Carbon Dioxide Utilization

CO_2 is a friend and a foe, and the greatest greenhouse gas by volume. Downstream products of CO_2 and applications make the commodity less of a foe. These uses include making chemicals and useful materials, such as plastics, fuels, building materials, carbonic acid, supercritical extraction uses, sodium bicarbonate (baking soda); replacement molecules for enhanced coal bed methane, enhanced oil recovery (EOR) ventures; and much more.

Useful applications for CO2 represent a partial solution toward reduction of greenhouse gases.

- Some estimates indicate a CO2 atmospheric presence of 0.036% (v), where many hoped we would stay clear of 0.04%, which poses an even greater danger of irreversible climate changes, per some accounts.
- CO2 from biofuels, such as fermentation can make these biofuels projects even greener, when using CO2 in a number of recycling and environmentally friendly applications.
- Beyond fermentation, even greater sums of CO2 are emitted by coal – based power plants, some 40% of all CO2 emissions; then CO2 emissions from engine exhaust may be second in volume, and many combustion processes make for ever greater CO2 reduction challenges.

Applying & converting CO2 into useful products; one being plastics is of great interest.

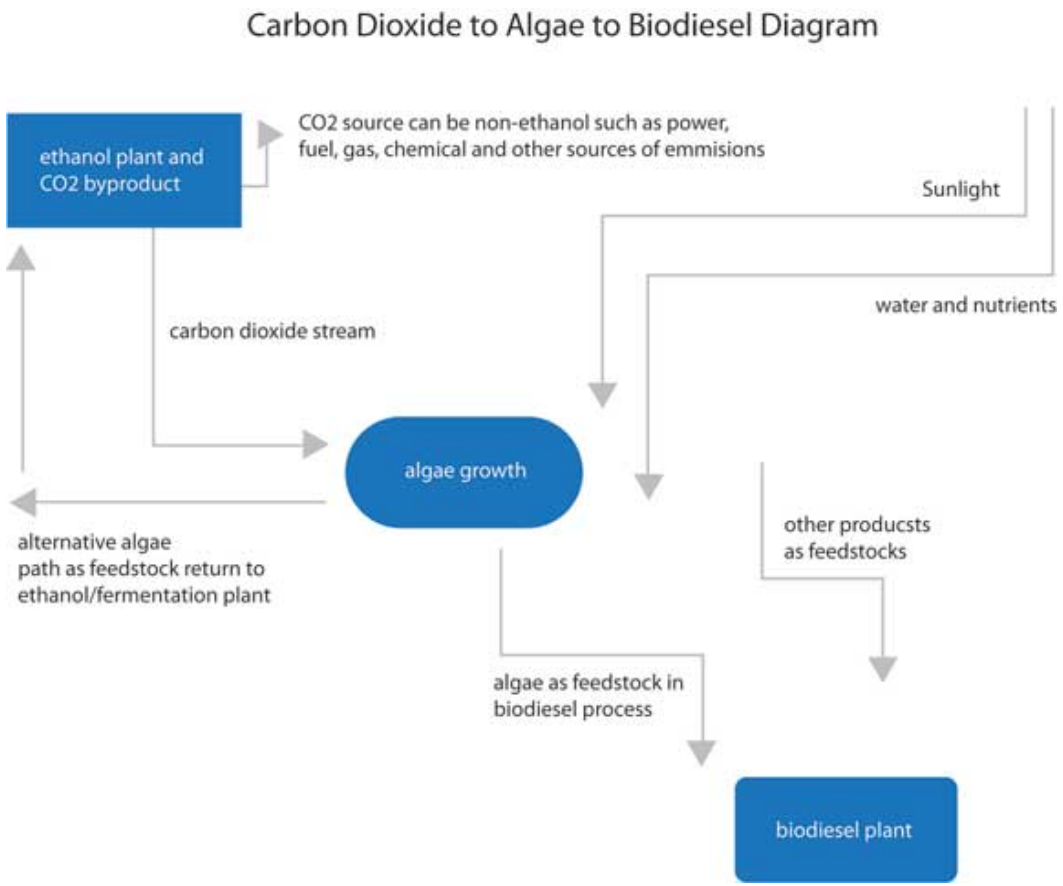
- CO2 as a feedstock for plastics is important for carbon reduction schemes; as well as applications for the production of fuels, chemicals, and building materials.
- In the case of polymers, over 40% of the product weight can be replaced with CO2; and the applications can range from solid plastics to soft foam – like products.
- The range in plastics density and form is a function of the size of the polymer chain.
- Conventional polyethylene and polyproplene are heavily dependent upon fossil fuels. Some CO2 applications in plastics can replace this petroleum – based content by 50%. Such processes include Novomer.

Other CO2 applications and useful products which represent better methods, and a net greenhouse gas reduction.

- CO2 (when dissolved in water) represents carbonic acid (H2CO3), which safely replaces mineral acids such as sulfuric; and leads to a benign by-product as carbonates and bicarbonates v. environmentally harmful sulfate compounds.
- CO2 usage for enhanced photosynthesis in commercial greenhouse settings and the production of algae for biofuels and other commercial uses, is an excellent CO2 sink.
- Supercritical extraction of essential oils, spices, etc., replace hydrocarbon materials such as hexane results in a non-toxic alternative, with no hydrocarbon disposal requirements.

More useful applications and products of CO2 usage in industry

- Grain fumigation with CO2 v. use of halogenated hydrocarbon (carbon tetrachloride) and other agents represents a non-carcinogenic approach to fumigation.
- Sequestration of CO2 in pre-cast concrete, enhances concrete curing. One such process can sequester 60 tons of CO2 in 100 tons of pre-cast concrete.
- Common commodity chemicals sequester CO2 in their manufacture, such as urea, methanol, sodium bicarbonate, and calcium carbonate.
- Enhanced recovery of fossil fuels is well proven in EOR (enhanced oil recovery), and CBM (enhanced coal bed methane) projects.



CO2 uptake in algae projects

- CO2 stream to algae site; also requiring sunlight, nutrients, and water……

- Yield algae for biodiesel oil extraction; and possible algae residue for return to fermentation via cellulosic approach.