



Green Sense 08/17/2014

Using Carbon Dioxide

Carbon dioxide in excess in our atmosphere is disrupting our climate, and a number of scientists and engineers are considering how this can be either mitigated or used as a source for fuel or chemical feedstock. CO₂ is an inert molecule that must first be broken down using energy to make it usable, a process that chemists call "reduction". If renewable energy is used to break it down, this opens up possibilities for producing fuels or making chemicals.

A number of technologies are being investigated that use CO₂ as a source of materials and energy. Some of these are "artificial photosynthesis" technologies such as electrolysis and catalytic water splitting, imitating green plants that grow using carbon dioxide, water and sunlight. Scientists and engineers hope to develop artificial means of copying the process that plants use.

A few recent news releases have reported on research into mitigating carbon dioxide emissions, or using the gas as a feedstock. The first report comes from the American Chemical Society, about a sponge-like plastic material that sops up the greenhouse gas.

According to Science Daily (www.sciencedaily.com), the material — a relative of the plastics used in food containers — could play a role in President Obama's plan to cut CO₂ emissions 30 percent by 2030, and could also be integrated into power plant smokestacks in the future. The report was presented at the 248th National Meeting & Exposition of the American Chemical Society in San Francisco last week.

"The key point is that this polymer is stable, it's cheap, and it adsorbs CO₂ extremely well. It's geared toward function in a real-world environment," according to Andrew Cooper, Ph.D, University of Liverpool. "In a future landscape where fuel-cell technology is used, this adsorbent could work toward zero-emission technology."

Another report from Liquid Light (<http://llchemical.com>), suggests that carbon dioxide could become a practical feedstock for multi-carbon chemicals. According to their website, the company has a lab-scale process, that they are ready to scale up, for the production of ethylene glycol, which is used to make a wide range of consumer products such as plastic bottles, antifreeze and polyester clothing. Liquid Light says their technology can be used to produce more than 60 chemicals, including propylene, isopropanol, methyl-methacrylate and acetic acid.

A third technology was reported by SOLAR-JET (www.solar-jet.aero/page/posts/), in a project using concentrated sunlight to convert carbon dioxide and water to a so-called synthesis gas (syngas). "This is accomplished by means of a redox cycle with metal-oxide based materials at high temperatures. The syngas, a mixture of hydrogen and carbon monoxide, is finally converted into kerosene by using commercial Fischer-Tropsch technology."

According to the “Solar chemical reactor demonstration and Optimization for Long-term Availability of Renewable JET” fuel, SOLAR-JET, webpage, “With the first ever production of synthesized “solar” jet fuel, the EU-funded SOLAR-JET project has successfully demonstrated the entire production chain for renewable kerosene obtained directly from sunlight, water and carbon dioxide (CO₂), therein potentially revolutionizing the future of aviation. This process has also the potential to produce any other type of fuel for transport applications, such as diesel, gasoline or pure hydrogen in a more sustainable way.”

These research outcomes give promise that carbon dioxide could be trapped in products that will keep it locked up for a long period of time. Wood is great at capturing carbon (in trees or in furniture or buildings), removing it from the air, but we can't plant enough trees fast enough to deal with the problem we have.

So, if CO₂ becomes a starting material for chemistry we may be able to invest in better ways to avoid the problems that are predicted if we act soon enough. We'll keep watching for advancements in this technology and be ready to support them - but until then, you can help by using nature's method, and plant more trees. If you'd like to support Reading's tree planting program, you will find the Tree Donation Form on Reading's webpages, under the Public Works 'quick links' listing (or by typing into your browser: www.readingma.gov/sites/readingma/files/file/file/taking_root_sponser_4_2014_0.pdf).

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