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Titulo: CALIBRATION OF THE MECHANICAL PROPERTIES OF SATURATING KRAFT PAPER SHEETS USING NEAR IR SPECTROSCOPY AND PHYSICAL TESTING

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Resumen: Saturating kraft paper is commonly used for laminate production through phenolic resin impregnation followed by in situ thermal resin curing. The laminate mechanical resistance and also its service performance depend on extent of resin curing. Nowadays, the conventional methods employed to quality control these products are time consuming, destructive, expensive, and, most of the time, supply only qualitative data. Using diverse temperature and time of treatments the extent of curing can be tuned to any values between 0 and 1. Kraft impregnating sheet production is a valuable niche market that has relied on empirical modeling for many years to improve quality and customer satisfaction. There are a number of proprietary technologies for their production, but the basic manufacturing motif is to form a wood pulp-based sheet that is then impregnated with polymer-based resin and the whole system is then heat cured. As far as we know, there have been very few systematic studies done to examine the process, let alone improve the state of the art in this market. However, there are a lot of data and patents that examine its assembly for decorative purposes of at least three plies of paper with at least one impregnated with phenolic resin; yet, the focus of a lot of past work concerns the gloss, pigmentation, and texture of the outmost ply. Saturating kraft paper was impregnated with phenol-formaldehyde (PF) resin and subjected to curing under nine different combinations of temperature and time. The minimum tensile modulus of elasticity was obtained at the lowest curing temperature (140 oC) and maintained the same higher value for the other two temperatures (160 and 180oC), and increased as the curing time increased. The tensile stress at the maximum load was highest for the median temperature of curing and presented the lowest value for the lowest temperature. NIR was successfully employed to predict the characterized properties through multivariate calibrations and provided correlation coefficients greater than 0.9. In general, our results suggest that NIR chemometrics can be used as a faster and cheaper tool to quality control tensile mechanical properties of PF resol resin-treated saturating kraft papers. To the best of our knowledge, prediction of mechanical properties of kraft paper treated with phenolic resin using NIR spectra not published, despite its great importance to industry because of its ability to supersede time consuming conventional methods.

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