



HAL
open science

Using in-situ viscosimetry and morphogranulometry to explore hydrolysis mechanisms of filter paper and pretreated sugarcane bagasse under semi-dilute suspensions

Tuan Le, Dominique Anne-Archard, Véronique Coma, Xavier Cameleyre, Eric Lombard, Kim Anh To, Tuan Anh Pham, Tien Cuong Nguyen, Luc Fillaudeau

► To cite this version:

Tuan Le, Dominique Anne-Archard, Véronique Coma, Xavier Cameleyre, Eric Lombard, et al.. Using in-situ viscosimetry and morphogranulometry to explore hydrolysis mechanisms of filter paper and pretreated sugarcane bagasse under semi-dilute suspensions. 10. World Congress of Chemical Engineering (WCCE 10), Oct 2017, Barcelone, Spain. hal-01886479

HAL Id: hal-01886479

<https://hal.science/hal-01886479v1>

Submitted on 2 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Using in-situ viscosimetry and morpho- granulometry to explore hydrolysis mechanisms of filter paper and pretreated sugarcane bagasse under semi-dilute suspensions

Tuan LE¹, Dominique ANNE-ARCHARD², Veronique COMA³, Xavier CAMELEYRE⁴, Eric LOMBARD⁴, Kim Anh TO¹, Tuan Anh PHAM¹, Tien Cuong NGUYEN¹, Luc FILLAUDEAU⁴

¹ Hanoi University of Science and Technology, Vietnam

² Institut de Mécanique des Fluides de Toulouse, France

³ Laboratoire de Chimie des Polymères Organiques, France

⁴ Laboratoire d'Ingénierie des Systèmes Biologiques et des Procédés, France

Abstract

The relationship between in-situ viscosimetry, in- and ex-situ morpho- granulometry, and biochemistry has been investigated during enzymatic hydrolysis of pretreated sugarcane bagasse (SCB, 3% w/v) and filter paper (FP, 1.5% w/v) at various enzyme dosages (0.3 to 25 FPU/g cellulose). Semi-dilute conditions (1.5 to 2 times higher than critical concentrations) were considered in order to generate non-Newtonian rheological behaviors and to avoid neglecting particle-particle interactions in opposition to dilute conditions. Observed phenomena as well as hydrolysis mechanisms including solvation, separation, fragmentation, and solubilization appeared to depend strongly on initial substrate properties. For both FP and SCB, suspension viscosities were correlated with particle size distributions and volume fractions during hydrolysis, but they exhibited strongly different trends. With SCB, a viscosity overshoot was clearly observed at enzyme loading ≤ 10 FPU/g cellulose. This phenomenon is explained by the separation of agglomerates into individual fragments, leading to an increase in the total number of particles and a morphological shift of particles from sphere-like into fiber-like. With FP, the viscosity collapsed at the initial stage in relation to the volume reduction of coarse particles and the number increase of fine particles. Suspension viscosity was strongly dependent on the fraction of coarse population and nearly independent from the glucose conversion yield.

Keywords

in-situ viscosity; particle size distribution; filter paper; sugar cane bagasse; enzyme; hydrolysis.