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A study on the determination method of Global Warming Potential (GWP) by measuring the experiment-based infrared absorption spectra and the reactivity of the hydroxyl radical

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As the use of chlorofluorocarbons (CFC) gas was completely banned in 2010, hydrofluorocarbon (HFC) and perfluorocarbon (PFC) gases are replacing its place. HFC and PFC demands are consistently increasing due to their use in extinguishing agent, refrigerant for cooling and also in semiconductor and display manufacturing process for etching, deposition, cleaning and more. However, most HFCs and PFCs currently in use have a very high GWP, which adversely affect the greenhouse gas reduction policies that each country is working on.

To this aspect, countries and relating companies are conducting research to replace from high GWP rated HFCs and PFCs to low GWP rated HFCs and PFCs or to new gases. However, the proper study has not yet been made because of unknown information about GWP, in the case of using or developing a gas which has not been clarified its GWP in IPCC, WMO, and related papers.

Therefore, here, we propose a determination method of global warming potential based on various literature studies as following.

- Calculating absorbed cross-sectional area by measuring infrared adsorption spectra using Fourier-transform infrared spectroscopy (FT-IR) and applying to Lambert-Beers' law using measured infrared absorption spectra.
- Applying original Pinnock curve (Pinnock et al., 1995) and final Pinnock curve using the Oslo LBL model (Myhre et al., 2006), to calculate the radiative forcing by integrating the calculated absorbed cross-sectional area from Step 1.
- Measuring the reactivity of the hydroxyl radical using PTR-Mass (V.Sinha et al., 2008) and based on measured OH radical, calculate the atmospheric life expectancy using the rate coefficient (Burkholder et al., 2014) and tropospheric lifetime (WMO, 2014) of CH_3CCl_3 (MCF), reference material proposed by WMO, 2014 .
- Following the IPCC AR5(2013), calculate GWP from the radiative forcing and the atmospheric life expectancy, determined by Step 2 and 3.

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