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DEVELOPMENT OF AN EDUCATIONAL METHODOLOGY FOR STUDENTS ON THE ELECTROCHEMICAL METHOD OF CARBON DIOXIDE REDUCTION

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Abstract. This paper describes a detailed method of reduction of carbon dioxide, as the main product of fuel combustion. Carbon dioxide reduced into carbon monoxide will be further used to produce hydrocarbon fuel. The relevance of this topic is that there is an inevitable increase in the concentration of carbon dioxide in the air atmosphere. Therefore leads to global warming due to the greenhouse effect.

Introduction. The increasing concentration of carbon dioxide in the atmosphere is a global problem society. Since carbon dioxide is the main product of fuel combustion, carbon dioxide must be processed into compounds such as carbon monoxide, methanol, ethanol, etc.

At present there are many different catalysts and approaches for reduction of carbon dioxide to hydrocarbon compounds. however, their application on an industrial scale is limited by high cost of processes, low stability of operation of catalysts, low yield of target components.

The aim of this research is to develop an educational module for bachelor or high school students of specialized educational institutions to focus attention on the problem of increasing the concentration of carbon dioxide in the atmosphere and to intensify the study of effective methods of processing waste gases of industries. The educational module includes basic knowledge from the course on electrochemistry, organic synthesis and materials science.

Main part. Electrochemical method of carbon dioxide reduction is one of the most perspective for practical use in gas flow cleaning systems. This approach has been intensively studied and applied in recent years. Electrochemical reduction makes it possible to study the mechanism of reaction, as well as to control the products formed. Carbon monoxide as a product of CO_2 reduction is the most demanded, as it can be later used in the Fisher-Tropsch process to produce hydrocarbon fuel using organic synthesis approaches.

To solve the tasks necessary to choose the optimal setup of the electrochemical cell (electrode material, electrolyte, operating voltage, method of detecting reaction products), which can be reproduced in the laboratory complexes of educational institutions. The key factor for effective carbon dioxide recovery is the material of the electrodes. The choice of electrodes is based on the need for stable operation over a long period of time in standard electrolytes within the potential limit of the actual for CO_2 recovery. The oxidation-reduction processes were studied by the method of cyclic voltammetry.

Conclusions.

Thus, the following conclusions can be drawn on the work done:

1. The configuration of a two-electrode electrochemical cell (electrode material, electrolyte, operating voltage, method of detecting reaction products) for CO2 recovery in laboratory conditions has been developed.
2. The protocol of laboratory workshop for bachelor students is developed.

The next step is to describe a detailed methodology for use in training courses and laboratory workshops and publish the results in ACS The Journal of Chemical Education.

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