Researchers study the conversion of carbon dioxide into fuel

Researchers from UFRGS' Institute of Chemistry analyze electrochemical CO2 conversion method for energy production

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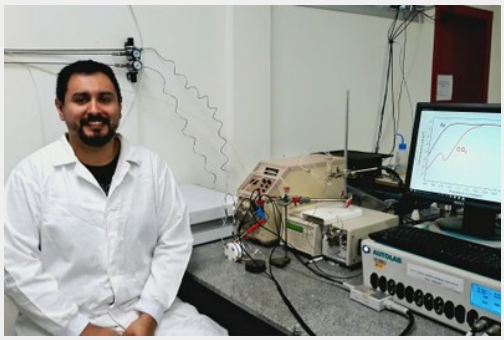

Wellington used ionic liquids to create a system that reduces the amount of energy required for the conversion process

According to a warning by researchers from the German Potsdam Institute for Climate Impact Research in an article published in the journal *Science Advances*, the CO_2 (carbon dioxide) in the atmosphere has achieved its highest concentration in the past 3 million years, making the greenhouse effect worse. However, a research conducted at UFRGS' Institute of Chemistry shows that it is possible to generate several useful chemical products, including fuels, from the CO_2 present in the atmosphere. This happens through a method called reverse combustion.

The processes that require combustion still play a big part in the overall world energy generation. The products of these chemical reactions are CO_2 and water. "The project I developed during my doctorate was basically to transform this CO_2 into something useful," explains Wellington Gonçalves, one of the research team members. The intention behind studying this chemical process is to use carbon dioxide to make fuel again, such as methane and ethane. Methane is the main component of biogas, a renewable option for electricity generation.

The study conducted by the researchers of the Institute of Chemistry was published in the article *Efficient electrocatalytic CO2 reduction driven by ionic liquid buffer-like solutions* (A eficiência dos líquidos iônicos como ativadores na redução eletroquímica do dióxido de carbono), featured on the 2019 September cover of the journal ChemSusChem, part of the *ChemPubSoc Europe*. The subject discussed in the article is the same as in Wellington's doctoral dissertation, completed in 2018 at UFRGS' Graduate Program in Materials Science. Professor Jairton Dupont was his supervisor.

The main subject of Wellington's doctoral dissertation is also the method used in the study: electrochemical conversion, which offers potential energy for a reaction to occur in a given system. The researcher opted for electrochemistry because the reactions of the process happen in normal temperature and pressure conditions. Besides, it is possible to change the energy levels given to the system and observe the results from each test, manipulation which makes experimenting simpler.

Stages of the chemical process

In Wellington's study, ionic liquids were used to allow the creation of a balanced system — called buffered system — that is capable of reducing the energy needed for the conversion process of CO_2 to happen, even when using commercial electrodes. Ionic liquids are organic compounds that bear a lot of energy, allowing a large "energy window" to work with in chemical experiments. The most important thing about the research is that the process analyzed allows fuels to be made at a low cost.

The application of this process in the market still depends on some further steps. Wellington explains that the production costs — one of the main obstacles to the marketing of any product — have already decreased but it is still necessary to increase the actual conversion of CO_2 that is produced in the chemical system. Currently, Wellington is working on his postdoctoral research, also at UFRGS, as a researcher funded by CAPES (Coordination for the Improvement of Higher Education Personnel), studying liquid products generated in the process of electrochemical reduction. During his doctorate, only gaseous results were analyzed. Now, in the postdoctoral fellowship, the researcher seeks to study parts of the experiment that were not previously analyzed in-depth.

Wellington adds that his research area is part of what is called green chemistry. It is a branch of chemistry related to the environment and the development of sustainable chemical processes in order to reduce the use and the production of harmful substances, as it is defined by the International Union of Pure and Applied Chemistry (IUPAC).

Translated into English by Betina Silva Rodrigues, under the supervision and translation revision of Professor Elizamari R. Becker (P.h.D.) – IL/UFRGS.