Too green to be true? Researchers develop highly effective method for converting CO2 into methanol

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Université Laval researchers have developed a highly effective method for converting CO2 into methanol, which can be used as a low-emissions fuel for vehicles. The team led by Professor Frédéric-Georges Fontaine presents the details of this discovery in the latest issue of the *Journal of the American Chemical Society*.

Researchers have been looking for a way to convert carbon dioxide into methanol in a single step using energy-efficient processes for years. "In the presence of oxygen, methanol combustion produces CO2 and water," explained Professor Fontaine. "Chemists are looking for catalysts that would yield the opposite reaction. That would allow us to slash greenhouse gas emissions by synthesizing a fuel that would reduce our dependence on fossil fuels."

The catalyst developed by Frédéric-Georges Fontaine and his team is made of two chemical groups. The first is borane, a compound of boron, carbon, and hydrogen. The second, phosphine, is made up of phosphorus, carbon, and hydrogen. "Unlike most catalysts developed thus far to convert CO2 into methanol, ours contains no metal, which reduces both the costs and toxic hazard of the catalyst," added the chemistry professor at the Faculty of Science and Engineering.

CO2 to methanol catalysis requires a source of hydrogen and chemical energy. The researchers had the idea of using a compound called

hydroborane (BH3), and the results have been spectacular. The reaction achieved is two times more effective than the best catalyst known—and it produces little waste. What makes the discovery even more compelling is the fact that the chemical reaction does not damage the catalyst, which can be reactivated by adding new substrate.

The only downside of the operation is the price tag. "Our approach to creating methanol is highly effective from a chemistry standpoint, but for now the process is expensive," explained Professor Fontaine. "It takes a lot of energy to synthesize hydroborane, which makes it more expensive than methanol. We are working on ways to make the process more profitable by optimizing the reaction and exploring other hydrogen sources."

Provided by Laval University