Zdravko Kravanja (Editor), Proceedings of the 26th European Symposium on Computer Aided Process Engineering – ESCAPE 26
June 12th -15th, 2016, Portorož, Slovenia

Is Wood Waste Only for Burning? A Methodology for Best Pathway Identification of Waste Recovery

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Abstract

Industry has always looked for maximizing on-site synergies using energy and mass integration methods, rather independently. However, considering the component valorisation in its original form, corollary implies missing the reuse opportunities of the component in another form. The conversion brings the possibility of turning the nonusable waste into another usable energy or material through chemical processes, and allows its reinsertion in the system. Hence the inclusion of these processes enables exploring new paths for the recovery of waste streams and bridging the gap between the two integration methods. This paper introduces a methodology which couples Energy and Mass integration techniques through conversion processes, in the aim of finding the best valorisation pathway of waste streams in a local context. In this methodology, the valorisation pathways are driven by the local demand leading to the synergies maximization. Indeed modeling the local demand profile will indicate the feasible pathways through identifying the needs. The best pathway will hence be determined through detailed economic evaluation. The proposed methodology is demonstrated on a case study considering a large industrial site where waste wood valorisation is assessed. Since waste wood has multiple valorisation pathways by its conversion to energy or to another high added value material, the proposed methodology will serve as a tool for the identification of the best economic valorisation solution. Each of these conversion pathways is modeled and validated with literature results. In this case study, waste wood valorisation through heat and power generation, hydrogen or methane generation is challenged in a multi-objectives optimization. For each possible waste wood conversion system, the obtained superstructure is analyzed through Energy and Mass integration methods for each set of the objectives.

Keywords: Industrial ecology, Energy integration, Mass integration, Process design.