

## A study on creep behavior of a wood flour-polypropylene-nanoclay hybrid composite

### Abstract

In this study, the effect of nanoclay particles content on creep behavior of the wood flour-polypropylene composite was investigated. To meet this objective, wood flour was mixed with polypropylene at the weight ratio of 60:40. The concentration was varied as 0, 3 and 5 per hundred compounds (phc) for nanoclay. The amount of coupling agent (PP-g-MA) was fixed at 2 phc for all formulations. The samples were made by melt compounding and injection molding. First, the modulus of elasticity, flexural and tensile strength of composites were measured before performing the creep test. Then, the short term flexural and tensile creep tests were performed at 20% of ultimate load in 12 minutes. The morphology of the nanocomposites was examined by using x-ray diffraction (XRD) and transmission electron microscopy (TEM). Results indicated that the creep deflection, relative creep and creep factor increases with the increase of nanoclay up to 3 phc and then decreases with addition of 5 phc nanoclay. Also, the effect of nanoclay was positive in terms of enhancing the mechanical properties of the composites. The morphological studies with XRD and TEM revealed that nanoclay was distributed as intercalation structure in polymer matrix.

**Key words:** composite, nanoclay, creep, mechanical strength, morphology.

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## Determination of effective criteria on development of RTA furniture industry in Iran

### Abstract

Ready to assemble furniture industry in Iran has not been considered by practitioners and investors as it is known in the other countries. While, it is possible to achieve the many competitive advantage, if this industry develop in Iran. With regard to this issue, the goal of this study is to introduce the potential market for ready to assemble furniture and determination and prioritize of the effective criteria on development of Iran ready to assemble furniture industry. For this purpose, after preliminary investigation and interview with some of the furniture producers and relevant experts, the identified criteria were divided into five major groups as Economic, Management, Marketing & Sales, Technical-Technological and Infrastructure and as well as 42 sub-criteria. The hierarchy of these criteria was designed and then the weighting values of criteria and sub-criteria were determined using Analytical Hierarchy Process (AHP) by expert choice software. The results indicated that the management and marketing & sales criteria have the highest weighting values at the first level. In addition, among the effective sub-criteria, the criteria as marketing innovation, design innovation, operations management, logistics management, raw materials innovation and product promotion, have the highest priorities for development of ready to assemble furniture industry in Iran.

**Keywords:** ready to assemble furniture, development, analytic hierarchy process (AHP), priority, criteria and sub-criteria.

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## Effect of dispersion and bleaching on the mechanical and optical properties of deinked recycled pulp

### Abstract

In this study, the effect of oxidative bleaching and mechanical dispersion on the optical and mechanical properties of deinked recycled pulp was investigated in different conditions. Industrial deinked pulp was treated in different conditions, including dispersion, combined oxidative bleaching during dispersion, separate dispersion, and oxidative bleaching. Handsheet papers were made from obtained pulps and were scanned. Spot content in taken photos were then analyzed by Digimizer software, version 4.1.1.0. Optical and mechanical properties of obtained handsheets were determined and compared. Results indicated that mechanical dispersion decreased spot content and brightness and increased yellowing of the handsheets. Moreover, mechanical dispersion increased dry and wet tensile and burst strengths, water retention value (WRV), ash content and decreased tear strength of handsheet papers. This study revealed that combined dispersing and oxidative bleaching of deinked pulp provides superior results in comparison to the separate dispersing and oxidative bleaching.

**Keywords:** disperger, deinked Pulp, tissue paper, spot content, optical and mechanical properties.

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## Evaluation of *Prosopis juliflora* (Mesquite) potential in Kraft pulping

### Abstract

In this research, physical, biometrical and chemical properties of *Prosopis juliflora* wood as well as physical and mechanical properties of kraft pulp from this species were investigated and calculated. Dry and critical densities of *Prosopis juliflora* were 0.806 and 0.696 g/cm<sup>3</sup>, respectively. Fiber length was 895 $\mu$ m, and cellulose, lignin, extractives, and ash were 48.80%, 23.66%, 3.88%, and 1.1%, respectively. The preparation conditions of Kraft pulp were as follows: effective alkaline 14, 16 and 18%, cooking time 120 and 180 min, temperature of cooking 170 and 180 °C and *L/W* ratio 5 to 1. After calculating the amounts of yield and Kappa number of pulps, two treatments were determined. The freeness of two pulps was achieved approximately 400 (CSF) by refining. Then, physical and mechanical properties of the handsheets were calculated. Finally, statistical analysis of pulp and handsheets data were performed by completely randomized factorial, duncan and T-test methods. The results showed that the handsheets resulted from produced Kraft pulp under the following conditions had better mechanical properties: effective alkaline of 18%, cooking time of 120 minutes, and cooking temperature of 180°C. The investigation results showed that *Prosopis juliflora* of south regions of the country has suitable properties for Kraft pulp preparation in comparison to other similar hardwood species and development of its planting is recommended in the region.

**Keywords:** *Prosopis juliflora*, Kraft pulp, physical properties, chemical properties, mechanical properties.

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## Optimization of cement-bonded particleboard properties made from cotton stalk and sawdust with chloride calcium ( $\text{CaCl}_2$ ) additive

### Abstract

The aim of this study was to evaluate the hydration behavior and mechanical properties of cement-bonded particleboard manufactured from cotton stalk and sawdust containing chloride calcium as an additive in different ratios. At first, curing time of cement paste containing different levels of  $\text{CaCl}_2$ , wood and cotton stalk flour was determined. Moreover, the effect of  $\text{CaCl}_2$  content, weight ratio of cotton stalk particle to wood particle and percent of sawdust on bending strength, modulus of elasticity and internal bonding of cement-bonded particleboard were estimated by response surface methodology. In order to optimize board properties, equation of mathematical model (second order polynomial regression model) was provided by a computer simulation program. Results showed that there was a favorable conformity between predicted and observed values (regression coefficients ( $R^2$ ) for modulus of rupture, modulus of elasticity and internal bonding were 0.93, 0.90 and 0.95, respectively). Also, it was determined that the response surface methodology can effectively be applied for modelization of board properties. According to obtained results, maximum values of modulus of rupture, modulus of elasticity and internal bonding were obtained by mixing percent of cotton stalk to poplar wood at weight ratio of 43:57, 4.5% of  $\text{CaCl}_2$  as an additive and 9% of sawdust.

**Keywords:** cement-bonded particleboard, cotton stalk, sawdust, mechanical properties, additive.

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## The influence of type of calcium carbonate fillers on the performance AKD and mechanical properties of printing and writing paper

### Abstract

This study aimed to evaluate the effect of sizing agent and various fillers on properties of printing and writing paper. Therefore, sizing agent (AKD) in 1.5% level and fillers including precipitated calcium carbonate (PCC), ground calcium carbonate (GCC) and the one obtained from water treatment process (softening calcium carbonate; SCC) in 30% level were applied based on dry weight of fibers to produce 60 g/m<sup>2</sup> basis weight handsheet papers according to TAPPI Standard. These papers were made in a furnish consisted of 80% mixture of chemical and CMP pulp of hardwood and 20% bleached softwood Kraft pulp (BSKP). Results showed that the dimensional properties of calcium carbonate species are effective on strength properties of paper. Among three types of used calcium carbonate, PCC caused a further reduction in paper strength due to smaller particles while SCC had a minimal impact on reducing the paper strength properties due to its larger particles. Paper filled with PCC had an intermediate strength property comparing to papers filled with PCC and SCC.

**Keywords:** calcium carbonate fillers, AKD, strength properties, printing and writing.

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## The mechanical properties of *Acer velutinum* var. *glabrescens* wood growing in different regions of Caspian forests

### Abstract

To determine the important mechanical properties of maple wood (*Acer velutinum* var. *glabrescens*) in four forest habitats in the north of Iran (Shafaroud region of Gilan, Golestan, Sangdeh and Visser) based on the ASTM Standard D143-52, 12 tree species were selected and then cut. Mechanical and physical properties were measured on both green and air-dried samples (12% moisture content). The data in both dry and green in different habitats were classified by analysis of variance and Duncan methods. The results showed that the drying timber enormously improves mechanical properties. Results of statistical analysis showed that the mechanical properties of maple wood were influenced by the altitude, but these changes depended on the measured property. The effect of geographical direction was not significant on the most mechanical strengths and the highest strengths were observed in the bottom of trees. In addition, the measured properties did not follow a specific trend: they decreased in the middle of trunk and then increased. In comparison of studied habitats, Visser and Sangdeh trees showed the highest and the lowest mechanical strengths.

**Keywords:** maple, *Acer velutinum* var. *glabrescens*, static bending, parallel to grain compression, perpendicular to grain compression.

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## The effect of biodegradable coatings on the barrier properties of papers

### Abstract

The objective of this work was to compare barrier property of biodegradable coatings on two base papers. Two different paper grades differing in structure (Kraft liner and printing & writing papers) were used. The papers were made in Mazandaran wood and paper industry. Coating materials with 30% solid content, included clay (100 parts) and cationic starch (12 parts), were mixed with two binders (PLA 10 parts and PVA 10 parts) for two formulations. The immersion method in both levels was 1 and 2 minutes and two coating formulations were applied on papers. Then, the treated samples were dried in standard room conditions (25°C of temperature and 54% of relative humidity). For that purpose, air resistance or porosity, thickness, mass, and Cobb60 were determined. As expected, time of treatment reduced porosity and increased coating weight, but in terms of barrier properties, combination containing PVA was more effective than PLA. In comparison to the control group, all treated samples had higher air resistance and water absorption due to an increase in capillary of texture paper. The analysis of results showed that the immersion coating factors had considerable effects on performance of air resistance improvement and coating weight of papers. Then, calculated values of the thickness and density of coating were evaluated, which confirmed the status of water absorption. The treatments greatly increased the wettability of the surface by water.

**Keywords:** coating, immersion of paper, barrier properties, poly lactic acid, polyvinyl acetate.

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## Dynamic mechanical and thermal properties of bagasse/glass fiber/polypropylene hybrid composites

### Abstract

This work aims to evaluate the thermal and dynamic mechanical properties of bagasse/glass fiber/polypropylene hybrid composites. Composites were prepared by the melt compounding method and their properties were characterized by differential scanning calorimetry (DSC) and dynamic mechanical analysis (DMA). DSC results found that with incorporation of bagasse and glass fiber, the melting temperature ( $T_m$ ) and the crystallisation temperature ( $T_c$ ) shift to higher temperatures and the degree of crystallinity ( $X_c$ ) increases. These findings suggest that the fibers played the role of a nucleating agent in composites. Dynamic mechanical analysis indicated that by the incorporation of bagasse and glass fiber into polypropylene, the storage modulus ( $E'$ ) and the loss modulus ( $E''$ ) increase whereas the mechanical loss factor ( $\tan\delta$ ) decreases. To assess the effect of reinforcement with increasing temperature, the effectiveness coefficient  $C$  was calculated at different temperature ranges and the results revealed that, at the elevated temperatures, improvement of mechanical properties was more noticeable due to the presence of fibers. The fiber-matrix adhesion efficiency determined by calculating the adhesion factor  $A$  in terms of the relative damping of the composite ( $\tan \delta_c$ ) and the polymer ( $\tan \delta_p$ ) and volume fraction of the fibers ( $\Phi_f$ ). Calculated adhesion factor  $A$  values indicated that by adding glass fiber to bagasse/polypropylene system, the fiber-matrix adhesion improves. Hybrid composite containing 25% bagasse and 15% glass fiber showed a better fiber-matrix adhesion.

**Keywords:** adhesion factor, bagasse, dynamic mechanical analysis, effectiveness coefficient, glass fiber, hybrid composite.

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## Study on adhesion strength of clear coatings in beech -furfuryl alcohol wood polymer

### Abstract

The objective of this study was to determine the influence of Furfurylation treatment on adhesion strength of clear coatings and surface roughness of Beech (*Fagus orientalis*) wood. Furfurylation of specimens were performed by impregnation and heat catalyze up to 20% and 65% weight percent gain. Half of the specimens were coated with acid catalyst paint and the rest were coated with polyurethane based paint. Surface roughness and adhesion strength (Pull-off) and cross-cut test were analyzed and compared to untreated specimens. Results revealed that 20% furfurylated specimens did not show significant difference in roughness and adhesion strength, compared to untreated control but 65% furfurylation of the specimens caused a decline in adhesion strength and raised surface roughness. Polyurethane based paint had better efficiency and adhesion strength than acid catalyst paint. The highest adhesion strength was observed in 20% furfurylated specimens coated with polyurethane and the least was obtained in 65% furfurylated wood coated with acid catalyst paint.

**Keywords:** adhesion strength, roughness, clear coating, furfurylation, beech.

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## Effect of hot water and dilute acid pretreatment on the chemical properties of liquorice root

### Abstract

In this study, previously extracted liquorice root was pre-hydrolyzed and the resulting chemical compositions (extractives, lignin content, holocellulose percent), the hydrolysis process yield and weight loss were measured. Pre-hydrolysis process was done by hot water, followed by 0.5 percent sulfuric acid and also alone sulfuric acid with different concentrations (0.5, 1, 1.5 and 2 percent). The samples were pre-hydrolyzed in hot water at 150 °C and 30, 60 and 90 minutes as well as in the mixture of hot water and 0.5 % sulfuric acid at 150 °C and 30 minutes and also in pure sulfuric acid, at 130 °C and at 60 minutes. The results showed that the pre-hydrolyzed treatment with hot water in 60 minutes was the best treatment in respect of weight loss, lignin content and holocellulose percent. Also, in the case of pre-treatment with sulfuric acid, 2% level of acid was a good option in terms of maximum holocellulose percent and minimum lignin content, so it can be suggested to produce higher value-added products such as bioethanol from licorice root.

**Keywords:** licorice root, pre-hydrolysis, biomass, hot water, dilute acid.

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## Analysis of location quotient index of poplar wood processing value chain in Iran

### Abstract

Value addition in the poplar wood value chain has great economic effects on poplar farmers and has a fundamental role in sustainable supplying of required cellulosic materials for industries in long-term. The purpose of this study was to analyze the value chain of poplar and use the results to improve poplar wood value chain. In order to determine the poplar value chain, Porter's value chain analysis framework was used. The statistical society was consisted of 76 experts to identify poplar wood value who were active in different parts of the value chain. Value chain analysis was performed using the location quotient index. With this method, the local economic conditions of poplar wood value chain were evaluated to the global economic conditions poplar wood value chain in Iran. With the help of experts and using a questionnaire, important industries that use poplar wood as a raw material were determined. The maximum poplar value chain location quotient index belonged to Golestan (2.72) and the minimum poplar value chain location quotient index belonged to Hormozgan (0.24). Golestan, Guilan and Mazandaran provinces with location quotient indexes of 2.72, 2.19 and 2.03, respectively, had the highest location quotient index compared to other provinces. The location quotient index of poplar wood processing in Zanjan, West Azerbaijan, East Azerbaijan and Kurdistan which are major manufacturers of poplar wood, were 0.36, 0.47 0.65 and 0.84, respectively.

**Keywords:** value chain, poplar wood, location quotient, Iran.

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