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Technology for Biogas Upgrading with Immobilized Algae Biomass

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Abstract : Technologies of biogas upgrading are now perceived as competitive solution combustion and production of electricity and heat. Biomethane production will ensure broader application as energy carrier than biogas. Biomethane can be used as fuel in internal combustion engines or introduced into the natural gas transmission network. Therefore, there is a need to search for innovative, economically and technically justified methods for biogas enrichment. The aim of this paper is to present a technology solution for biogas upgrading with immobilized algae biomass. Reactor for biogas upgrading with immobilized algae biomass can be used for removing CO_2 from the biogas, flue gases and the waste gases especially coming from different industry sectors, e.g. from the food industry from yeast production process, biogas production systems, liquid and gaseous fuels combustion systems, hydrocarbon processing technology. The basis for the technological assumptions of presented technology were laboratory works and analyses that tested technological variants of biogas upgrading. The enrichment of biogas with a methane content of 90-97% pointed to technological assumptions for installation on a technical scale. Reactor for biogas upgrading with algae biomass is characterized by a significantly lower cubature in relation to the currently used solutions which use CO_2 removal processes. The invention, by its structure, assumes achieving a very high concentration of biomass of algae through its immobilization in capsules. This eliminates the phenomenon of lowering the pH value, i.e. acidification of the environment in which algae grow, resulting from the introduction of waste gases at a high CO_2 concentration. The system for introducing light into algae capsules is characterized by a higher degree of its use, due to lower losses resulting from the phenomenon of absorption of light energy by water. The light from the light source is continuously supplied to the formed biomass of algae or cyanobacteria in capsules by the light tubes. The light source may be sunlight or a light generator of a different wavelength of light from 300 nm to 800 nm. A portion of gas containing CO_2, accumulated in the tank and conveyed by the pump is periodically introduced into the housing of the photobioreactor tank. When conveying the gas that contains CO_2, it penetrates the algal biomass in capsules through the outer envelope, displacing, from the algal biomass, gaseous metabolic products which are discharged by the outlet duct for gases. It contributes to eliminating the negative impact of this factor on CO_2 binding processes. As a result of the cyclic dosing of gases containing carbon dioxide, gaseous metabolic products of algae are displaced and removed outside the technological system. Technology for biogas upgrading with immobilized algae biomass is suitable for the small biogas plant. The advantages of this technology are high efficiency as well as useful algae biomass which can be used mainly as animal feed, fertilizers and in the power industry. The construction of the device allows effective removal of carbon dioxide from gases at a high CO_2 concentration.

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