ETHANOL AS AN ALTERNATIVE OPTION FOR ENERGY STORAGE

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Physicists at the Oak Ridge National Laboratory of the US Department of Energy have developed an electrochemical process that converts carbon dioxide - CO_2 - into ethanol, that is, ethyl alcohol (Ellichipuram, 2016). The discovery, as the scientists themselves admitted to the official ORNL website, is largely accidental: "We actually discovered by chance that this material works the way it works. Initially, we just wanted to implement the first step in this reaction, but during the experiments we quickly realized that the catalyst conducts the entire reaction itself, without intervention from our side." (Song, Peng, Hensley, Bonnesen, Liang, Wu, Meyer, Chi, Ma, Sumpter, & Rondinone, 2016).

The team used a catalyst made from carbon, copper, and nitrogen, as well as an electric current, to bring about a complex chemical reaction that is essentially the

reverse of combustion. It is known to emit carbon dioxide, and scientists have been able to turn it back into fuel (Gallucci, 2016).

According to the article published in the journal ChemistrySelect, during the experiments, the team activated water using a catalyst that was copper "nano-needles" embedded in graphene folds. In recent years, scientists have been actively trying to find a way to turn atmospheric CO_2 into biofuels and other useful substances. For example, in July of this year, physicists from Chicago presented an unusual solar cell made of nanomaterials that directly uses light energy to split carbon dioxide molecules and produce carbon monoxide and hydrogen, from which methane, ethanol and other biofuels can be obtained.

With the help of a nanocatalyst, which contains many points for the reaction to take place, carbon dioxide dissolved in water is converted into ethanol, the yield of this particular substance as a result of the experiment was 63 percent. Although usually this type of electrochemical reaction results in a mixture of several products, consisting of hydrogen, oxygen and carbon in various combinations.

The novelty of the catalyst used ties in its structure, which is copper nanoparticles mounted on carbon "needles". According to the scientists' initial assumptions, graphene folds could react especially efficiently, thereby facilitating the process of converting carbon dioxide into ethanol. The scientists compared this to 50-nanometer lightning rods (Antidote, 2016), which concentrate electrochemical reactivity at the tip. This approach avoids the use of expensive or rare metals such as platinum, which limits the economic viability of such projects.

“Using conventional materials, but positioning them in terms of nanotechnology, we figured out how to limit side reactions and ultimately get what is really required,” the scientists explained (Song et al., 2016).

Thus, it was noted that the technology is almost ready for practical application, since the cost of such catalysts is low, and the reaction can be carried out in water at room temperature. The scientists are confident that this approach can be applied on an industrial scale, in particular, to store excess electricity from wind or solar power plants - using the discovery made, energy can be stored in the form of ethanol.

References:

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