CONTENT

Liquid hot water pretreatment of Arundo Donax: a comparison between batch and a flow-through systems

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Lignocellulosic biomass is a valuable alternative raw material to partially substitute oil as both energy and chemical source. To this aim, biomass conversion processes should be developed and optimized in order to obtain quantitative valorization of the whole matrix, achieving the highest possible yields in fuels and/or platform chemicals. For example, polysaccharide constituents of lignocellulosic materials, hemicellulose and cellulose, can be hydrolytically depolymerized using acid catalysts or enzymes, while residual lignin can be used as a source of aromatic building blocks [1].
The kinetic severity of the hydrolysis process can be adjusted to maximize alternatively the yields in fermentable sugars (bioethanol-way) or in chemicals such as furfural, hydroxymethylfurfural, levulinic acid that are generated by consecutive reactions of sugars and are valuable intermediates for the chemical industry (platform chemicals-way). It is well known that, before performing the main hydrolysis step, a pretreatment stage of the matrix is necessary to cleave the bonds between hemicellulose, cellulose and lignin and to start breaking some of the polysaccharide chains [2]. By this way, the selectivity of the hydrolysis process can be better controlled, thus minimizing the formation of undesired by-products. Liquid hot water (LHW) can be used for the pretreatment of biomass, without adding any acid to the system, thus avoiding the need of any subsequent neutralization step.
For this process batch reactor are usually used, in which high conversion of the biomaterial can be easily obtained by prolonging the treatment time, but significant sugar degradation is frequently reported [3].
In order to move toward industrial scale plant for production of energy and bulk chemicals from biomasses, continuous systems are desirable. An intermediate step toward the design of a continuous layout is constituted by semi-continuous processes [4] in which a fixed bed of biomass can be continuously treated with renewed hot water to match high liquefaction yields of polysaccharides of the matrix with limited formation of the sugar degradation products.
In this study, we have performed the LHW pretreatment of Arundo Donax (giant reed) in two different systems: a microwave (MW)-assisted batch reactor, where high heating rate can be achieved leading rapidly the system at the operative conditions of the pretreatment, and a fast heating flow-through layout in which the flow rate of the process water stream can be tuned.
An experimental campaign has been performed in comparable conditions for the two systems in terms of process temperature, treatment time and biomass to overall treatment water amount. The achieved results highlight that in the microwave (MW)-assisted batch reactor good hemicelluloses solubilization, little sugar degradation and insignificant lignin and cellulose fractionation can be obtained by optimizing reaction temperature and time and that in the flow-through system high biomass conversion as well as very limited formation of degradation products can be obtained by adjusting the flow rate of the treatment water. In general, a comparison of the performances of the two layouts will be given in terms of amount, composition and concentration of the obtained hydrolysates.

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Radiation Synthesized Bio

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International Atomic

Radiation processing technologies are gree
applied in both developed and developing co
renewable, biodegradable, and readily ava
radiation-degraded low molecular weight polym
when applied under well-defined conditions,
from diseases, and natural antioxidant for
crosslinked water-soluble polymers that absor
dry weight) can be used as soil conditioner
porosity, and cutting the usage of fertilizers.
the preparation of solventless inks and coati
food products, preserving them longer, while

The IAEA has been supporting Member St
modification of indigeneous biobased material
project (CRP) under which the participan
characterization of radiation-degraded polym
application. Recently, a CRP focusing on deg
and synthetic polymers by radiation techniq
(gamma, electrons, and X-rays) on commercia
their use in pre-packaged foods intended for
developing recyclable, biodegradable, biob
technical meeting was convened to provide
radiation technologies for preparation of
performance testing of the products for various
benefit of both using green technologies and
by support given under regional and national

This presentation will give a glimpse into the
biobased materials, showcase the variety of a
achievements, and present plans for future pro