can grow 4320 g/m^2/day, if enough N and P are provided [63].

70% of CO_2 assimilation is said to be carried out at sea. Assimilation is carried out by sea weed and plankton. Sea weed and plankton are growing under ice at arctic and Antarctic ocean, eating much CO_2, absorbing much heat and giving much food for whales, penguin and earless seals. When we consider the fact that oil is fossil of plankton and coal is a fossil of tree. We astonish the magnitude, greatness and contribution of plankton assimilation.

The reason why earth is warmed up is due to the heart evolved by the burning of fossil fuels. CO_2 assimilation is a reverse reaction. By absorption of heat by CO_2 assimilation, earth can be cooled down.

Fossil fuel 1.4×10^{10} t was burned at whole world in 2010 and about 4.4×10^{10} t CO_2 was produced and 2.5×10^{15} kcal is produced. By doing reverse reaction, CO_2 assimilation, and by absorption of same amount of CO_2 and heart, the equilibrium of CO_2 and heart will be possible.

Nitrogen oxide NOx is natural fertilizer for ten thousand years

Best method to protect global warming is the promotion of growth of plant and plankton. To promote the growth of plant, the supply of nutrient nitrogen and phosphorous is most important [1-5].

Nature has natural systems to change N_2 to nutrient nitrogen. By the high temperature at fire place for cooking, warming up of room by burning of wood, by thunder storm, by forest fire, by forest burning, by bonfire, following reactions proceed.

$1/2\ N_2+1/2\ O_2$ ----------> NO- 21.6 kcal

$2NO+O_2$ ----------> $2\ NO_2$+13.5 kcal

$3\ NO_2+H_2O$ ----------> $2\ HNO_3$+NO

NOx (Mixture of 90% NO and 10% NO_2) is produced and dissolved in rain water, giving nutrient nitric acid ion NO_3^- produced. NO_3^- ions is a natural nitrogen fertilizer and promote the growth of plant and plankton.

In 1 liter rain water, 0.8 mg ammonium ion and 0.44 mg nitric acid nitrogen, total 1.2 mg of nitrogen is contained in 1970. As 1200 mm water fall in one year, 120 liter of rain fall in 1 m^2 in Japan, 15 kg nitrogen in 1 hectare area are given as fertilizer to all area irrespective to mountain, field or sea. Old agriculture such as rice production was carried out without synthetic fertilizer using this natural fertilizer. Old proverb says that many thunder storm year gives good harvest.

In such way, use of nitrogen and recycle of nitrogen are done for 10 thousand years. The equilibrium of burning of plant (CO_2 generation) and production of plant (CO_2 absorption), and the equilibrium of heat generation and heat absorption were maintained.

As civilization advances, people use fossil fuel like oil, natural gas and coal. Large amount of CO_2 was released. Large amount of NOx is liberated in the process of burning of fossil fuels. In 2010 fossil 1.4×10^{10} t was burned and CO_2 4.4×10^{10} t was produced. As C/N ratio of plant is around 5/1-50/1(average 25/1) [64,65]. NOx 1.4×10^{10} $t\times1/50=2.8\times10^8$ t were produced. Plant is growing by eating CO_2 and nutrient N by the ratio of CO_2/N 5/1-50/1 (average 25/1). One N can fix 5-50 (average 25) CO_2.

The CO_2 assimilation is promoted by the increase of nutrient N and P. The most easily available nutrient N is NOx. Therefore we should use all NOx produced by burning as it is produced. We should not eliminate NOx. Nature look likes set up the amount of NOx to balance the loss of burning material (fossil) and increase of burning material (plant) by promoting the growth of plant by produced NOx.

Fossil fuel 1.4×10^{10} t was burned at whole world in 2010 and about 4.4×10^{10} t CO_2 was produced and 2.5×10^{15} kcal is produced and NOx 2×10^9 t is estimated to be produced. NOx produced by exhaust gas is 0.4×10^8 tones. If we use these all NOx 2.4×10^9 t, we can fix CO_2 5×10^{10} t ($25\times2.4\times10^9$ t). This amount is almost same as 4.4×10^{10} t (CO_2 produced in 2010). We can protect global warming by promotion of CO_2 assimilation by using NOx.

Toxicity of NOx

NOx is hated as pollution gas and is eliminating using much fossil. But no report as to the sickness caused by NOx is reported.

Low doses of inhaled nitric oxide have been reported to be clinically effective, and most current dosing recommendation does not exceed 40 ppm. At this dose, the little measurable short term toxicity. Indeed, it is noteworthy that in the large randomized trials of inhaled nitric oxide, major clinical toxicity (e.g., methemolobinemia) was observed only at dose>80 ppm [66,67]. NOx is released at exhaust gas at power station and does not exceed 40 ppm in respiratory tract.

Phosphorous is essential for fixing CO_2

Phosphorous P is important atom constituent of plants and animals. Phytic acid (Inositol Hexaphosphate) calcium salt is contained in every surface of grain such as rice, wheat and corn about 30%. Plant makes glucose by photosynthesis from CO_2 and water. Some of glucose is converted to inositol. Inositol is converted to phosphoinositides (PIP_2) and phytic acid. PIP_2 is converted to IP_3 and diacylglycerol. These two compounds are essential for signal transduction of plant [3]. Plants make phytic acid as storage of phosphorous. Phosphorous is an essential atoms as fertilizer, because it is an essential atom to make DNA. The seed store phosphorous atoms as a store so that even when seed germinate at no phosphorous land. To make this phytic acid,

plants absorb corresponding phosphorous at harvest time. Lack of phosphorous gives poor harvest [3,68-71].

How phosphorous is supplied?

There are three routes to supply phosphorous to plant.

1. **Tripolyphosphate:** As laundry detergent, 60 thousand tones were used in 1984 in Japan. By using this tripolyphosphate, 60 thousand×25=1500 thousand tone CO_2 was fixed. CO_2/P ratio would be similar to CO_2/N ratio, 1000 thousand tone plankton is produced and fish 490 thousand tone was produced.

2. **Phosphorous in drainage:** About 60 thousand tone phosphorous was contained in drainage in Japan. By using this phosphate, 60 thousand×25=1500 thousand tone CO_2 can be fixed. And 1000 thousand tone plankton can be produced and fish 490 thousand tone will be produced. Animal eat food containing P and exclude excreta containing P. When toilet disposal and drainage are sent to excreta disposal treatment plant. P in water was made to water insoluble mass, mixed with cement and made to concrete and buried in soil. Plant cannot use P any more. This process use huge electricity and consume much fossil fuel. Around two hundred thousand tone fossil and producing five hundred thousand tones CO_2. For the elimination of one phosphorous, about 2 carbon fossil is used and about 2 CO_2 is produced. One phosphorous can fix 25 CO_2. The phosphorous elimination process should be avoided. Because excreta is best food for plant. Ocean dumping, field dumping and forest dumping of excreta are recommended to increase the concentration of nutrient phosphorous.

3. **Phosphorous:** 88 μg is in 1 little sea water. Annual CO_2 fix by ocean plankton in the world is 2×19^{10} tones. This amount is more than half of CO_2 generated in the world. Therefore fixing of CO_2 by plankton at sea is most important.

Method to Reduce CO_2 Production

CO_2 production can be reduced 20% by stopping NOx and nutrient P elimination process.

Stopping NOx elimination process

The facility like power station has NOx elimination equipment. Flue gas is reacted with ammonia and NO is converted to N_2 gas.

$4\ NO+4\ NH_3+O_2$ ---------> $4\ N_2+6\ H_2O$

Equivalent molar amount of ammonia is required to eliminate NO.

The production of nitrogen oxide by persons operation in Japan is two million tones. If destroy NOx by ammonia, 1.13 million tone ammonia is necessary. This amount is 2 times of nitrogen fertilizer used in Japan. To make ammonia 1.13 million tone, 0.2 million tone hydrogen gas is required. To make 0.2 million tone hydrogen, butane 0.64 million tones is required. As the result, 1.76 million t CO_2 is released. This is a huge promotion of global warming.

$C_4H_{10}+8\ H_2O$ ----> $9\ H_2+4\ CO_2$

$N_2+3\ H_2$ ----> $2\ NH_3$

By stopping this NOx elimination equipment, we can reduce 1.76 million tones CO_2 production. Japan eliminates NOx completely. Therefore electricity price in Japan is two times higher than that of Korea. Because construction cost plus fossil cost are added for elimination of NOx. Many industrial factories are built at outside of Japan.

Stopping of elimination process of nutrient nitrogen and phosphorous in drainage. About 60 thousand tones phosphorous are present in drainage in Japan. We can reduce the production of 2 million tones CO_2 production by stopping of elimination process, corresponding 1.5 % of total CO_2 production. Two million tones NOx is produced in Japan and about two hundred million tones NOx is produced in the world About 60 thousand tones P are present in drainage in Japan, and 6 billion tones P in the world. We should use these N and P to increase the concentration of N and P at the surface of sea.

Elimination of nutrient N and P resulted in the elimination of plankton growth and fish industry and CO_2 fix

Two news about the red sea (red plankton grow) at near hatchery fish plants at Kagawa prefecture, Japan and much water weed grow at Biwako lake were reported. These were special event at special district. But Japan Government established Environment Ministry. This Ministry established very strict rules to eliminate all N and P to inhibit the growth of all plankton effective for all over Japan by eliminating all N and P in air and water. This policy destroyed Japan fish industry. Sea changed dramatically. Sea weed do not grow. Plankton does not grow. Nori growing plant stopped. At all Japan sea area where Kuroshio (poor N, P nutrient sea current) is running: Rocky-shore denudation is seen. Fish decreased especially Pacific saury (sanma), Tuna (maguro), Bonite (katsuo), Sardin (iwashi) decreased, Bream (tai), Eel (unagi), Sea eel (anago), Shell fish like Oyster (kaki), Basket clam (shizimi), Short-neck clam (asari) decreased. Fisherman decreased. Fish price increased. Japan must buy Mackerel and Salmon from Norway, Octopus from Morocco, Tuna (maguro) from Croatia, and Shrimp from Vietnam. All these fish were cheap than meat before 1970. Japanese can live longest by eating these fish [72-78]. But now fish is much more expensive than meat since nutrient N and P elimination rule. We Japanese may lose long life record. In Japan, CO_2 fix and absorption of heat by plankton CO_2 assimilation decreased.

Agitation of deep sea water with shallow sea water promotes plankton growth and fish production

Annual CO_2 fix by ocean plankton in the world is 2×19^{10} tones. Therefore fixing of CO_2 by plankton at sea is most important. 88 μg of P is in 1 liter sea water. The Kuroshio current Japan (running water from south to north at east south coast of Japan) is clean and contain poor nutrition salt (phosphate salt, nitrate salt) and poor in plankton and fish. Oyashio Japan (running north of Japan near Hokkaido) is rich in nutrient salt and rich in plankton and fish. Cold current running west coast of United State is very rich in nutrient salt and is rich in plankton and fish.

Concentration of N and P of surface sea water at 100 km south of Muroto (South corner of Shikoku) is 1 μg/l, 0.3 μg/l respectively. N 33 μg/l, P 2.9 μg/l at 1000 m deep sea, water is 30 times and 10 times rich in nutrition than that of surface sea water. At Kumejima, Okinawa in Japan Plankton production and Kaki (Oyster) production using sea water pumped up from deep sea are now in production stage.

Agitation or stirring of sea water by using current power or wind power or construction of fence must be studied to increase the concentration of N and P at surface.

Coral bleaching is reported at sekisei reef lake at Okinawa, Japan in Sept 2016. Because no typhoon approach this year at this district, agitation was not enough to replace nutrient deep sea water (contain much nutrient nitrogen, phosphorous) with poor nutrient shallow sea

water caused the no growth of zooxanthella. Coral bleaching is reported at Great Barrier Reef in 2016 June 6. They say coral bleaching is caused by too warm water by global warming. But I think this is caused by lack of nutrient N, P by insufficient agitation of nutrient rich deep sea water with poor nutrient surface sea water.

Global warming produce high temperature of sea water, evaporation of water and consequent many typhoon, hurricane. These typhoon and hurricane agitate surface sea water (poor nutrient) with deep sea water (rich nutrient). Plankton growth infinitely if enough nutrient N and P are present. Many hurricane attacking east south part of United State producing nutrient rich surface sea water and this Gulf current goes up to north producing much plankton and much CO_2 and heat absorption and producing much fish.

Le Chatelier's principle is working at Nature

High temperature is caused by global warming. Then evaporation of sea water causes hurricane and typhoon. Hurricane and typhoon agitate the sea water to give enough N and P to promote the CO_2 assimilation, to promote the growth of plankton and promote CO_2 absorption and heat absorption to cool down the earth. We must study and find out best method to agitate sea water. By the use of wind, sea current, the use of attraction of moon.

Amount of buried fossil and global warming

Since industrial revolution, mankind is using large amount of fossil for transportation and manufacturing of iron, aluminum, plastic and fertilizer. Global warming comes from over burning of fossil. Fossil fuels are fossil of plants made by CO_2 assimilation from CO_2 and water in 50 billion years. Mankind is now using up these fossils in 500 years. Estimated amount of buried fossil: oil is 42 years, natural gas is 60 years, coal is 132 years, and buried uranium is 124 years. When fossil is burned out, no global warming will happen. We must consider how we can live civilized life. How can we drive car, air plane, agriculture machine, fishing boat. How can we generate electricity? From what can we make plastic and solar cell module? We must consider how to use limited precious fossil. We should not use fossil for elimination of NOx and nutrient P. We should use produced NOx for promotion of CO_2 assimilation. In 2010, fossil 1.4×10^{10} tones was burned and 4.4×10^{10} tone CO_2 was produced. Estimated CO_2 4×10^{10} tones was absorbed by plant and plankton. The difference is 10 percent. If we use NOx and nutrient P effectively, we can protect global warming.

Summary

Global warming can be protected by the promotion of plankton growth by the supply of nutrient N and P at sea by following three items to fit Paris agreement.

1. Stopping of NOx (at buned gas) elimination process.
2. Stopping of nutrient phosphorous and N elimination process in drainage.
3. Agitation of nutrient deep sea water (rich N, P) with poor nutrient sallow sea water.

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