Opportunities related to formic acid

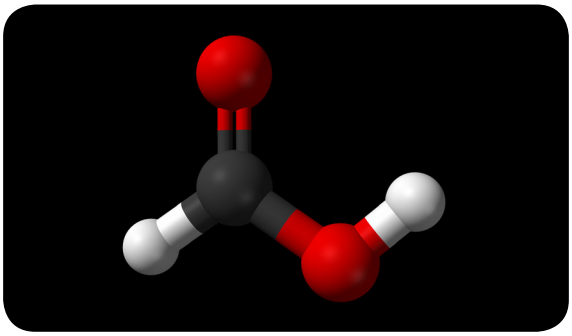
June 22, 2009

Formic acid is of interest to Mantra because of its ERC technology, electro reduction of CO_2, an alternative to CCS, carbon capture and storage. ERC is very different from CCS, it is a form of carbon recycling. It has many advantages (see the Mantra brochure), one of which is the production of a valuable end product, formic acid.

There are a number of application related opportunities attached to formic acid, and they are:

1. Steel pickling: formic acid, the strongest of the organic acids, can replace the current use of hydrochloric acid, a strong, environmentally unfriendly acid. This is based on research and patents originally done in Europe. ERC production of formic acid starts with using CO_2 as a raw material and thus earns carbon credits; it is environmentally benign; it also generates oxygen gas which further reduces the CO_2 given off by the steel industry. It offers a positive return on investment as compared to CCS which is all cost.
2. Papermaking: the use of formic acid in papermaking is well established in China; its use is based on 3 Finnish patents. Formic acid reduces the overall emission of CO_2 (its first advantage), is environmentally benign, and is economic. It produces a superior paper.
3. Cement production: cement manufacturers have particular difficulty in meeting emissions limits as they must use volumes of fossil fuels to achieve the necessary process heat, and CO_2 is emitted from their raw material in the making of lime or cement. They are looking for ways in which they can reduce their emissions without incurring great additional cost. The ERC process can be adapted to their needs: it can produce calcium formate instead of formic acid and this can be used in concrete manufacture to enhance curing and strength of the final product. They achieve: carbon credits, a valuable byproduct and stronger concrete.
4. Delivery of hydrogen for fuel cells: the greatest limit to the use of hydrogen powered fuel cells is the lack of infrastructure brought about by the difficulty in handling the necessary volumes of H_2. “formic acid contains more hydrogen per liter than hydrogen gas compressed at 350 bar. By using it as a liquid hydrogen carrier, scientists can avoid the problems associated with storing large volumes of explosive hydrogen gas. The energy density of formic acid is 5 to 10 times higher than the current lithium ion batteries”, says Matthias Beller of the University of Rostrock in the 19 June 2009 article in Chemical Technology, Phototriggered fuel production. Using their technology, the release of hydrogen is controlled by turning on and off the light.
5. Fuel cell powered with formic acid: a new design of fuel cell has been developed using formic acid directly as its source of power. The first of these was developed by Tekion for use in personal communication devices and lap top computers. It is intended to replace small batteries. Mantra is investigating a bigger fuel cell that will use a larger volume of formic acid and produce more power. It could be used, for example, in providing combined home power and heat. There will be more information released when that acquisition has been completed.
6. Chemical feedstocks from biomass replacing the equivalent from petrochemical products: 5% of the world’s supply of petroleum is used to make feedstocks that are synthesized into commodity chemicals,” says Jonathan Ellman, a UC Berkley chemistry professor. A readily available biomass byproduct, glycerol, when treated with formic acid and nitrogen creates allyl alcohol, which is a starting material for polymers, drugs, organic compounds, herbicides and other chemical products. More generally, the treatment of biomass with formic acid could produce many of today’s petrochemical products from biomass. This is taken from the Biomass Magazine, June 2009 issue, written by Lisa Gibson.

It is clear from the above, that formic acid from ERC has many possible new and attractive uses which promise to be profitable in industry. The reduction of emissions is also attractive to governments, industry and the public.



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