Thermodynamic and structural Behaviour of textile Covers for Biogas Storage Systems
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ABSTRACT

The operation during a year requires for biogas storage systems that temperatures be maintained in the chamber for the gas production. Heat loss on cold days and overheating on hot days often lead to additional heating of the gas space or cooling of the support air space to maintain the temperaturenecessary for the fermentation process. The gas, air and temperature management of a textile double layer covers is directly related to the changes of state of the supporting air as an ideal gas, the heat transport in gases and solids, and the behavior of the membranes under solar irradiation. Their interaction has a great influence on the air, gas and temperature management. The thermal behavior of the textile covers has a direct influence on the internal pressure and temperature in the supporting air and gas volume due to the size of the surface and the inclination-related different boundary layers at the membrane. Absorption and transmission of solar radiation on the outer membrane lead to changes in the internal pressure and temperature of the enclosed air and gas.

The heat transfer coefficient is composed of convection and radiation components and depends on the local flow direction generated by the air flow, which changes continuously over the membrane surface. Necessary for a permanent, efficient and flexible operation is the consideration of the radiation behavior of the membranes. Approaches will be presented on how textile covers and corresponding coatings can be used to make verifiable use of solar radiation to optimize the production of biogas.

The special feature lies in recognizing and describing the interaction between structural, temperature and radiation behavior, wind flow, air flow, surface finish and texture under varying environmental conditions. Changes of external conditions include clear and hazy summer days, clear and hazy winter days associated with use of warm or cool air to condition air and gas volume. The difficulty in this regard is the representation and linkage of time-dependent processes such as heat transport and wind-induced movements of the membranes with static and thermodynamic equilibrium states. This requiresthe systematic and comprehensible approach of the laws describing the transition from material heat transport to radiation and vice versa, the derivation of temperature-dependent heat conduction, the identification of the influence of boundary layers on heat transfer and heat transport.

This results in certain interconnections at coatings. Investigations of the relationship between material heat transfer and radiation in connection with active air flow through the air chamber and the effects of temperature and volume flows on load transfer, dimensional stability and temperature behavior of the membranes are presented. Options are shown how an active gas, air and temperature management can be used to adapt to the climatic conditions (both in domestic and export countries) to influence the temperatures in the gas volume.