CO_2 Decomposition: Direct Solution to Global Warming

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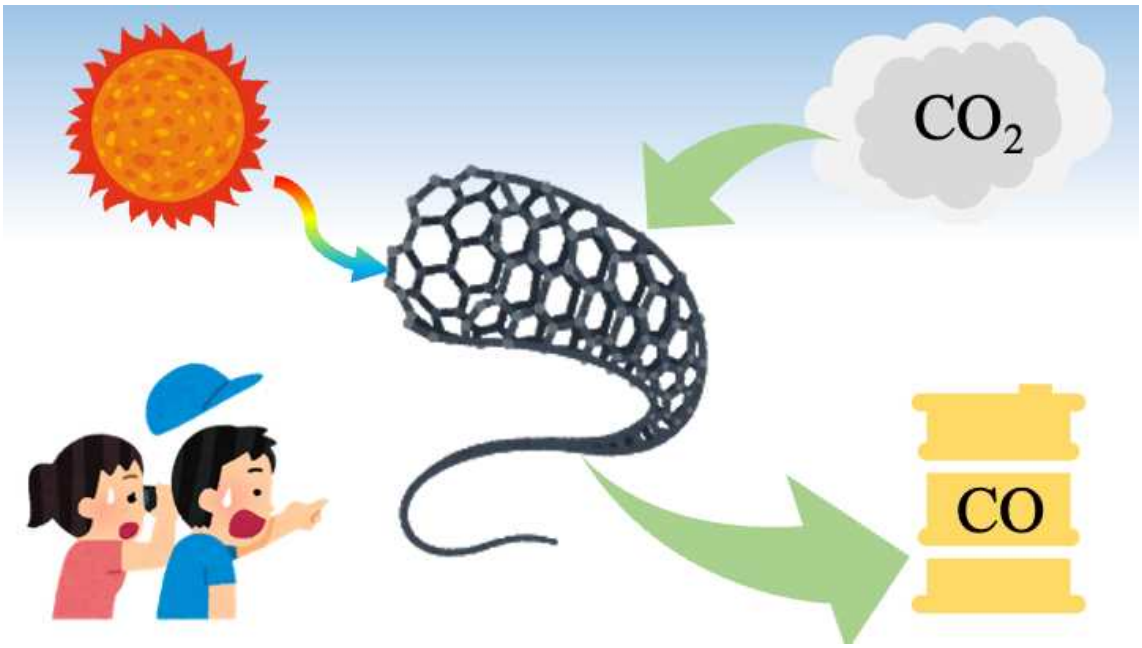

In April of this year came the news, “Japan will cut CO2 emissions 46% by 2030”. This goal was declared in a Leaders’ Summit on Climate; this summit aimed to accelerate the tackling of global warming issues caused by an increase in the concentration of atmospheric carbon dioxide, CO2. Such high-level political calls to reduce CO2 emissions have repeatedly arisen, with the most famous recent examples being the Kyoto Protocol in 1997 and the Paris Agreement in 2015. They all aim to prevent climate disasters such as droughts, floods, and rising sea levels resulting from anthropogenic increases in global temperatures.

How on earth is global warming caused? The earth is revolving around the sun and receives sunlight. The light is absorbed into the ground and raises the temperature of the globe. When it’s night, the light doesn’t reach the ground to lower the temperature. This is because the surface of the earth is always radiating energy to space. The balance of absorption and radiation keeps the global temperature. However, with only these two factors, the average temperature would be -19 degrees Celsius. As you know, the average temperature of the earth is higher than this. In actuality, the effect that the atmosphere absorbs energy to space and re-radiates to the ground biases the equilibrium in the direction of higher temperature and makes the climate comfortable. In this way, the greenhouse effect of the atmosphere is necessary for us to live. On the

other hand, excess increases in greenhouse gas bring about too high temperatures.

Indeed, the most influential greenhouse gas is water vapor, which has about 50% of the impact, while CO_2 has only about 20%. Then why do they take up only CO_2 in global warming issues? This answer is water vapor does not directly increase or decrease by humans, while CO_2 does. The greenhouse effect of water vapor is virtually natural, and that amount is controlled by nature. However, CO_2 cannot be controlled without intentional human intervention. Moreover, the influence of increasing CO_2 is not only the greenhouse effect itself. Warming by CO_2 evaporates seawater much more and the increased water vapor brings about many times the greenhouse effect. This is called climate feedback. Therefore, the amount of CO_2 takes a very important role to decide the temperature of the globe.

Today, countries all over the world advance decarbonization policy to cut CO_2 emissions. However, the other day new scientific discovery from another point of view is published. That is a direct solution to global warming issues, which decomposes CO_2 into CO with sunlight. CO is useful in the organic chemical industry and can be used to make methanol, which can be used as a fuel, adhesive, resin, and so on. In other words, CO_2 can be used as a new energy source. If this discovery is put to practical use, we may be able to roll back global warming.

Al-zubaidi et al. (2021) made carbon nanotubes, a tube made of carbon atoms, with iodide (AgI) and iodic acid compound ($AgIO_3$) inside. Iodide efficiently absorbs sunlight and iodic acid compounds work as CO_2 reduction photocatalyst. The photocatalyst is a substance to active with light and helps chemical reactions proceed. Until now, only high-energy light like ultraviolet rays was able to activate it. In this study, they discovered it makes photocatalyst activation with weaker energy light, visible light, that $AgIO_3$ puts AgI together using carbon nanotube. This discovery makes it possible to decompose CO_2 with sunlight, which is one of the renewable energy sources.

It is easy how to make. All you have to do is to prepare carbon nanotubes with iodine inside and soak it in $AgNO_3$ aqueous solution. It is important to be able to make it easier because costs would be high and large-scale practical use would be prevented if it is difficult. This is one of the main reasons why this discovery could be proposed as a realistic solution to that issue. Furthermore, this substance is made of carbon nanotubes

so that it be able to be spread on various materials like transparent polymer film or glass sheet. This also lowers the bar for practical application.

Of course, some problems to solve remain yet. This study shows the CO conversion efficiency was about one-tenth slower than other catalyst-based methods, and a very large amount of photocatalyst would be needed to reduce the atmospheric CO_2 concentration. To overcome this, it is being studied to control the electronic state in carbon nanotubes or crystal size of AgI and $AgIO_3$ to improve efficiency. It is also important whether this photocatalyst is durable or not. In this study, it was sure it does not worsen for 72 hours at least. In the future, it needs to check durability for a longer time.

Global warming is an inevitable issue for humans. If we were not to start to move now, the future climate would be harsh in the future. We have to tackle this issue from various perspectives, as failure is not an option. This discovery, which can reduce the amount of CO_2 directly, has enough potential to be another option of the current international policy of decarbonization. It may be not long before we control CO_2 and keep the environment of the earth comfortable. Future research on the practical application of this technology is expected.

Reference

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