INVASIVE ACACIA SPECIES' WOOD TO PAPER

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ABSTRACT

Acacia species have invasive status in southern Mediterranean Europe countries with control initiatives generating significant amounts of biomass waste, mainly used for energy production, or left in the field. An alternative use for *Acacia* wood could add to the ever-needing pulp and paper industry, though little is known about most species regarding their viability as pulpwood. In this work, the pulpwood potential of five *Acacia* species (*A. dealbata, A. longifolia, A. mearnsii, A. melanoxylon and A. saligna*) for bleached kraft pulp and paper production was assessed. We used Response Surface Methodology (Central composite design) to produce models correlating alkali charge (A.A. from 16-24% as Na_2O) and reaction temperature (T between 151-179°C) on pulping yield and delignification extension (through kappa number). Optimal pulping conditions were determined for each species. The pulps were bleached and refined (2500 Rev) and both pulp and paper characteristics were determined: physical (Schooper-Riegler degree, Air permeability); strength (tensile index and tear index); optical properties (brightness, opacity). *Eucalyptus globulus* wood was used for comparison. *Acacia* pulp yields varied between 52.5-55% and kappa number between 14.7-18.3 at the optimal conditions. The pulp degree of polymerization decreased with bleaching. Fiber characteristics determined through MORFI showed *Acacia* fibers are "short-fibers" with a tendency to be smaller than *E. globulus*. Regarding pulp and paper characteristics, the Schooper-Riegler degree fell between 15-19°SR for unbeaten and 30-43°SR for 2500 rev while Air permeability was between 14-2500 ml/min. Tensile index (increased from 16-23 N.m/g to 71-90 N.m/g with beating) and tear index (increased from 0-4 $mN.m^2/g$ to 5-8 $mN.m^2/g$ with beating) with *Acacia* species showing similar results to *E. globulus*. Regarding the optical properties, although all species presented original acceptable brightness after bleaching (81-84%), the beating drastically reduced this parameter to 64-76% for *Acacia* species while remaining almost unaltered for *E. globulus* (from 84% to 81%). On the other hand, handsheet opacity, while decreasing with beating, showed the same behavior between *Acacia* species (83-86% to 74-78% at 2500 Rev) and *E. globulus* (83% to 76% at 2500 Rev). Overall results showed bleached kraft paper could be a promising end-use for Acacia species wood obtained from control actions, which could encourage further initiatives and help mitigate their propagation.

Keywords: Response surface methodology, kraft pulping, fiber morphology, handsheets properties