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作品名稱

Geo-engineering CO_2 Scrubber

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Abstract

On account of the rapid development of human activities, much more fossil fuel is burnt and thus a greater amount of greenhouse gases are emitted to the atmosphere including carbon dioxide (CO_2). CO_2, is considered as the major cause of the exacerbating global warming. “Geo-engineering”, literally, means the options that would involve large-scale engineering of our environment in order to combat or counteract the effects of changes in our atmosphere.

As a carbon neutral CO_2 scrubber is proposed to be a large-scale scheme to fix carbon globally through reducing the CO_2 emitted to the atmosphere and our ultimate goal is to implement the CO_2 scrubber scheme to the whole globe, that is, a large-scale scheme to our environment, it is a project of geo-engineering.

The procedures of the project are as the following:

(a) Investigating on the absorption of CO_2 produced by calcium carbonate ($CaCO_3$), using different basic substances at different temperatures

(b) Investigating the absorption of CO_2 in car exhaust produced by combustion of petrol in car engine using basic solid

(c) Feasibility of using a prototype of CO_2 scrubber in exhaust pipe of car

(d) Feasibility of fixing carbon by turning CO_2 into dry ice and stored in deep water

(e) Feasibility of growing plant in used basic solution

Results:

1. The CO_2 scrubber prototype had an **average CO_2 removal ability over 50%, which was considered to be efficient.**

Method	Chemical absorption using **KOH**	Chemical absorption using **soda lime**	membrane technology	LM2500 PE simple cycle gas turbine (21MW)
CO_2 removal efficiency/ %	**57.2**	**55.6**	**>50%, membrane areas greater than 500 m^2 (Andrea, 2004)**	**86% (Falk, 1997)**

The **concentration of CO_2 (561ppm) was even lower than that in the ambient air (CO_2 612ppm)**. During the experiment, the prototype was closely attached to the exhaust pipe and did not fall down. Thus, a CO_2 scrubber was feasible to be used in the vehicles. Besides, **our prototype was more energy efficient than LM2500 PE simple cycle gas turbine (consumed 21MW electricity)** though our prototype had a lower CO_2 removal efficiency. The **cost of our prototype would be much lower than membrane technology as the production cost of the membrane was high.**

2. Unlike existing CO_2 scrubber prototype installed in open area (with electric fan installed), our CO_2 scrubbers installed in the chimneys of power stations and exhaust pipes of cars are **carbon neutral** as exhaust gas has high kinetic energy and would pass into the scrubber.

3. dry ice would not evolve carbon dioxide gas at high water pressure such as at the bottom of the ocean.

4. Plants grew well in alkaline environment, it was feasible to grow plants in basic solution.

Conclusion: CO_2 scrubber is a suitable choice in combating the climate change

through absorbing the excess carbon dioxide, with the utilization of the carbonates produced in the reaction, it is hoped that the climate change can be relieved using an environmentally-friendly device.

評語

本研究是開發汽機車廢氣中 CO_2 之清除器，本研究之對象除了無機材料，也嘗試以藻類來做清除媒介，假以時日，或可能發展成實用科技。