Modelling, Sustainability Assessment and Risk-based Hotspot Analysis of Microalgae as a Bioplastic Feedstock (BPFS)

이지환, 허성민[1], 이재형[2,†]
KAIST; [1]단국대학교; [2]한국과학기술원
(jayhlee@kaist.ac.kr[†])

A major criticism of microalgae as a renewable biomass feedstock for fuels and chemicals is the large amount of downstream processes and high energy demand. The high costs mean that most algae-based products are uncompetitive in commercial markets. One viable application of algal biomass is as a bioplastic feedstock (BPFS). This has several advantages, including minimal downstream processing and higher market price of end product (1500-2500 USD). Still, the sustainability of algae-based bioplastics cannot be guaranteed as it is significantly influenced by natural variability (e.g. solar intensity, temperature), in addition to pre-existing endogenous and exogenous uncertainties.

In this work, a preliminary process model for microalgal BPFS production was developed using experimental cultivation data from Taean coal-fired power plant. UTEX 2714 was cultivated in a greenhouse utilizing flue gas emissions as the carbon source. Flue gas is also utilized as a waste heat source for convective drying in order to reduce overall energy demand. In addition to techno-economic analysis and CO_2 life cycle assessment, we perform a hotspot analysis by analyzing key risk-based uncertainties.