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Development of a PFAS-free Adaptive Biological Waste Treatment Cover Membrane Product Family

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Abstract

Semi-permeable membrane covers used in industrial composting were traditionally built on laminates equipped with an ePTFE functional layer. However, perfluorinated compounds (PFAS/PFOS) were used during the production of these materials, which, due to their environmental risks, have come into the focus of the European Chemicals Agency's (ECHA) restriction proposal. Since market trends and expected EU regulations forecasted the phasing out of ePTFE membranes, the objective of the research was to develop a new, PFAS-free alternative cover material capable of replacing traditional technology in the environmental industry and waste management in the long term. As long-term industrial experience with alternative materials was not available, our primary task during the research was to develop a new series of accelerated aging tests and a corresponding methodology. This includes monitoring changes in the samples bursting strenght, air permeability, and water vapor resistance measurements, as well as conducting material fatigue tests. This procedure enabled the performance modeling of alternative membranes in accordance with the 4-5 year lifespan expected in the environmental technology industry. During the tests, we paid particular attention to the measurement of odor, ammonia, and VOC emissions, as well as testing the resistance to mechanical stress. In the development process, alongside technological parameters, various climatic conditions were also taken into account when optimizing cutting patterns and material structures. As a result of the project carried out in a joint consortium between the Hungarian University of Agriculture and Life Sciences and ProfiKomp Environmental Technology Inc., we successfully created a validated, PFAS-free semi-permeable cover material that complies with BAT-BREF technological standards and strict environmental requirements. Comparative analyses demonstrated that the emission indicators and functional performance of the developed material reached or exceeded the levels of traditional ePTFE laminates.

Keywords: composting, semipermeable membrane cover, eternal chemicals, PFAS