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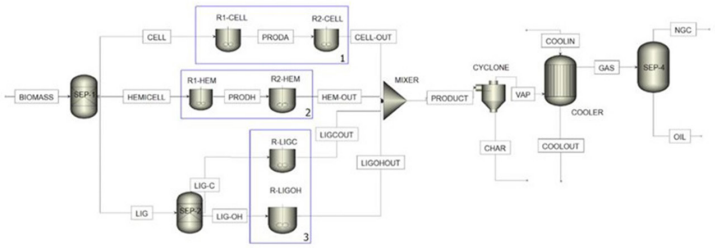
Exergoeconomic evaluations can optimize the energy efficiency of pyrolysis processes while minimizing economic costs.



Large amounts of agro-industrial waste often remain untreated despite its immense potential to be transformed into liquid fuel. If treated properly, residues from major crops can provide alternative sources of energy that reduce carbon footprint. The realistic implementation of such fuel transformation processes, however, requires consideration of both energy efficiency and economic analysis.

Exergoeconomic evaluations integrate concepts of thermodynamics and economics to optimize the efficiency of chemical processes. To calculate the fuel potential of rice husks in Colombia, Gómez-González et al. conducted an exergoeconomic evaluation involving both slow and fast pyrolysis.

“We bring a compilation of a kinetic model of pyrolysis, which is novel in relation to the implementation of exergoeconomic analysis, as many studies are based solely on stoichiometric reactors,” said author Harvey Milquez-Sanabria. “This allowed the system to be analyzed under slow pyrolysis vs. fast pyrolysis.”

The authors developed kinetic models in the Aspen Plus simulator and obtained the yield and exergoeconomic values of slow and fast pyrolysis, which generate products of char and pyrolytic liquid, respectively. Their results indicated that implementation of energy cogeneration and investment in low exergy equipment can reduce the costs of rice husk pyrolysis.

The authors hope to create more realistic simulations of various bioprocesses to account for evolving waste recycling technologies and constantly changing markets, laws, and environments.

“It is necessary to develop more detailed economic models, which consider not only equipment and currents, but also personnel, civil work, licenses, and more,” said Milquez-Sanabria. “We also expect to apply exergoeconomic analysis to the design of bioprocesses, including dark fermentation, anaerobic digestion, and fuel cells.”

Source: “Exergoeconomic evaluation of fuel production from rice husk residue through the pyrolysis process,” by David Alejandro Gómez-González, Luis Alejandro Méndez-Duran, and Harvey Andrés Milquez-Sanabria, *Journal of Renewable and Sustainable Energy* (2024). The article can be accessed at https://doi.org/10.1063/5.0173767.