

SUMMARY

The charcoal that is produced in the Province of Chaco, Argentina comes mainly from rubbish from sawmills and carpenter's shops.

The species *Aspidosperma quebracho-blanco* is the most abundant in the region of Parque Chaqueño and the charcoal, which comes from it, is the best paid in the market. The production of charcoal from this species is made in conventional furnaces, like the ones used in the building industry, with a charcoal yield of an approximately 25 % and a fixed carbon content of 74 %, both percentages upon a dry basis.

Because of the above mentioned, the reason for this investigation is to infer a more efficient alternative in the use of sawmill rubbish, from the destructive distillation, to improve on one hand the yield of the charcoal, and on the other hand, its contents of fixed carbon.

To do so, charcoal was produced from *Aspidosperma quebracho-blanco* through destructive distillation. This raw material, which came from the rubbish from sawmills of the whole province, was processed in a Destructive Distillation Pilot Plant which has a vertical retort, with enough room for 50 kg of wood, with indirect heating; an air condenser and a cross-current water one, a multiple temperature meter connected to a thermocouple type "K".

The destructive distillations were made according to a Central Composites Design controlling the following parameters: on one hand, changing the heating rate between 60 °C/h and 120 °C/h, and on the other hand, changing the final temperature of carbonisation between 450°C and 550 °C.

The rubbish used for the destructive distillation and the charcoal obtained from it were analysed under specific Argentine Institute of Material Rationalisation Standards (IRAM).

The results obtained show a yield of approximately a 48 % of charcoal and a fixed carbon yield greater than 82 %, both of them on a dry basis. To sum up, the charcoal yield, on a dry basis, produced by rubbish destructive distillation of the species *Aspidosperma quebracho-blanco* is enlarged in a 49 % as regards the conventional furnaces, working at a heating rate of 60 °C/h and with a final temperature of carbonisation of 450 °C.

The fixed carbon yield, on a dry basis, obtained by rubbish destructive distillation, is about a 13 % greater than the average in relation to the conventional

Keywords: Distillation of wood-*Aspidosperma quebracho-blanco* - Pyrolysis - Charcoal - Fixed carbon

EFFECTO DE LA IMPREGNACION CON CCA (CROMO-COBRE-ARSENICO) SOBRE LAS PROPIEDADES FISICAS Y MECANICAS DE LA MADERA DE *Pinus taeda* L.

EFFECT OF THE IMPREGNATION WITH CCA (CHROMIUM-COPPER-ARSENIC) ABOUT THE PHYSICAL AND MECHANICAL PROPERTIES OF THE WOOD OF *Pinus taeda* L.

M.Sc.Ciencias de la Madera, Celulosa y Papel
Orientación: Tecnología de la madera

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RESUMEN

Este trabajo tuvo por objetivo, estudiar el comportamiento de las propiedades físicas y mecánicas de la madera de *Pinus taeda* L. sin impregnar e impregnada por vacío-presión con preservador CCA (Cromo, Cobre, Arsénico) con tres retenciones, 5, 10 y 15 kg/m³ y la comparación entre ambas.

Para el estudio, se utilizaron seis árboles con catorce años de edad con un DAP (Diámetro altura del pecho) medio de 31 centímetros, proveniente de

Caraguatay, departamento de Montecarlo, provincia de Misiones.

El proceso de impregnado fue realizado en un autoclave de laboratorio, aplicándose el método Burnett, para hidrosolubles; el procedimiento consistió en realizar vacío inicial de 0,5 kg/cm² (-381 mm de Hg) durante 30 minutos, aprovechando este vacío se llenó el autoclave con el preservante y se aplicó 7 kg/cm² de presión por un lapso de tres horas. Luego se descargó el producto y se extrajeron las

probetas para su estacionamiento y secado bajo cubierta.

Los ensayos de las propiedades físicas y mecánicas se determinaron según lo establecen, las normas técnicas IRAM (Instituto Argentino de Racionalización de materiales), ASTM (American Society for Testing and Materials) y DIN (Deutsche Industrie Norm). Para ello se usaron una balanza Metler de precisión, balanza digital, calibres, estufas, desecadores y una máquina universal de ensayos SIFIC, de 10 toneladas de capacidad.

Los valores obtenidos de las propiedades de la madera sin impregnar e impregnadas con las diferentes retenciones fueron procesados estadísticamente y analizados. Del análisis de los resultados, sobre las propiedades físicas y mecánicas, se determinaron las siguientes conclusiones:

- 1) Las propiedades físicas como ser los pesos específicos a distintos porcentajes de humedad no son afectadas por las retenciones de CCA en la madera.
- 2) Las contracciones tanto en el sentido tangencial como radial en las maderas impregnadas son menores, significando esto una ventaja para las mismas.
- 3) Las propiedades mecánicas de resistencia a la flexión estática, compresión paralela a las fibras, tracción perpendicular a las fibras, dureza Janka radial y tangencial y corte paralelo radial, no han denotado diferencias estadísticamente significativas con respecto a la madera sin impregnar. Sin embargo el tratamiento ha producido un efecto positivo en la dureza Janka transversal y en el corte paralelo a las fibras tangencial.

Palabras clave: *Pinus taeda*, impregnación con CCA, propiedades físico-mecánicas,

SUMMARY

This work had by objective, to study the behavior of the physical and mechanical properties of the wood of *Pinus taeda* L. without impregnating and impregnating by empty - pressure with preserving CCA (Chrome, Copper, Arsenic) with three retentions, 5, 10 and 15 kg/m³ and the comparison between both.

For the study, were used six fourteen years old trees with a middle diameter of 31 centimeters, originating from Caraguatay, department of Montecarlo, Misiones province.

The process of impregnation was accomplished in an autoclave of laboratory, being applied the Burnett method, for hidrosolubles. The procedure consist of accomplishing initial vacuum of - 1 kg/cm² (- 381 mm of Hg) during 30 minutes; taking advantage of this vacuum, the autoclave was filled with the preservative and a pressure of 7 kg/cm² was applied pressure during three hours. Then, the product and was unloaded and the samples extracted for dryieng under cover.

The samples of the physical and mechanical properties were determined according to establish it, the technical procedures IRAM (Argentine Institute for Rationalization of materials), ASTM (American Society for Testing and Material) and DIN (Deutsche Industrie Norm). For this were used a of precision scale Metler, digital scale, calipers, stoves, driers and schemes and an Universal machine of trials SIFIC, of 10 tons capacity.

The values obtained from the properties of the wood without impregnation and impregnated with the different retentions, were estadístically processed and analyzed. Of the analysis of the results, on the physical and mechanical properties, were determined the following conclusions:

- 1) The physical properties as the specific weights to different percentages of humidity were not affected by the retentions of CCA in the wood.
- 2) The shrinkage so much in the tangential sense as radial in the impregnated woods were smaller, meaning this an advantage for the same.
- 3) The mechanical resistance properties to the statics flexion, parallel compression to the fibers, perpendicular traction to the fibers, hardness tangential and radial Yanka and paralell radial cut, they have not denoted statistically meaningful differences with respect to the wood without impregnation, however the treatment has produced a positive effect in the hardness transverse Yanka and in the parallel cut to the tangential fibers.

Key words: *Pinus taeda*, impregnation with CCA, Physics and mechanical proprieties.

DETERMINACIÓN DE TIEMPOS DE SECADO POR DIFUSIÓN EN CÁMARAS CONVENCIONALES PARA *Pinus taeda* IMPLANTADO DE MISIONES

DETERMINATION OF DRYING TIME BY DIFFUSION IN CONVENTIONAL KILNS FOR *Pinus taeda* IMPLANTED IN MISIONES

M.Sc.Ciencias de la Madera, Celulosa y Papel
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