Bioresource Technology 117 (2012) 117–123

Contents lists available at SciVerse ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

TCF bleaching sequence in kraft pulping of olive tree pruning residues

A. Requejo [a,*], A. Rodríguez [a], J.L. Colodette [b], J.L. Gomide [b], L. Jiménez [a]

[a] Chemical Engineering Department, University of Córdoba, Spain
[b] Laboratory of Pulp and Paper, Department of Forest Engineering, Federal University of Viçosa, Brazil

HIGHLIGHTS

- Chemically characterization and Kraft pulping of olive tree pruning residues.
- TCF bleaching with the following sequence of stages: OZQPOZQPO.
- Obtaining a TCF bleached Kraft pulp with a value of brightness above 90% ISO.
- Analysis of the need to refine the TCF bleached pulp.
- Comparison of physical–mechanical properties of different TCF bleached pulps.

ARTICLE INFO

Article history:
Received 13 March 2012
Received in revised form 19 April 2012
Accepted 20 April 2012
Available online 26 April 2012

Keywords:
Kraft pulping
Olea europaea
Agricultural residues
Beating
TCF bleaching

ABSTRACT

The aim of the present work was to find a suitable Kraft cooking process for olive tree pruning (OTP), in order to produce pulp of kappa number about 17. The Kraft pulp produced under optimized conditions showed a viscosity of 31.5 mPa·s and good physical, mechanical, and optical properties, which are suitable for paper production. The physical–mechanical and optical properties were measured before and after bleaching. Although the OTP pulp was bleached to 90.9% ISO brightness (kappa < 1), the process demanded a long sequence of stages, OZQPOZQPO. The bleached pulp showed a brightness reversion equal to 1.3%. Furthermore, this bleached pulp did not need a high intensity of beating due to high drainability degree in the unbeaten pulp. So that, OTP is suggested as an interesting raw material for cellulosic pulp production because its properties are comparable to those of other agricultural residues, currently used in the paper industry.

1. Introduction

The papermaking industries has traditionally used wood as raw material, but at present, agricultural residues are presented as a potential source of cellulose fibers, due to its low cost and wide availability in the fields, since their use in less than 40%, and often burned in the field with the loss of energy as well as causing environmental problems such as fires, plagues, CO_2 emissions to the atmosphere, etc. For this reason, agricultural residues are proposed as a resource with high economical and environmental potential, for the production of cellulose pulp and paper (López et al., 2001).

These agricultural residues have some disadvantages which include a low pulp quality, its high content of non-fibrous material and the silica content of the consumed cooking liquor, which makes recycling difficult; these disadvantages are alleviated firstly, by the presence of these residues in small areas with no or low abundance of woody species as well as its high production speed (Roncero et al., 2003); and secondly, by the reduced consumption of chemicals and energy in cooking and bleaching operations by effect of the more porous and readily accessible tissue structure of non-wood raw materials (Martín-Sampedro et al., 2012).

In particular, olive tree prunings (OTP) residues are the most abundant agricultural residues in the Mediterranean region of the European Union, being the only woody crop in Spain which has increased its area harvested in 2010 (0.3%) (Survey about areas and yields, 2011. Ministry of Agriculture, Food and Environment); only in Spain, the production amounted to 13.9 million tons (FAO, 2012). For this reason, residues from olive tree pruning are proposed as a potential source of cellulose fibers for its use in the paper industry.

Economical and environmental problems related to the paper industry are mainly due to bleaching processes that use chlorine compounds. The conventional technologies cause many environmental disadvantages by the discharge of AOX (adsorbable organic halogens) in the effluents from bleaching.

* Corresponding author. Address: Chemical Engineering Department, Campus of Rabanales, University of Córdoba, Córdoba, Spain. Tel.: +34 957 218658; fax: +34 957 218625.
E-mail address: a92resia@uco.es (A. Requejo).

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http://dx.doi.org/10.1016/j.biortech.2012.04.084