● Eco-friendly adhesive based on sugar for wood particleboards

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Abstract content

Introduction: Eco-friendly adhesive, in general, are poor used in sector such as sustainable packaging, furniture, and general woodworking now because all adhesives on the market are based on fossil-based resources. The demand for environmentally friendly adhesives has focused on reducing overall solvent content and improving cross-linking in the process and lowering solvent emissions. Sucrose adhesive are obtained from renewable resources poses other challenges such as improved the water resistance, the cost or stability of adhesive. Since the properties of these adhesives are promising, further research is needed along this line to improve the properties of sucrose-based adhesives. The purpose of this study is to analyze the different experimental variables that could influence the process using sucrose (S) and citric acid (CA). Methodology & Theoretical Orientation: The process for synthesizing wood adhesives based on sucrose and citric acid is carried out on a laboratory scale using a round three-necked flask, at a temperature of 100ºC for 2 and 4 hours. Magnetic stirrer was used at shear rate between180 and 540 rpm, and mass ratio of S and CA (S/CA) were 75/25 and 25/75. Besides, solid contents were varied from 83 to 60% The adhesive obtained were chemically characterized by ATR-FTIR spectroscopy, viscometry, and solid content determination. Thermal properties were analyzed by TGA and DSC. Particleboards were obtained using a spraying equipment and hydraulic hot press and pressing for 10 min at 200ºC and 80 bars. Samples were characterized by determination of moisture, density, resistance to swelling and tensile strength perpendicular to faces. Findings: Better results for sucrose and citric acid adhesives were obtained for a process at low agitation, at a synthesis time of 2 hours, at a higher sugar mass ratio, properties such as resistance to swelling worsened and by decreasing the Solid content improved fiber impregnation but tensile strength improves with increasing solids content. Conclusion & Significance: With an adhesive synthesized with sucrose and citric acid (100ºC, 180 rpm, 2 h, 75 (ca) / 25 (s) and 83% sc) it is possible to obtain samples of boards with properties such that they would exceed the specifications of UNE EN 312: 2010 for dry environment, however the improvement of the resistance to swelling and cohesion resistance should be studied in more detail in future works.

References

Shijing Sun 1, Zhongyuan Zhao 2,* and Kenji Umemura 3,* Further Exploration of sucrose-citric acid adhesive: Synthesis and application on plywood. Polymers. November 2019.