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**Contents**

- 1 Application of artificial neural network and ordinary least squares regression in modeling land use changes  
Sara Azizi Ghalaty; Kazem Rangzan; Ayub Taghizadeh; Shahram Ahmady
- 2 Effects of ground-based skidding using wheeled skidder timberjack 450C on forest soil physical properties (Case study: Gorazbon District, Kheyroud Forest)  
Shokouh Soltanpour; Meghdad Jourgholami
- 3 Structure and composition of oriental beech stands in the middle stage of ecological succession in the hyrcanian region  
Mahdi Kakavand; Mohanad Reza Marvi-Mohadjer; Khosro Sagheb-Talebi; Kiomars Sefidi
- 4 Morphological characteristics of old trees in hyrcanian forest (Case study: Pattom and Namkhaneh districts, Kheyroud)  
Mojtaba Azaryan; Mohammad Reza Marvie Mohadjer; Vahid Etemaad; Anoushirvan Shirvany; Seyed Mohammad Moein Sadeghi
- 5 Some soil and quantitative characteristics of Christ's thorn (*Ziziphus spina christi* L. Desf.) in natural sites of south west of Iran (Case study: Khuzestan and Booshehr provinces)  
Pedram Ghadiripour; Khosro Sagheb Talebi; Mohammad Hassan Saleheh Shushtari; Omid Esmailzadeh
- 6 Effect of osmopriming on germination indices of salinity-affected seeds of *Pinus eldarica* Medw.  
Zeinab Javanmard; Masoud Tabari; Hamid Reza Eisvand; Fatemeh Ahmadloo
- 7 Swelling control of forest road bed soil by polymeric materials  
Fatemeh Mousavi; Ehsan Abdi
- 8 Influence of source variation on biomass and survival of Caucasian oak (*Quercus macranthera*) in kentia nursery in north of Tehran  
Shima Hasanvand; Vahid Etemad; Manouchehr Namiranian; Pedram Attarod; Noushin Aftabtalab
- 9 Spatial patterns and intra-specific competition of chestnut leaf Oak (*Quercus castaneifolia*) using ripley's K-function (Case study: Neka-Zalemrood forest- Sari)  
Farideh Omidvar Hosseini; Reza Akhavan; Hadi Kia-Daliri; Asadollah Mataji
- 10 Xylem and Bast Fiber Properties of Six Iranian Hemp Population  
Amir Saadati; Kambiz Pourtahmasi; Seyed Alireza Salami; Reza Oladi
- 11 Potential of canola oil utilization in dielectric paper fabrication using unbleached bagasse pulp  
Kajal Moradian Gilan; Mohammad Azadfallah; Amir Abbas Shayegani Akmal; Ali Abdolkhani
- 12 Accelerated autocondensation of quebracho tannin wood adhesive by boric acid  
Davood Efhamsisi; Yahya Hamzeh; Marie-France Thevenon; Ali Naghi Karimi; Anotonio Pizzi; Kambiz Pourtahmasi
- 13 The effect of extraction method on bioactive phenolic compounds of *Cupressus arizonica*  
Ali Abdulkhani; Akram Sedaghat; Faramarz Khodayian Chegini; Mohammad Hadi Ghasemi
- 14 Investigation changes in structure and thermal properties of glyoxalated soda and kraft lignins  
Hamed Younesi Kordkheili; Saeed Kazemi Najafi; Rabi Behrooz; Antonio Pizzi
- 15 Influences of Combined-Hydro-Thermo-Mechanical (CHTM) modification on moisture absorption and dimensional stability of poplar wood  
Peyman Fallah-Moghadam-Behambari; Behbood Mohebbi; Hoori Sharifinia Dizboni
- 16 Effect of styrene and methyl methacrylate monomers on mechanical properties and decay resistance of beech (*Fagus Orientalis*)  
Maryam Ghorbani; Rozhin Kaki; Asghar Omidvar
- 17 Investigation of physical and mechanical properties of old magazine recycled fiber and glass fiber- polypropylene hybrid composite  
Monireh Imani; Ali Ghasemian; Alireza Shakeri; Iman Akbarpour
- 18 The effect of cationic modification of Precipitated Calcium Carbonate (PCC) on the optical and physical properties of paper  
Moghadaseh Akbari Amri; Nadia Kaboodi Torabi; Hossein Resalati; Ghasem Asadpour; MohammadReza Dehghani



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## Application of artificial neural network and ordinary least squares regression in modeling land use changes

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### ABSTRACT

Owing to the vital effects of future land use changes, it is necessary to predict land use growth pattern before any decision making by the authorities and decision makers. Purpose of this research is to model land use change of Kohmare Scorch plain of Shiraz province using Ordinary Least Squares regression (OLS) for pre-processing variables and Modeling using neural networks. To perform this model, the land use maps using Landsat images of the years 1987, 2000 and 2012 were prepared. Next, the validation of classified images and change detection analysis performed. Results of change detection between 1987 and 2000 with accuracy of 83% kappa, shows the greatest increase in rangeland area (4224.24 ha) and the greatest decrease was on forest area (3953.75). Considering these changes, selection of the best combination of explanatory variables, potential land use changes for year 2012 was performed using multi-layer perceptron algorithm of artificial neural network. Next, using Markov chain method the land use map for 2012 was predicted. The error matrix for modeled land use map and that of Landsat image of year 2000 is 75%. Next, the revealed changes for the second period (2000-2012) with Kappa of 88% show greatest increase for rangeland area (1807.02ha). In contrast the greatest decrease was for forest (2132.82). Considering change detection at second period, land use for year 2024 was predicted and result shows that irrigated agriculture would have the greatest change.

**Keywords:** land use change, modeling, multi-layer perceptron neural network, ordinary Least Squares.

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## Effects of ground-based skidding using wheeled skidder timberjack 450C on forest soil physical properties (Case study: Gorazbon District, Kheyroud Forest)

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### ABSTRACT

Forest harvesting operations for extracting of forest products in these trails, causing extensive damage in a wide range of soil and its productivity every year, therefore it is necessary to research about degradation of soil properties should be down. The aim of this study was investigate changes in the skid trails soil physical characteristics due to wheeled cable skidder traffic by measuring soil texture, bulk density, porosity and soil penetration resistance. For this purposes, 311 and 319 compartments of Gorazbon district in Kheyroud educational and research forest were selected. This study was conducted in a completely randomized factorial design and treatments consisted of two slope (uphill and downhill), three levels of skidder traffic intensity such as low intensity (less than 3 passes), moderate (3 to 7 passes) and very large (more than 7 passes) and two soil depths (0-10 and 10-20 cm). The results showed that machine traffic intensity and skid trail slope statistically had significant effects on soil compaction. Soil compaction and penetration resistance will increase with increasing of machine traffic, but the largest percentage increase observe in initial passes (less than 3 times) although subsequent passes change this factors, but its trend is not significant, also soil compaction is greater than in the uphill skidding of downhill skidding and in the 0-10 cm soil depth greater than 10-20 cm. Hence, we concluded that skidding operation should be planned in slope lower than 20% and uphill skidding (higher than 10%) should be excluded from ground-based logging systems.

**Keywords:** penetration resistance, slope gradient, soil compaction, soil depth, total porosity.

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## Structure and composition of oriental beech stands in the middle stage of ecological succession in the hyrcanain region

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### ABSTRACT

This study was designed to investigate the structural characteristics of beech forests in the middle stage of ecological succession. In order to this purpose undisturbed beech stands in Kheyroud forest had chosen and three one hectare sampling plot laid out. All of tree species measured with full callipering method and diameter and height of trees were recorded. Natural regeneration within one hectare plots was counted and recorded in three different height classes including: i) shorter than 30cm, ii) between 30and 130cm, and iii) taller than 130 cm. Vitality and stem form of seedlings and asplings were also recorded as unforked, forked and broom-shaped forms. According to the results, beech stands in this stage of succession are far from typical irregular structure and deficiency of tree number in diameter classes of 10cm and over55cm is obvious. Meanwhile stratification of trees in different stand stories within one, two and three hectare area calculated and results revealed 40, 48.5 and 57% of beech trees occupied middle or under story layers, respectively. In hornbeam as second dominant species these amount calculated 42, 54.5 and 42, respectively and for other species 52, 42 and 29% were observed. The ratio of seedlings and saplings number to adult tree species demonstrates that the proportion of hornbeam is relatively high in the middle and under storey and the successional pathway of the studied stands is toward the late stage, where the proportion of beech increases.

**Keywords:** hornbeam, middle stage, natural regeneration, oriental beech, stand structure, succession.

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## Morphological characteristics of old trees in hyrcanian forest (Case study: Pattom and Namkhaneh districts, Kheyroud)

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### ABSTRACT

The aim of study was to evaluate qualitative and quantitative characteristics of old trees in Pattom and Namkhaneh districts in the Nowshahr, Northern Iran. The trees quantitative characteristics of DBH, total height, slenderness coefficient, trunk height, crown length, buttress height, and canopy cover area and qualitative characteristics of crown and trunk, *i.e.*, health, vitality, and concurrent, decay, health, branching system, form, and quality were measured. DBH was regarded as a criterion for identification of old trees, hence, the minimum DBH was considered for each species. Non-plot method was used in the regions with slopes lower than 60%. Full forest inspection showed 49 individual old trees composed of eight tree species. *Quercus castaneifolia* had the absolute maximum and maximum average of DBH, as well as the maximum height. The mean values of the slenderness coefficient, trunk relative height, crown relative length, buttress relative height, and canopy cover area were 20.2, 42.7%, 57.3%, 4.4%, and 325 m<sup>2</sup>, respectively. The mean values of the healthy crown, good condition of crown vitality, in-concurrent of crown, trunk without any decay, and cavity of trunk averaged 88%, 59%, 39%, 45%, 59, respectively. Forty five percent of old trees had no single trunk and two-third of them was categorized as middle and poor classes. This research was the first of its kind to address and introduce old trees in the natural Hyrcanian forests of northern Iran.

**Keywords:** diameter at breast height, height, morphological characteristics, Northern Iran.

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## Some soil and quantitative characteristics of Christ's thorn (*Ziziphus spina christi* L. Desf.) in natural sites of south west of Iran (Case study: Khuzestan and Booshehr provinces)

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### ABSTRACT

In order to investigate some silvicultural and soil physico-chemical characteristics of Christ's thorn (*Ziziphus spina christi* L. Desf.) natural stands, ten natural stands of the tree species which have similar climate and aspects were selected and altitude from sea level (ASL), the thickest sprout collar diameter (TSCD) and total tree height (TH) of the tree species were measured in 1000 m<sup>2</sup> circular main plots. Seedling regenerations of the species were counted in 100 m<sup>2</sup> circular microplots. We sampled soil from three depths of 0-30, 31-50 and 51-70 cm for studying on soil physico-chemical properties in each main plot. To compare means of tree quantitative characteristics, t-student, ANOVA and Duncan and for soil studying, CA and PCA were used. The results showed that TSCD and TH hadn't significant differences in two levels of ASL. Although there were an exclusive correlation between presence of the species and sand percent of all three layers of soil in around 60% of Christ's thorn sites, the minimum TSCD were recorded in the sites too. Christ's thorn had the maximum TSCD in sites correlated with N, OC and EC in shallow and percent of silt and clay in deep layers of soil. So for increasing success of Christ's thorn plantations we suggest such sites are selected.

**Keywords:** collar diameter, Khuzestan, PCA, soil, tree height, *Ziziphus spina-christi*.

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## Effect of osmopriming on germination indices of salinity-affected seeds of *Pinus eldarica* Medw.

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### ABSTRACT

To answer this question that if osmopriming improve germination indices in salinity-affected seeds of *Pinus eldarica* Medw., a factorial experiment in randomized completely design was carried out with three replications. Osmotic treatments were applied in 5 levels (-2, -4, -6 and -8 bar for 72 hours and non-primed) by polyethylene glycol (PEG) and salinity treatments in 8 levels (0, 40, 80, 120, 160, 200, 240 and 280 mM) by sodium chloride. The results showed that osmopriming, salinity and their interaction had significant effect on seed germination indices. Germination of non-primed seeds ceased in salinity stress higher than 160 mM, but primed seeds were able to germinate in 280 mM. In all salinity levels, primed seeds (particularly, -2 bar) had highest germination speed, germination energy and vigor index and lower variation for relative germination percentage, showing the positive effect of osmopriming technique on improving germination indices in salinity-affected seeds of *Pinus eldarica*.

**Keywords:** germination energy, polyethylene glycol, osmotic potential, seedling vigor index.

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## Swelling control of forest road bed soil by polymeric materials

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### ABSTRACT

Soil is known as the base material for many structure, on the other hand, some soils cause problems for some structures such as roads. Some types of soils absorb moisture and swell then they may shrink when losing water. The changes of moisture in these soil samples cause changes their volume and pressure to layers of the pavement and eventually leads to destruction of roads. Therefore, it is necessary to assess and study methods to improve the swelling properties of these soils. Unfortunately no study has been conducted in this field in forest environment yet. In this study the effect of *RPP* as a polymer stabilization for controlling swelling of forest soils was investigated. Compaction tests, swelling potential and swelling pressure on the soil samples treated with different percentages of *RPP* (0.019, 0/04 and 0.06%) were conducted. In order to test swelling potential and swelling pressures, samples were prepared with optimum moisture determined by compaction test and were compressed by static compaction method and then moved to consolidate apparatus. According to the results of this study, adding of *RPP* can decrease swelling potential and swelling pressures of soil slightly and to achieve better results the percentage of *RPP*, should be increased. The results showed that *RPP* may be an alternative for swelling control of soil in forest roads but economic and technical studies are needed to determine the mechanism for stabilization and evaluating their performance in field conditions.

**Keywords:** consolidation apparatus, forest roads, *RPP* material, swelling control, swelling properties.

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## Influence of source variation on biomass and survival of Caucasian oak (*Quercus macranthera*) in kentia nursery in north of Tehran

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### ABSTRACT

The research was carried out to study the effect of provenance variation on stem length, stem biomass, root biomass and survival of Caucasian oak (*Quercus macranthera*) seedlings. The seeds were collected from several seed sources grown in an altitude range of 1800-2000 m a.s.l in Alborz Mountain, both from the northern facing slope, Kordkoy and Chichal, and from the southern facing slope, Roudbarak and Ghostin. The seeds were sown at a randomized completely block design (with three replicates) in a nursery in Tehran (1620 m a.s.l). The results of first growing period showed stem length, stem biomass, root biomass, and survival of seedlings were significantly different. The mentioned characteristics were higher in the Kordkoy provenance than Roudbarak provenance. Seeds collected from Kordkoy provenance) with survival =91.63% and stem length = 15.69 cm) found to produce the best quality of *Quercus macranthera* seedlings in nursery.

**Keywords:** biomass, Caucasian oak, *Quercus macranthera*, seedling, source variation, survival.

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## Spatial patterns and intra-specific competition of chestnut leaf Oak (*Quercus castaneifolia*) using ripley's *K*-function (Case study: Neka-Zalemrood forest- Sari)

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### ABSTRACT

One of the most visible aspects of a forest stand structure is the spatial patterns of trees. Competition affects on forest structure and its understanding is important, when the purpose of forest management is to imitate the dynamic of natural ecosystems. For this purpose, an unmanaged intact forest was selected with 26 hectares area. All Chestnut leaf Oak (*Quercus castaneifolia*) trees with a diameter at breast height greater than 7.5 cm were measured and their Cartesian coordinates were determined. Then the measured trees were divided into four classes based on their diameter at breast height as small timber, medium timber, large timber and extra large timber. To investigate the spatial patterns of oak trees in the region and in the each diameter size class, and to examine the intra-specific competition the univariate and bivariate Ripley's *K*- function were used, respectively. Results showed that the spatial patterns of oak trees was cluster in short distances due to heavy seed and high frequency of young trees and then changed to random distribution as distance increased. Moreover, interactions between diameter size classes showed that oak trees with different sizes had different positive (attraction) and negative (repulsion) competitive effects which occur at different scales based on the size of trees, influenced by light-demanding, limited seed dispersal and intra-specific competition of oaks with various diameter sizes. Since the Chestnut leaf Oak trees showed random distribution, the silvicultural interventions should be based on individuals and random single selection to create random spatial patterns in the stand.

**Keywords:** Chestnut leaf Oak, intra-specific competition, Ripley's *K*- function, spatial patterns, untouched stand.

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## Xylem and Bast Fiber Properties of Six Iranian Hemp Population

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### ABSTRACT

Natural, renewable, biodegradable and low pollution hemp fibers are an alternative to trees xylem and artificial fibers. In this study, xylem and bast fiber properties of six Iranian hemp populations including length, width, wall thickness, lumen width and wall index were measured and compared. To this purpose, collected population seeds from different parts of Iran were nursed in a controlled greenhouse conditions. After the growing season, plant stems with root were removed from soil pots and roots, branches and leaves were cut with a knife and the stems were stored in the warehouse to dry at room temperature. Then, xylem and bark fibers were separated with a knife and macerated. The results showed that in xylem fibers, except for fiber width and lumen width, other properties at the 5% and in bark fibers, all properties at the 1% level were significantly different. Also, all properties of xylem and bark fibers at the 1% level were significantly different from each other which mean a high diversity in Cannabis populations from Iran. Finally, index populations of each property were specified and proposed for appropriate industrial usage and Sirjan, Kerman, Kashan and Arak populations due to having the highest measured properties were introduced as possible high potential fiber populations for further investigation.

**Keywords:** bark fibers, fiber properties, Hemp, population, xylem fibers.

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## Potential of canola oil utilization in dielectric paper fabrication using unbleached bagasse pulp

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### ABSTRACT

The oil-paper insulation is a type of an inexpensive combination insulation system in oil-filled power transformers. In this study the dielectric and strength properties of Canola oil and mineral oil impregnated hand-sheet papers were investigated. All hand sheets were made of unbleached bagasse soda pulp with two different freeness levels of  $200 \pm 25$  ml, CSF and  $400 \pm 25$  ml, CSF. After drying the hand sheets to zero moisture content, degassing and drying of the oils were conducted. The impregnation process was then carried out under vacuum and heat condition. Finally the impregnated papers were examined for evaluating strength and dielectric properties such as tensile strength, capacitance, insulation resistance, dielectric constant, loss tangent, and breakdown voltage. The results showed that refining will give rise to enhance the dielectric and mechanical properties such as capacity, dielectric constant, and tensile index. The vegetable oil regardless of the lower dielectric resistance and the higher loss tangent has better performance in comparison with mineral oil.

**Keywords:** bagasse pulp, dielectric paper, freeness, mineral oil, vegetable oil (canola).

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## Accelerated autocondensation of quebracho tannin wood adhesive by boric acid

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### ABSTRACT

Quebracho tannin wood adhesive in non formaldehyde approach has low autocondensation rate and needs more press time than formaldehyde-based wood adhesives to produce wood composites. In this study, boric acid was used to increase autocondensation rate of quebracho tannin adhesive to make poplar plywood. The main ingredients of the adhesives include quebracho tannin, NaOH, hexamine, boric acid and polymeric isocyanate (PMDI). Thermomechanical analysis of control adhesives (without boric acid) showed maximum Young's modulus values increased with increasing tannin initial concentration from 40% to 50% (m/m), while no significant effect has been found by adding 20% PMDI based on the tannin solid content. The addition of the boric acid not only (1) lowered time and temperature of hardening, (2) but also increased Young's modulus values of the adhesive by adding boric acid from 2% to 4% based on the solid content of the tannin.. Tensile shear strength of the plywoods confirmed thermomechanical previous results. Tensile shear values did not meet EN 314-2 requirements for interior plywood classification without boric acid systems. While boric acid significantly increased tensile shear values which had ascending trend with increasing boric acid and tannin concentration. The current study indicates that plywoods were made by 50% quebracho tannin and 2-4% boric acid meet the relevant performance requirements for interior applications.

**Keywords:** autocondensation, boric acid, polymeric isocyanate, poplar plywood quebracho tannin, tensile shear, thermomechanic.

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## The effect of extraction method on bioactive phenolic compounds of *Cupressus arizonica*

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### ABSTRACT

The effect of Soxhlet and simple immersion extraction methods on the amount and type of bioactive phenolic compounds of *C. arizonica* woodknots were studied. Lipophilic and hydrophilic compounds were Soxhlet extracted according to T280 pm-99 standard method with hexane and acetone solvents, respectively. Also, in the immersion method woodknot samples were dipped in hexane to remove the lipophilic moieties and then treated with ethanol: H<sub>2</sub>O (1: 9, v/v) solvent to isolate the hydrophilic compounds. Also, an alkaline hydrolysis step with one molar NaOH solution was performed to remove sugar impurities from the ethanolic extract of the immersion method. GC-MS was used to identify the extractives components of different procedures. The results of analysis indicated the efficiency of bioactive components extraction with ethanol: H<sub>2</sub>O (1: 9, v/v) solvent comparing to acetone procedure. Moreover, the simple immersion method was showed to be a suitable method in extraction of bioactive extractives. Contribution of matairesinol (MR), dienestrol and curumine in the extract of EtOH: H<sub>2</sub>O were 11.2, 0.4 and 0.9%, respectively. Alkaline hydrolysis led to a partial degradation of phenolics according to the results of GC-MS analysis.

**Keywords:** acetone, bioactive phenols, ethanol, extraction, extractives, Soxhlet apparatus, woodknot.

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## Investigation changes in structure and thermal properties of glyoxalated soda and kraft lignins

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### ABSTRACT

One of the solutions to increase the applications of lignin molecules is increasing reactive functional groups by chemical modification. Adding reactive functional groups into the lignin structures is one of the best proposed methods. The aim of this study was to investigate change in structure as well as glass transition temperature ( $T_g$ ) of Soda and Kraft lignins after hydroxymethylation them with non-volatile aldehyde entitle Glyoxal. Kraft and Soda black liquors were prepared from Choka and Pars Co, respectively. Lignins were extracted from black liquors by acidic method. Then changes in structure and thermal properties of the glyoxalated lignins were measured with Fourier transform infrared (FTIR) and differential scanning calorimetry (DSC) compared to pure lignins, respectively. The results indicated that glyoxalation increase reactive functional groups in lignins. Also FTIR result indicated that glyoxalation made some changes in lignin structure. DSC analysis showed that  $T_g$  of Soda and Kraft lignins reduced by glyoxalation. Finally DSC and FTIR analysis indicated that Soda lignin exhibited better potential for glyoxalation and have lower  $T_g$  compared to Kraft lignin.

**Keywords:** differential scanning calorimetry, fourier transform infrared, glass transition temperature, Glyoxal, lignin.

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## Influences of Combined-Hydro-Thermo-Mechanical (CHTM) modification on moisture absorption and dimensional stability of poplar wood

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### ABSTRACT

In this research work, it was planned to study influences of hydrothermal treatment temperature, holding time and press temperature on wood density, spring back, moisture absorption as well as dimensional stability of combined-hydro-thermo-mechanically modified poplar wood. Wood blocks were treated hydrothermally at temperatures 120, 150 and 180°C for holding time of 0, 30 and 90 min. Afterwards, those blocks were compressed immediately in a press at temperatures 160 and 180°C for 20 min with a compression set of 60% in radial direction. Density, spring back, moisture absorption and dimensional stability of treated samples were determined and compared with the untreated ones. Results revealed that density was increased due to the treatment. Spring back was reduced by raise of hydrothermal treatment temperature. Moisture absorption was also decreased by treatment temperature. Although, any increase of relative humidity caused increase of moisture content in compressed wood, however it was less than that of untreated one. Any extended holding time had no significant effects on moisture absorption. There was also a reductive effect of press temperature on moisture contents. Radial swelling of treated samples was also reduced by gained treatment temperature. Press temperature also decreased the swelling; however, it was not as much as the treatment temperature. Generally, this research work indicated proper capability of this innovated combined-hydro-thermo-mechanical wood modification on properties of compressed wood to be used practically.

**Keywords:** Combined-hydro-thermo-mechanical (CHTM) wood modification, dimensional stability, moisture absorption, poplar wood.

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## Effect of styrene and methyl methacrylate monomers on mechanical properties and decay resistance of beech (*Fagus Orientalis*)

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### ABSTRACT

This research was conducted to study the effects of styrene and methyl methacrylate cell lumen monomers on the mechanical properties and decay resistance of beech wood. Mechanical and decay resistance test samples were prepared according to ASTM D143-94 and DIN EN113 standards and impregnated with five concentration monomer solution 0, 40, 60, 80 and 100 percent using Bethell method. Treated samples were heated in oven at 90°C for 24 hours then at 103°C to polymerize the monomers. Modules of elasticity and rupture, hardness, compression strength parallel to grain and weight loss of samples were determined. According to the results, mechanical resistance increased with monomer concentration. Modulus of elasticity, modulus of rupture, and hardness and compression strength parallel to grain at the highest level (100%) compared with control samples were increased respectively 36.4, 44.4, 29 and 30.7% for methyl methacrylate monomer and for styrene monomer 32, 35.5, 36.5 and 27.5. Also, decay resistance improved as the absorbed polymer was increase, so that weight loss of control was 36.9%, but in treated samples with styrene and methyl methacrylate monomer decreased to 7.6 and 6.5% respectively.

**Keywords:** decay resistance, mechanical properties, methyl methacrylate, styrene, wood-polymer composites.

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## Investigation of physical and mechanical properties of old magazine recycled fiber and glass fiber-polypropylene hybrid composite

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### ABSTRACT

In this research, Old Magazine (OMG) recycled fiber and glass fiber (GF) were mixed at different levels of 10%, 20%, 30% and 40% (based on weight) with two levels of 50% and 60% Polypropylene (PP) and then the produced composites evaluated compared to those from net Polypropylene. On the basis of obtained results from normalization equations in different treatments done, two treatments has been selected at a point of the better physical and mechanical properties and then chemically modified by maleic anhydride Polypropylene (MAPP) at two levels of 0 and 4%. Achieved results showed that treatments including the ratios 20:20:60 and also 20:30:50 (GF, OMG, PP, respectively) were resulted in the composites with improved physical and mechanical properties. Utilizing MAPP caused to improve the mechanical properties of composites and decrease of thickness swelling, water absorption in two optimum treatments before determined. Scanning electron microscopy results showed that in the composites contain of MAPP, Fibers were desirably compounded with Polypropylene.

**Keywords:** composite, maleic anhydride, mechanical properties, old magazine recycled fiber, physical properties.

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## The effect of cationic modification of Precipitated Calcium Carbonate (PCC) on the optical and physical properties of paper

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### ABSTRACT

In this study, precipitated calcium carbonate (PCC) was modified using cationic starch, and its effect on optical and physical properties of paper was examined in comparison with unmodified filler afterwards. To determine the filler retention in paper, both modified and unmodified fillers were added to pulp suspensions by 20, 30, and 40 percentages. For comparing the utilization effect of modified and unmodified PCCs, filler content as assigned by preliminary tests that final papers contained 10, 16, and 30 percentages of filler, based on dry weight pulp. Results indicated that papers containing modified-filler have more values of retention rather than those with unmodified filler, both in 20% and 30% filler dosages. Among the two mentioned dosages, highest value of retention and ash belongs to PCC-15% S that its modification also consumed most amount of starch was. Obviously, adding the dosage rate of fillers (both modified and unmodified) increased the brightness of papers. It found that papers filled with modified-filler have lower opacity than those are unmodified. It obtained from X-ray spectrums that both modified and unmodified fillers are composed from calcite, while the units are different in terms of geometry.

**Keywords:** cationic modification, optical and physical properties, precipitated calcium carbonate, XRD.

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