

A RAPID RHEOLOGICAL METHOD FOR THE ASSESSMENT OF THE HIGH PRESSURE HOMOGENIZATION OF CITRUS PULP FIBRES

S.J.J. DEBON¹, J. WALLECAN^{1*}, J. MAZOYER²

¹ Cargill R&D Centre Europe, Havenstraat 84, 1800 Vilvoorde, Belgium

² Cargill Usine de Baupte, 50500 Carentan, France

Corresponding author: joel_wallecan@cargill.com

Fax: x32.2.2570675

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ABSTRACT:

This paper describes the development of a rapid rheological method for the characterization of functionalized citrus pulp fibers by high pressure homogenization. The suspension rheology of the fibers differ significantly depending on the applied processing conditions, making it critical to have quick and robust quality control tools in place. The weak polyelectrolyte nature of the fibers was considered in order to define the adequate solvent conditions for the rheological evaluation of the suspensions. Secondly, an improved dispersion method using ethylene glycol was developed in order to ensure optimal hydration of the dry fiber. The effect of fiber concentration was then studied both under steady-shear and oscillation tests. The dry matter concentration for the rapid rheological method was set at 4 w/w% above the experimental critical concentration or percolation threshold.

ZUSAMMENFASSUNG:

In diesem Artikel wird die Entwicklung einer effizienten rheologischen Methode zur Charakterisierung von funktionalisierten Fasern, bestehend aus Fruchtfleisch von Zitrusfrüchten, durch Homogenisierung bei hohem Druck beschrieben. Die rheologischen Eigenschaften dieser Suspensionen variieren deutlich in Abhängigkeit von den Verarbeitungsbedingungen, was eine schnelle und stabile Qualitätskontrolle erschwert. Die Eigenschaft der Fasern, schwache Polyelektrolyte zu sein, wurde berücksichtigt, um adäquate Lösungsbedingungen zur rheologischen Charakterisierung der Suspensionen zu definieren. Darüber hinaus wurde eine verbesserte Dispergierungsmethode mit Ethylenglykol angewandt, um eine optimale Hydratisierung der getrockneten Fasern zu gewährleisten. Der Einfluss der Faserkonzentration wurde sowohl in stationären und als auch in oszillatorischen Scherströmungen untersucht. Die Konzentration der getrockneten Fasern bei dieser effizienten rheologischen Methode betrug 4 w/w% oberhalb der experimentell bestimmten kritischen Konzentration (Perkolationsschwelle).

RÉSUMÉ:

Cet article décrit le développement d'une méthode rhéologique rapide pour la caractérisation de fibres de pulpe de citron fonctionnalisées au moyen de l'homogénéisation à haute pression. La rhéologie de la suspension de fibres diffère de manière significative en fonction des conditions de procédé appliquées, ce qui rend critique la nécessité d'avoir un outil robuste et rapide de contrôle de qualité. La nature de polyelectrolyte faible des fibres est considérée afin de définir les conditions de solvant adéquates pour l'évaluation rhéologique des suspensions. En second lieu, une méthode de dispersion améliorée utilisant l'éthylène glycol a été développée dans le but d'assurer une hydratation optimale de la fibre sèche. Les effets de la concentration en fibres ont été étudiés avec des tests oscillatoires et d'écoulement continu. La concentration en matière sèche a été fixée à 4 % en poids au-dessus de la concentration critique de percolation, pour la méthode rhéologique rapide.

KEY WORDS: plant cell walls, citrus pulp fiber, Herschel-Bulkley, homogenization.

1 INTRODUCTION

Every year, large amounts of citrus fruits are being processed within the juice manufacturing industry. Resulting by-products such as the citrus peel (flavedo and albedo) and juice pulp account for about 50 % of the original whole fruit

mass [1], thereby representing a significant amount of waste. Common valorization pathways for these products include, i.e. reprocessing into food systems (e.g. addition of orange pulp into juice), ingredient extraction (e.g. pectin extraction from lemon peel) or use for animal feed.

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