Air to Fuel

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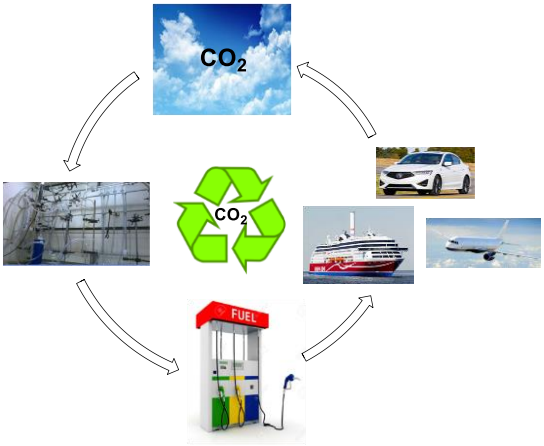
Global warming is directly linked to the increase of greenhouse gases in our atmosphere. Among the greenhouse gases carbon dioxide contributes a major role to air pollution. If no action is taken, it would have severe harmful consequences to humanity and the biosphere. It has been suggested that the reduction of CO_2 and conversion to renewable fuels and valuable chemicals may be considered as a promising solution to reduce the greenhouse gas emissions. Among alternative fuel, methanol is valuable for internal combustion and other engines, either in combination with gasoline or directly. It is now used in racing cars in many countries since conventional energy sources include coal, petroleum and natural gas are limited in quantity.



Sau *et al.* "*Transforming Atmospheric CO_2 into Alternative Fuels: a Metal-Free Approach under Ambient Conditions*" *Chem. Sci.* **2019**, *10*, 1879 – 1884.

To address the above issue, recently we have developed a metal free compound which can absorb the carbon dioxide from air in solution as well as in solid state also. This result motivated us to find out the best way to switch the absorbed carbon dioxide into alternative fuel such as methanol to address the two issues simultaneously global warming and energy crisis. Finally after numerous efforts, we succeeded to establish the unique methodology for the synthesis of alternative fuel from air. The study highlights the fact that our group was able to capture carbon dioxide from air under

ambient conditions and could convert it into methanol using a highly reactive yet a metal-free compound.

Untold story behind this success: This discovery of air to fuel transformation was serendipitous. During the reduction of commercially available carbon dioxide project, I wanted to check the stability of Carbene-borane adduct, I playfully exposed in open atmosphere for few days in solution. Interestingly, a sharp color change of the solution was noticed from pale yellow to green. It made us curious to understand the reason for such color change. In fact, I was able to grow crystals from this reaction mixture after few days and it was confirmed that the compound instead of decomposition has undergone an interesting transformation by arresting the carbon dioxide from air. We first discovered this result in the beginning of 2015. A series of discussions with my guide led to the present shape of the work and finally we published this result in December 2018 along with filing a patent.