Carbon dioxide radical anion for organic synthesis and water depollution

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Carbon dioxide (CO_2) contributes to global warming by trapping heat in the stratosphere and its concentration is >430 parts per million, approximately 50 % increase since the industrial revolution caused by deforestation and burning of fossil fuels. One of the potential solutions of reducing carbon dioxide to convert it into useful product. In this presentation, we will show its transformation to carbon dioxide radical anion ($CO_2^{\bullet-}$), which is a strong reductant with redox potential of - 1.90 V versus normal hydrogen electrode. The formation of carbon dioxide radical anion can be achieved by single electron transfer for exploiting it in organic synthesis and remediation of halogenated pollutants in water and wastewater (Figure 1) [1,2].

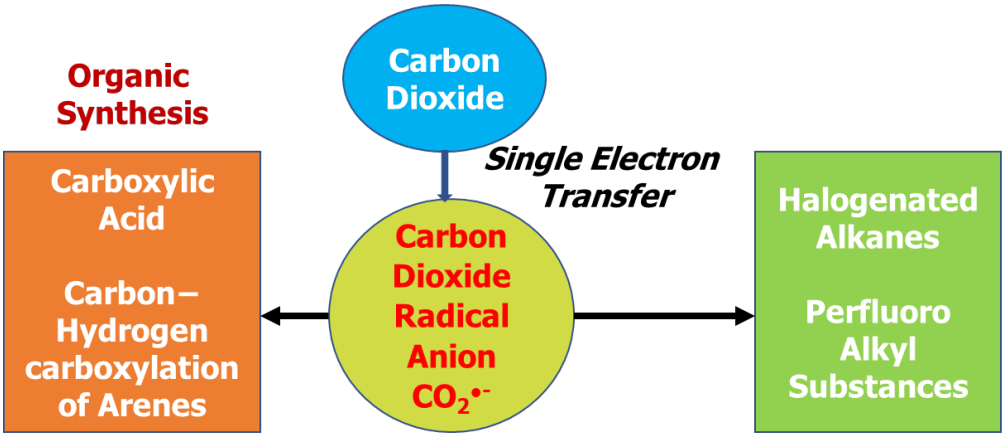

Figure 1. Application of carbon dioxide radical anion in green chemistry and remediation of organic pollutants

The addition of carbon dioxide radical anion to carbon-hydrogen bond can produce an accessible approach to synthesize carboxylic acids. Example of green synthesis of organic synthesis will be shown. The major focus of the presentation will be on the role of carbon dioxide radical anion in remediation of persistent halogenated organic compounds like aliphatic chlorinated compounds. The kinetics of such compounds with carbon dioxide radical anion and hydrated electron will be compared [2,3]. The current status on the reactivity of carbon dioxide radical anion with perfluoroalkyl substances (PFAS) using fast kinetics approaches (e.g., pulse-radiolysis technique [4]) will be given. Assessment of carbon dioxide radical anion in treating halogenated compounds in real environment (i.e., dissolved oxygen and matrix constituents) will be done in the presentation.

References

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