

ABSTRACT FOR THE GENERAL PUBLIC

Currently, biogas is a modern form of bioenergy, which an alternative to conventional energy carriers, i.e. coal, oil or natural gas. Waste products from various industries and agriculture (agri-food and animal waste) are increasingly used for biogas production. This is consistent with the theory of sustainable development, but the biogas produced in these activities, in addition to the main components (methane and carbon dioxide) contains numerous impurities that are also released into the atmosphere during the combustion of biogas. Volatile organosulfur compounds (VSC) are particularly onerous trace compounds present in biogas. These are chemical compounds that not only are a source of nuisance odors in biogas plants but also are characterized by high reactivity, toxicity and corrosive properties that cause operational problems (including the destruction of pumps and supply lines). In order to protect energy devices against damage, and reduce emissions to the atmosphere and improve the efficiency of energy production, it is necessary to remove VSC from the biogas stream before the combustion process, using an appropriate effective method.

The basic technologies of biogas purification include adsorption, absorption, membrane, biological processes and cooling combined with condensation. In physical absorption processes, volatile organosulfur compounds can be selectively removed from the biogas stream by using a suitable solvent with a high absorption capacity, i.e. mineral oils or organic substances. However, due to environmental concerns, the solvents used should meet a number of requirements, including non-toxicity, easy regeneration, and biodegradability. All these standards are met by Deep Eutectic Solvents (DES), which belong to the so-called "new generation" solvents. These are compounds that are composed mainly of two substances present in solid form at room temperature, which when combined by specific interactions (i.e. hydrogen bonds) form a new liquid substance. The possibility of numerous DES combinations through a wide range of natural substances, i.e. sugars, amino acids, polyphenols, allows you to control the physicochemical properties of DES, which determines their subsequent use. In scientific research, DES has been successfully used as absorption materials to remove carbon dioxide, water, and ammonia. So far, no studies have been conducted on the possibility of removing a wide range of volatile organosulfur compounds from the gas phase using DES.

The scientific aim of the project is to reduce the selective transfer barrier the VSCs compounds from the model biogas stream, thus accreting the VSCs absorption effectiveness by enhancing the accessibility of the active sites (influence of structure hydrogen bond acceptor and donor) in DES. In the project, knowledge on the emergence of chemical bonds, which determine the formation of new deep eutectic solvents will be gained as well as their physicochemical properties, which may have a significant impact on the use of DESs in absorption processes will be determined. In the next stage of this project, basic studies on the use of new DESs as absorption materials for the removal of selected VSCs from model biogas streams are planned. In addition, the project will carry out research on the regeneration of new absorption materials. The acquired knowledge may in the future contribute to the development of new effective "green technologies" for the purification of real biogas streams.