The effect of using the textile waste fibers and nanoclay particles on physical and mechanical properties of composite made from wood flour/polypropylene

This study was conducted to investigate the feasibility of using waste textile fibers and the effect of nanoclay content on the physical and mechanical properties of a composite made from wood flour and polypropylene. Therefore, wood flour and polypropylene (50:50 weight ratio) were mixed in an extruder at 160°C with textile waste fibers in two levels (0 and 15%), nanoclay in three levels (0, 2 and 4%), and 3% compatibilizer. Afterwards, the specimens were made with injection molding technology. Mechanical properties including tensile, flexural, and notched impact strengths and also physical properties such as water absorption and thickness swelling were measured. The overall results showed that addition of textile fibers significantly improved the mechanical properties of the studied composites while the physical properties were reduced. The results indicated that the physical and mechanical properties of wood plastic composites, except for notched impact strength, improved with increasing nanoclay content. The results of morphological studies aimed at evaluating the distribution of nanoclay using a range of X-ray diffraction (XRD) showed that the distribution of particles in the polymer matrix is the type of intercalation, and by increasing nanoclay content, layer to layer distance was increased.

Determination and prioritization of effective criteria in construction of particleboard factories with using wastes of tamarisk, palms and musa trees case study: Sistan and Baluchestan province

According to the wrong uses of valuable lignocellulosic resources in Sistan and Baluchistan province and wood industries demand for raw materials in the mentioned province, determination and prioritization of effective criteria in construction of particleboard factories using wastes of Tamarisk, Palms and Musa trees were considered as the purposes of this research. There were 7 main criteria and 52 sub-criteria for construction of such factories. The important criteria were: materials and products, environmental, cultural and social, technical and human, economic, and financial infrastructures, and also geopolitical issues and laws and regulations. Numerous methods have been mentioned for determining the effective criteria in construction of wood industries, one of which is the "Analytical Hierarchy Process". In this method, questionnaires were provided and completed by experts. The results were processed with "Expert Choice" software, and the most important criteria were characterized. Some of the mentioned criteria were: assurance of offering the base materials (0.088), ceaseless work force (0.055), transport of base materials (0.052), available materials in location (0.048), regional economic growth (0.044), quality of base materials (0.042), facilities of life (0.036), cost of base materials (0.034), flexibility of factories in change of base materials (0.033), and profitability and time of investment returning (0.033).

Evaluation f pulp and paper properties obtained from maple juvenile wood through organosolve alcohlol method catalyzed by calcium and magnesium salt

The properties of catalyzed organosolv pulp obtained from maple juvenile wood were studied. The physical properties of fiber (e.g. length, width, and cell membrane thickness) and chemical composition of maple juvenile wood (e.g. average cellulose, lignin, extractives, and ash content) were determined. The variables were cooking temperature (190 and 200 ºC) and time (40, 60, and 80 minutes). Chemical charge (280 ml methanol, 70 ml water, and 0.025 mols of Calcium Chloride and Magnesium Nitrate) was kept constant. Pulp screen yields (54.9 to 60.91%) and Kappa No. (15.5 to 18.4) were measured. Pulp freeness was reduced to 350 ml CSF in PFI mill, and ten 60 g/m^2 handsheets were made from the selected pulps. The strength properties of catalyzed organosolv handsheets including tear length (3.83 to 4.25 km), tear index (10.22 to 12.81 $mN.m^2/g$), and burst index (1.74 to 2.15 $kPa.m^2/g$) were compared with those of the conventional Kraft handsheets of maple juvenile wood. The least allowed values of the mentioned properties in the Indian (IS) and Japanese international standards (JIS) reveal that while the tear length value is slightly below that of the standards, the values of tear and burst indices are well beyond the given standards, and the environmentally-friendly catalyzed organosolv pulping process (higher yield and lower Kappa No. compared to Kraft) can be recommended to produce paper pulp from maple juvenile wood.

Analysis of Poplar value chain model in Western Azerbaijan province aims to upgrading

Due to the size and importance of poplar culturing and its role in West Azerbaijan province economy, evaluation of poplar value chain is necessary. By drawing up a comprehensive value chain and identifying the existing shortages, the conditions of completing the value chain in the mentioned province were studied. Finally, due to the shortages of the value chain, the proper strategy to develop the value chain was identified using ANP. The results of the calculation of location quotient in West Azerbaijan province showed that the LQ is equal to 0.65852. Due to its lower LQ than one, it can be concluded that poplar costumers in West Azerbaijan province are less than the country average. The results of prioritizing the criteria affecting on poplar value chain development in the above-mentioned province indicated that the most important criterion is the access to wooden raw materials weighing 0.16. After that, the stable supply of raw materials, machinery and equipment, manpower, proximity to local markets, expertise, and financial resources are with weights of 0.132, 0.123, 0.116, 0.105, 0.102, and 0.07, respectively. The weights of the other criteria have a little importance in the development of poplar value chain. The final results of prioritizing the alternatives showed that the maximum weight is related to particleboard with 0.295. The following options having development priority are OSB, MDF, and HDF which have a weight of 0.185 and 0.178, respectively. After the composite wood products, chemical products namely cellulose, pulp, and paper have priority with weights of 0.112, 0.1, and 0.066, respectively.

Comparison of predicted thickness swelling of particleboard with fuzzy systems and artificial neural networks

Swelling percentage is one of the important physical properties of the final product. Determination of Swelling is a time consuming and high cost process. Therefore, prediction of the percentage of board swelling during production process can ensure a consistent quality of production. In this research, variables such as the moisture content of wood particles before dryer, the amount of adhesive used per board, press time, press temperature, press pressure, and swelling percentage of particleboard were collected from the production line of Debalkhazae mill. The normalized data was analyzed by artificial neural network and fuzzy systems. Also, swelling percentage was predicted by the most optimal model. The best model to predict the percentage of board swelling is 5-5 basis of artificial neural networks, and the best function of fuzzy systems is Z-shaped curve membership function. Means absolute percent errors of the predictions are 5 and 22 %, respectively. ANN method has better performance compared with fuzzy systems.

Industrial round-wood losses associated with motor-manual tree felling and bucking (Case study: Kheyrud forest)

Damage to the harvested log can occur during the felling, delimbing, bucking, skidding, piling, and, hauling functions of wood harvesting. A field-based study was performed to determine the amount of industrial round-wood losses associated with most applicable motor-manual tree felling and bucking systems in the Gorazbon district in Kheyrud forest, north of Iran. Observations were made for motor-manual harvesting systems during the felling and bucking operations. The damages detected were broken down into four groups in the felling operations: split damage, stump height, slab damage, and splintering or breakage damage. There were three types of damage recorded following the bucking operations: split damage, splintering or breakage damage, and measurement error or deviation from the desired log dimensions. In the felling operations, splintering or breakage damage and splits were the most frequent types of damage. The majority of woody tissue damage in the bucking process was caused by measurement error. The total losses in industrial round-wood volume were measured as 32.6 cubic meters (in the felling and bucking operations; were as 86 and 14 percent, respectively). The total losses in industrial round-wood value at the study area were estimated as 196.6 million Rials (in the felling and bucking operations; were as 85 and 15 percent, respectively).

Study on Physical and Mechanical Properties of Wood flour/ABS Composites

The aim of this research was to study the effect of SMA, as coupling agent (0, 4 phc), wood flour filler loading (30, 40, 50% of total weight), wood flour filler loading (30, 40, 50% of total weight), and virgin and recycled ABS on physical and mechanical properties of wood flour/Acrylonitrile Butadiene Styrene (ABS). Samples of composites were made by injection molding method, and physical tests including long term water absorption and thickness swelling, and mechanical tests containing hardness and tensile strength and also their moduli were performed according to ASTM standards method. The results showed that by increasing the amount of wood flour, water absorption, water absorption coefficient, thickness swelling, hygroscopic thickness swelling rate, hardness, tensile strength and modulus of composites were increased. Using virgin ABS in composites increased the tensile properties and hardness, but water absorption, thickness swelling, and the other parameters decreased. Using SMA in composites decreased the hardness of the composites.

Use of viscozyme enzyme as an alternative technology for pulp refining and improvement bagasse soda pulp properties

In this research, the effect of enzyme treatment on modifying bagasse soda pulp properties was investigated. Viscozyme enzyme (mixture of carbohydrates degrading enzymes), extracted from fungus Aspergillus aculeatus, was added to pulp at different dosages of 0.5, 1, and 2 IU (based on per gram of oven-dried pulp) at reaction times of 0.5, 1, and 2 hours. Tappi standard was used for handsheets preparation. Analysis of variance and Duncan test were used for comparing handsheets properties and the resulted means, respectively. The results showed that pulp freeness and polymerization degree decreased as the enzyme dosages and reaction times increased. In fact, enzymatic pretreatment by partial fiber fibrillation played the role of a refiner and improved the mechanical properties of the paper. Tensile and burst indices were improved by enzymatic treatment. Enzyme concentration of 0.5 IU and 1hr reaction time had the most effect on tensile and burst indices. Although higher enzyme concentrations (2IU) decreased the strength properties of pulps due to declined viscosity, these enzyme treated pulps had higher strength properties compared to the control sample.

The effect of combined colloidal nano silver hydrothermal treatment on weight changes and chemical structure of beech wood (*Fagus orientalis*)

In this research, synthesis of colloidal silver nano-particles, as well as the effect of combined colloidal nano-silver and hydrothermal modification on weight and chemical changes of beech (Fagus orientalis) wood through spectroscopic FTIR was investigated. Treatment levels were divided into 4 groups namely, control, nano- impregnated, hydrothermal, and nano-hydrothermal. Hydrothermal and nano-hydrothermal treatments were separated into two temperatures (150 and 170°C) and two times (30 and 45 min) with total of 10 treatment levels. Colloidal Nano silver with 100 ppm concentration was prepared. The scanning electron microscope images clearly proved the presence, size and appropriate distribution of colloidal silver nanoparticles in wood particles. With regard to the results, increasing the time and temperature of hydrothermal treatment had significant effect on weight changes. Also, colloidal nano silver intensified weight loss, which was maximum at 170°C. The FTIR spectra indicated that increase in the temperature and time of hydrothermal treatment declined absorbance intensities in wave numbers of 3422.25, 2922.38, 1740.55, 1330.50, 1243.39, and 1053.05cm^{-1} due to breakdown of acetyl groups in hemicelluloses and decrease in hydrophilic sites. These reductions were more obvious in samples treated with nano hydrothermal method compared to those which were hydrothermally treated.

Effect of heat-treatment with raw cotton seed oil on decay resistance and dimensional stability of Beech (*Fagus orientalis*)

This research was conducted to determine the effect of raw cotton seed oil heat-treatment on decay resistance and dimensional stability of beech, which were determined according to EN113 and ASTM-D1037 standards, respectively. The heat treatment of raw cotton seed oil was carried out in a cylinder at the temperatures of 130 and 170 ºC for 30 and 60 minutes. Following the decay of samples, oil uptake, density, volumetric swelling, water absorption, and weight loss were measured. Oil uptake at 30 and 60 min were determined as 10.5 and 13.3 Kg/cm^3, respectively. Oil-heat treated samples at 30 min and 130°C indicated the maximum density showing an increase of 87.7% compared to the control sample. According to the obtained results, water repellency and dimensional stability improved with oil-heat treatment. Water absorption in 130°C and 60 minutes showed a 76% reduction in comparison with the control samples. Decay resistance of the samples which were oil soaked for 60 minutes was 80.2% more than that of the control ones. Compared to oil treatment, Oil-heat treatment improved decay resistance to a higher extent, and this effect was significant at 30 min treatment time. Adding the temperature of oil–heat treatment at 30 minutes improved decay resistance, but increasing the time of treatment at the same temperature did not have a significant effect on decay resistance improvement.

The effect of nanoclay on physicochemical, mechanical and thermal properties of new urea- glyoxal resin

In order to eliminate the environmental harm of formaldehyde emission from panels bonded with UF resin, a type of urea (U) with low volatility and a nontoxic dialehyde -glyoxyal (G)- were reacted to prepare urea-glyoxal (UG) resin as a new type of wood adhesive and a substitute for the conventional urea-formaldehyde (UF) resin. The urea-glyoxal (UG) resin was synthesized under weak acid conditions, and its physico-chemical, mechanical and thermal properties were determined. The effect of nanoclay on the properties of UG resin was also investigated. For this purpose, the prepared UG resin was mixed with 0, 1, 2, and 3 wt% nanoclay under mechanical stirring for 5 min at room temperature. The physico-chemical properties such as SPG, viscosity, solid content, and gelation time, and dry shear strength of the prepared resin were determined according to standard methods. The strength properties of UG resin and the effect of nanoclay on curing temperature of UG resin were analyzed by shear test and Differential Scanning Calorimetry (DSC) device, respectively. The physico-chemical test results indicated that addition of nanoclay increased SPG, viscosity, and solid content of UG resin, while gelation time of the prepared resin decreased. Dry shear strength test results showed that increasing nanoclay content from 1 to 3 wt% increased shear strength of UG resin, as the panels containing 3% nanoclay exhibited the highest values of shear strength and wood failure percentages. Based on DSC test results, hardening rate as well as enthalpy value of the prepared UG resin decreased by addition of nanoclay.

Investigation on the possibility off manufacturing the Kraft pulp from Criptomeria wood

In this study, chemical composition, fiber biometry, pulp, and paper characteristics obtained from *Criptomeria japonica* wood grown in Gilan province (Pisseson region) were investigated. Mean values of specific gravity and basic density of wood were 0.376 and 0.338 gr/cm^3, respectively. Also, fiber (tracheid) dimensions including fiber length, fiber diameter, lumen diameter and cell wall thickness were determined as 2920, 41.23, 32.57, and 4.41 µm, respectively. The chemical composition of *Criptomeria japonica* wood including α-cellulose, lignin, extractives, and ash content were analyzed. On average, *Criptomeria japonica* wood has 48.35% cellulose, 32.08% lignin, 0.988% ash, and 5.64% extractives. The results of this investigation showed a total average pulp yield of 50.53%. With a 6% increase in effective alkali charge from 12% to 18%, pulps yield decreased at a confidence level of 99%. Breaking length of handsheets made at 12%, 14%, and 18% effective alkali were 7.36, 7.17, and 9.14 km, respectively. It was also observed that burst strengths of handsheets made at 12%, 14%, and 18% effective alkali were 4.87, 4.93, and 6.19 KPam^2/g as well.

Study on leaching of copper nanoparticles in combined impregnation-densification treatments of wood after accelerated aging

This study was performed to evaluate the effect of steaming and densification on the leaching rate of wood impregnated by copper nano oxide particles with concentrations of 200 and 400 ppm, repectively. The impregnation of poplar and spruce wood was carried out under a pressure of 4 bar for 20 minutes. Half of the specimens impregnated with the nano particles were oven-dried and then steamed at 150°C for 2 hours. The given specimens were then densified under a hot press at 170°C for 3 hours to reach a compression rate of 33%. All the specimens were exposed to the 6 steps of accelerated aging procedure according to ASTM D-1037. Leaching test was performed according to EN84 standard (1997) for a period of 14 days. The leaching residues were investigated in the Mineral Exploration and Geological Center by atomic absorption method. Results showed that the specimens impregnated only with nano-copper particles had no leaching, whereas steaming pretreatment and densification led to the leaching of nano-copper particles from the treated wood.

Cellulose nanocrystal properties and their applications

The main purpose of this work is to provide an overview of recent research in the area of cellulose nanomaterials production from different sources. Due to their abundance, their renewability, high strength and stiffness, being eco-friendly, and low weight, numerous studies have been reported on the isolation of cellulose nanomaterials from different cellulosic sources and their use in high performance applications. This work covers an introduction into the nano cellulose definition as well as the methods used for isolation of nanomaterials (nanocrystals) from various sources. The rod-like cellulose nanocrystals (CNC) can be isolated from sources like wood, plant fibers, agriculture and industrial bio residues, tunicates, and bacterial cellulose using acid hydrolysis process. Following this, the paper focuses on the characterization methods, materials properties, and structure. The current review is a comprehensive literature regarding the nano cellulose isolation and demonstrates the potential of cellulose nanomaterials to be used in a wide range of high-tech applications.