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Green conversion of municipal solid wastes into fuels and chemicals

Leonidas Matsakas^{a,*}, Qiuju Gao^b, Stina Jansson^b, Ulrika Rova^a, Paul Christakopoulos^a

^a *Biochemical Process Engineering, Division of Chemical Engineering, Department of Civil, Environmental and Natural Resources Engineering, Luleå University of Technology, 971-87 Luleå, Sweden*

^b *Department of Chemistry, Umeå University, 901 87 Umeå, Sweden*

*Corresponding author: leonidas.matsakas@ltu.se

Abstract

Society is facing a serious challenge for the effective management of the increasing amount of produced municipal solid wastes. The accumulated waste has caused a series of environmental problems such as uncontrolled release of greenhouse gases. Moreover, the increasing amount has resulted in a shortage of areas available for waste disposal, resulting in a non-sustainable waste management. These problems led to serious public concerns which in turn resulted in political actions aiming to reduce the amount of the waste ending in the environment. These actions aim to promote sustainable waste management solutions. The main objective of these policies is to promote recycling of municipal solid waste and also the conversion of waste to energy and valuable chemicals. These conversions can be performed by using either biological (e.g. anaerobic digestion) or thermochemical processes (e.g. pyrolysis). The research efforts during the last years have been fruitful and many publications demonstrate the effective conversion of municipal solid waste to energy and chemicals. These processes are discussed in the current review article together with the change of waste policy that was implemented in EU during the last years.

Keywords: anaerobic digestion; biogas; conversion of waste to energy; environmental problems; ethanol; gasification; hydrogen; public concerns; pyrolysis; uncontrolled release of greenhouse gases; waste disposal.

1. Introduction

The rising environmental problems, involving greenhouse gases and air and water pollution together with the energy crisis and resource scarcity will become more imminent in the coming decades, dictating that we need to take actions towards a more sustainable society. Energy and chemicals are mainly produced by using fossil resources which causes the release of CO₂ in the atmosphere together with other toxic compounds (such as volatile organic compounds and nitrogen oxides). It is estimated that 90% of the global emission in CO₂ (which reached approximately 34

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