Feasible use of methane as a raw material

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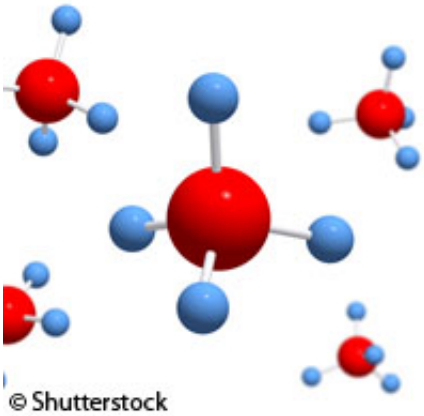

A team of EU-funded researchers has moved one step closer to using methane as a raw material.

Funded through the call 'Chemical activation of carbon dioxide and methane' as part of the European Research Area's Chemistry Programme, the project scientists from France and Spain have successfully managed to transform methane into a more complex organic molecule.

Writing in the journal *Science*, the team, made up of researchers from the University of Valencia, the University of Huelva and the University of Toulouse, set out how methane, as the simplest hydrocarbon and main component of natural gas, can be used as source for the production of

more complex organic compounds.

This finding could have positive implications from both an economic and an environmental point of view: methane could be used as a raw material in the chemical industry. For environmentalists, methane as a fuel is one of the kindest for the planet as when burned it produces less carbon dioxide for each unit of heat released. Methane is also the main component in compressed natural gas, a clean substitute for traditional high polluting fuels such as petrol and diesel.

However, until now scientists have stumbled upon many problems in their methane research. As methane has one of the strongest C-H links in the whole series of alkanes, manipulating it is no easy task.

In addition, methane's gaseous nature and its low solubility in common solvents pose further problems for transforming it chemically. These features make it tricky for methane to come into contact with the catalysts and reagents that perform the chemical reaction; as a result, this is performed either with great difficulty, or not at all.

Due to these problems, very few processes have yet to prove effective for the functionalisation of this hydrocarbon, but now the Franco-Spanish team have solved these problems by developing a methodology for transforming methane into more complex organic molecules.

The reaction involves a silver catalyst that has been specifically designed to activate the C-H methane bonds, a process that has previously proved effective on heavier hydrocarbons. The challenge of attaining effective contact between the catalyst and the reagents needed for the transformation and methane was achieved by using carbon dioxide in a supercritical state as the reaction medium.

Although carbon dioxide is a gas under normal conditions, at

temperatures and pressures above its critical values it becomes a fluid similar to a liquid and is capable of solubilising the molecules involved in the reaction. These properties of supercritical carbon dioxide have found wide industrial applications such as, for example, the decaffeination of coffee. In addition, the chemical inertness of carbon dioxide prevents it from reacting with the catalyst or the reactants involved in the conversion of methane, and therefore it is an ideal solvent for these reactions.

This study has paved the way for further research into the process of functionalisation of methane and of hydrocarbons in general.

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