EDITORIAL

Microalgae – a Promising Raw Material for Biofuel Production

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The increasing concentration of greenhouse gas in the atmosphere forces to look for new uses of renewable energy in various sectors of the economy. In the transport sector, the aim is to replace mineral fuels with biofuels derived from biomass. Their production and use are encouraged by the Paris Agreement, the Glasgow Climate Pact and the recently adopted European Green Deal. By 2030, 6% of fuel is expected to be replaced by biofuels. Given that the development of conventional first-generation biofuels from agricultural crops has slowed down in recent years, the European Commission encourages the introduction and expansion of the production of second and third generation biofuels using cellulosic biomass and its waste or other materials unfit for human consumption. The search for new raw materials is very important for the production of biodiesel, rapeseed currently being the main raw material in Europe. As the volume of biofuel production increases, the area of crops grown for the production of biofuels increases, and the natural balance of ecosystems is threatened (increasing land demand can be met by the destruction of natural habitats). In order to increase crop yields, fertilisers are used for this purpose posing a risk of contamination of groundwater and surface waters. In addition, the production of biodiesel from vegetable oil competes with the food industry.

Recently, there has been interest in the possibilities of using microalgae for the production of biofuels. The use of microalgae in the production of biodiesel has a number of advantages. They grow very rapidly compared with conventional oilseeds used to produce biodiesel, and the amount of microalgal biomass can double per day. Microalgae, like other plants, carry out photosynthesis, during which they use solar energy and produce biomass. In addition, some species of microalgae are able to accumulate a large amount of oil under certain conditions: when cultivating microalgae, it is possible to obtain more than 10 times more oil and biodiesel than when growing rapeseed on the same area of land. Microalgae can be cultivated on areas other than agricultural land, and so they do not compete with plants grown for the food sector. The cultivation and use of microalgae for the production of biofuels would reduce public dissatisfaction with the use of food oil for technical purposes and the consequent increase in arable land allocated to the production of raw materials for biofuel production. The use of microalgae in the production of biofuels is also relevant from an environmental point of view. As a source of carbon, microalgae require carbon dioxide, which is converted into biomass. This property of microalgae can be used to reduce industrial pollutants causing the greenhouse effect. Exhaust gases from industrial enterprises, power plants and boiler houses could be used for the cultivation of microalgae. Another possibility is application of microalgae for the purification of biogas from CO2. For the growth of microalgae, macro and microelements are necessary, the most important of which are nitrogen and phosphorus. Due to the fact that algae can grow in various conditions, they can be used not only for the elimination of atmospheric pollutants, but also for cleaning wastewater containing nitrogen and phosphorus compounds. The effectiveness of nitrogen and phosphorus removal in some algae species can reach 90% or more. Such an opportunity arises when growing microalgae for technical purposes. The use of suitable waste can significantly reduce the costs of growing microalgal biomass, while addressing environmental pollution problems.

The cultivation of microalgae requires heat, so countries in Asia and Africa have greater prospects in this area, where climatic conditions allow microalgae to be grown in natural conditions in open ponds, lakes or equipped reservoirs. In colder climate conditions, bioreactors are used for the cultivation of microalgae, the structure of which may be different, and additional heating and lighting are used. Grown microalgae biomass is concentrated, dried, oil extracted by pressing or solvent extraction. The fatty acid composition of oil depends on the type of microalgae; the amount of saturated fatty acids in algae oil is slightly higher than in rapeseed oil, but the quality of the oil is suitable for the synthesis of biodiesel by the method of conventional transesterification with alcohol. Biodiesel derived from microalgae oil has been found to meet the quality requirements for biofuels. It is characterized by rapid biological degradation in the environment, and the use of such fuels significantly reduces atmospheric pollution by particulate matter, sulphur compounds and unburned hydrocarbons released with exhaust gases of engine.

In conclusion, the cultivation and use of microalgae for the production of biofuels is promising and relevant in solving environmental problems, but there are challenges associated with high material costs for the cultivation and preparation of microalgae biomass. Microalgae fuel is characterized by a higher production cost than mineral diesel; therefore, ways are being sought to reduce material and energy costs in microalgae fuel production: the use of waste and cheaper nutrients, including atmospheric and water contaminants, is being attempted, scientists are studying new types of microalgae capable of accumulating a larger amount of biomass and oil, technologies and equipment for algae biomass cultivation and processing are being improved, and the possibilities of using by-products generated during production are being explored. Solutions are likely to be found and microalgae will become a viable and widely used raw material in the fuel production of the future.