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ORGANIC SUBSTANCES FROM NATURAL RAW MATERIAL OF CELLULOSE ETHERS PROSPECTS OF THEIR USE IN A WIDE RANGE AS RAW MATERIALS AND FINISHED PRODUCTS

***Murodov Muzaffar Murodovich,**
****Sandybaeva Zamira Hudayberdievna,**
***Yusupova Nasiba Fattahovna**
**Tashkent Innovative Chemical-Technological Scientific-Research Institute*
*** Osh State University*

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Abstract:
Paulownia is a genus of fast-growing trees. Homeland Paulownia - South and Southeast Asia. This tree is very common in Japan and Central China (Paulownia in China is grown on 2.5 million hectares!). All species of Paulownia are fast-growing trees. It is known that Paulownia Feltosa maintains temperatures down to -27 ° C, Elongata variety maintains temperatures up to 16 ° C, and Fortunei variety does not tolerate temperatures below 0 ° C.

Keywords: Banana cellulose, extraction process, basic substance content, cotton lint, polymerization rate, pentosan, alkali sediment, brittleness, ash content, moisture, cellulose, concentration, parameter, optimal conditions, destruction.

Cellulose ethers (MHEC, MHPC) are the main additives for the production of modern dry mortars, which provide water retention, thickening and improve the workability of the mixture.

ETHERS OF CELLULOSE

products obtained by the interaction of cellulose with acids and alcohols.

They are solid amorphous film-forming agents. Strictly speaking, they are not synthetic polymers, but their properties have much in common with the properties of synthetic polymers. Cellulose ethers are thermoplastic, soluble in suitable organic solvents, and are used for the same purposes as synthetic resins.

Cellulose esters are thermally unstable and have low chem. resistance to acids and alkalis. Ethers are stable in acids and alkalis and withstand heating to relatively high temperatures without decomposing or releasing free acids that cause corrosion of metals. Cellulose ethers and some ethers are good dielectrics.

Cellulose ethers are obtained in autoclaves at elevated temperatures by reacting alkali cellulose with alkyl chlorides and/or certain heterocyclic compounds. Cellulose esters are produced in industry by: esterification of cellulose with oxygen-containing inorganic and carboxylic acids; the action on cellulose mainly of acid anhydrides in an environment of organic solvents or diluents in the presence of catalysts. Using mixtures of anhydrides of various acids, mixed cellulose ethers are produced

Cellulose ethers are used as thickeners, plasticizers and stabilizers of clay solutions for boreholes, asbestos and gypsum-cement plaster mixtures, coating masses for welded electrodes, water-based paints, dyes (when printing on fabrics), toothpastes, perfumes and cosmetics, water-based fatty pharmaceutical formulations, food products. Esters are used as binders in foundries; as emulsifiers in polymerization; as resorbents of contaminants in synthetic detergents; as components of adhesive compositions, etc.

Materials based on cellulose ethers are used as an outer, wear-resistant coating of multilayer materials (laminates). Containers of various standard sizes suitable for packaging a wide range of food products are obtained from rolled materials based on DAC by thermoforming methods.

- *There are several species of the Paulownia tree;*
- *Paulownia catalpifolia*
- *Paulownia fargesii*
- *Paulownia fortune*
- *Paulownia kawakami*
- *Raulownia tomentosa / imperialis*

Paulownia tree - the tree of the future! All parts of the tree - trunk, leaves, flowers - are a potential source of income.

The Republic of Uzbekistan in the study of cellulose, as well as its production and has unlimited possibilities in processing as well.

Wood is the main source of cellulose production, which is constantly regenerated as a result of the vital activity of plants and it does not require large labor costs by the person, and the available material costs are very low [1-12].

On February 8, 1994, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan №62 "On measures to develop the cultivation of poplar in industry and the creation of shrubs from other fast-growing trees in 1994-2003" was adopted. The sixth paragraph of the decree instructs the Academy of Sciences of the Republic of Uzbekistan to improve research in this area. According to this decree, more than 10,000 hectares of terraces are planted in the country every year and other fast-growing tree varieties, in general, trees were planted on 100,000 hectares of planted land in the republic.

Strengthening the economic independence of the Republic of Uzbekistan implies the creation of its own production capacity for the production of various leafy types of Central Asian region, in particular, wood-based fiber semi-finished products - cellulose and its derivatives. Poplar trees and plantations are expanding every year [13-25].

Poplar wood is the most promising raw material for cellulose production with high paper-forming properties and the availability of a sufficient raw material base for the production of paper and cardboard. Wastes generated in the form of twigs and etc, in the process of cutting logs can serve as an additional source of wood raw material for the production of cellulose.

All of the above is then research to develop a technology to produce cellulose from poplar wood suitable for chemical processing and predetermines the need for developments.

Failure to recycle poplar wood waste such as poplar, root, hornbeam in a timely manner can have a negative impact on the environment. Basically, we can observe the effects of harmful gases generated when poplar wood waste is used as firewood. Based on the resolutions of the Cabinet of Ministers №146 of July 28, 1993 and № 23 of February 1, 1995, it is aimed at meeting the needs of the Republic in wood and paper materials. Every year 10 thousand hectares of land are allocated for planting poplars. These decisions are implemented every year. Since 1993, the total area of poplar plantations today is more than 160 thousand hectares. One poplar produces 12-18% waste. This means that a large amount of wood waste, which is generated each year and is not used as firewood, can produce a large amount of valuable products. This work is based on the above facts. Cellulose as one of the most widely used natural polymer materials is one of the most important semi-finished products used in the paper, textile and chemical industries.

The main plant raw materials for cellulose production are softwood, hardwood and cotton linters. However, in the last 20–30 years, annual plants are also common: rye, barley, wheat, rice and reed straw. Abroad, cellulose is also obtained from bamboo and sacks. Cellulose can also be obtained from non-woody plant species such as flax, cotton stalks (hemp-stalks), hemp, jute, kenaf and others.

Due to its high paper-forming properties and sufficient raw material base for the production of paper and cardboard, the most promising types of raw materials are cotton processing and waste from the pulp and paper industry in the form of cotton linters, rice straw, cyclone cotton and others [26-38].

At present, the share of products of Uzbek paper industry enterprises is only 10-12%, the rest of the paper is mainly imported from Russia.

PAULOWNIA PLANTATIONS WILL BE ESTABLISHED IN UZBEKISTAN: Tashkent, Uzbekistan (UzDaily.com) - The Resolution of the Cabinet of Ministers № 520 of 27.08.2020 "On measures to create plantations of fast-growing Paulownia industrial plant in the Republic of Uzbekistan" was adopted. Development of handicraft raw materials, construction materials production, in order to meet the demand for wood in the furniture industry, reduce imports, as well as to meet the needs of the population for alternative energy, the following was approved:

in arid lands, in saline soils, in non-agricultural areas where groundwater sources are located at a depth of more than 30 meters. Forecast indicators for the creation of palm tree plantations for 2020-2024; forecast procurement indicators for plantations for 2020-2024.

The Council of Ministers of Karakalpakstan and regional khokimiyats have been instructed to allocate land plots for growing pilaf on a lease basis. At the same time, for the furniture industry, at least 100 hectares of land will be allocated for each project for the production of wood raw materials from Paulownia and the production of granules (biofuels).

The State Committee for Forestry, in cooperation with “Uzgeodezkadastr”, will conduct an inventory of land plots within two months and place Paulownia plantations on electronic maps.

Scientists of Tashkent Agrarian University and other scientific institutions were instructed to develop recommendations for growing and propagating seedlings without seeds, in vitro and other vegetative methods, based on science and innovative technologies, and post them on their websites within a month.

The Association of Honey Producers is recommended to establish cooperation with Paulownia planters to increase honey production. The Ministry of Agriculture, together with the Ministry of Investment and Foreign Trade and the Chamber of Commerce and Industry, has been instructed to develop project proposals for the organization of palowen plantations within two months with the involvement of foreign investment and grants.

 

The Ministry of Economic Development and Poverty Reduction together with the Association "O'zsanoatqurilishmateriallari" and the Ministry of Agriculture within three months to develop a program of measures for the production of import-substituting products "*Paulownia*".

From 2021, the Ministry of Innovative Development together with the Ministry of Agriculture will produce palowen products in the building materials industry, medicine and landscaping and conducts competitions on scientific and innovative work, startups on topics related to their use.

Paulownia (Paulovnia) is a genus of fast-growing trees. Homeland Paulownia - South and Southeast Asia. This tree is very common in Japan and Central China (in China, Paulownia is grown on an area of 2.5 million hectares!).

All species of Paulownia are fast-growing trees. It is known that Paulownia Feltosa maintains temperatures down to -27 ° C, Elongata variety maintains temperatures up to 16 °C, and Forchuna (fortunei) variety does not tolerate temperatures below 0 °C.

There are several species of the Paulownia tree;

- Paulownia catalpifolia
- Paulownia fargesii
- Paulownia fortunei
- Paulownia kawakami
- Paulownia tomentosa / imperialis

Raw materials	**Annual growth**	**3-year-old tree height**	**The maximum height of the mature tree**
Paulownia	3-5 м	10,5-15,5м	15-20 м
Hybrid Iva	1,5-4 м	7,5-12 м	15-25 м
Black poplar	2,5-3,5 м	9-12 м	20-25 м
Delta-shaped poplar	2,5-3,5 м	9-12 м	20-30 м
Texas red Dubi	2-2,5 м	7,5-9 м	15-20 м
Red Equalipt	2-2,5 м	6-9 м	10-15м
crying iva tree	1,5-2,5 м	4,5-9 м	15-20 м

Paulownia tree - the tree of the future! All parts of the tree - trunk, leaves, flowers - are a potential source of income.

Paulownia grows surprisingly and gains mass (up to 3-5 meters per year and up to 100 tons of biomass per hectare in three years!). The trunk can be cut several times and the tree will continue to grow again.

Paulownia growth rate

The table shows that Paulownia has clear advantages over other species of valuable wood. Growing Paulownia is a very profitable business! "Paulownia growth rate.

The table shows that Paulownia has clear advantages over other types of valuable hardwoods.

Paulownia is a beautiful large-leaved (about 70 cm in diameter), flowering (up to 6 cm in diameter) and beautifully crowned tree. Trunk diameter reaches 1 meter. Life expectancy is up to 100 years. Depending on the growing environment, trees can reach different heights, up to a maximum of 25 meters. It grows well in normal, any, even dry soils containing up to 2% lime, but grows best in deep, moderately moist, dry, sufficiently fertile, loamy soils. Photophile prefers open, well-lit areas

Paulownia tree - The color of Paulownia wood ranges from silvery gray to light brown, sometimes reddish.

The Paulownia tree is very strong but soft, resistant to bending and twisting.

Mass: The Paulownia tree is lighter, by far the lightest, fungal tree. It is lightweight and at the same time very durable - it is an ideal combination in cases where the ratio plays an important role. The average mass of one cubic meter of Paulownia is about 208-300 kg, which is almost four times lighter than oak (one cubic meter weighs 850 kg) and half times lighter than pine wood (one cubic meter weighs 482 kg).

Strength: Paulownia wood has the highest strength and weight ratio of any wood species. In addition, Paulownia has excellent resistance to deformation under load and moisture. Paulownia tree has a low fire risk. Paulownia burns at a temperature (400 ° C) twice the combustion temperature of hardwood (spruce, pine).

In ancient times, the Japanese made their closets and chests from Paulownia to protect their property (clothing, jewelry, essential papers) from fire. Drying: Air drying takes at least 30 days. The boards can be dried in ovens at high temperatures for 24 hours until the moisture content of the wood is 10% to 12%.

Once drying is complete, no expansion of the material is observed. The reduction coefficient of wood dried in the oven from green is only 2.2% longitudinally and 4% longitudinally.

Paulownia wood as a construction material.

Paulownia wood is one of the best building materials due to its high density and weight ratio. Helps easily with any processing. Many artisans choose it for its durability, smoothness, and flawless flair.

Today, Paulownia wood for construction is very popular all over the world as a raw material for a wide range of products - construction and decoration materials, furniture, interior items, musical instruments and so on.

Paulownia timber is actively used for the construction of houses. Its advantage is that it dries quickly without deformations and has high fracture resistance. Fences, pegs, beams, ceilings, rafters, lining, parquet, cladding materials, window frames, doors, as well as any furniture are made from Paulownia.

Paulownia is a wonderful material that wood carvers like to process because of its softness. Combined with difficult combustion and lack of deformation, it is an ideal material for the most difficult carvings.

Price: One cubic meter of Paulownia wood sells on the world market for $ 200 to $ 800, depending on the level of processing. However, due to its very rapid growth, Paulownia is far ahead of other trees in annual weight gain.

Burning from Paulownia

Granules are biofuels, an alternative environmentally friendly source of heat energy. The price of pellets in the international market is about 100 euros / ton, and this is due to the huge demand for renewable heat sources.

Paulownia pellets have a high heat dissipation. When burning 1 ton of Paulownia granules, 480 cubic meters of gas, 500 liters of diesel fuel, 700 liters. The same amount of energy is released as when burning fuel oil.

Pellets are economical and have high thermal efficiency during combustion. However, peacock pellets are more environmentally friendly than other tree species. When burning pellets from Paulownia, CO_2 emissions are 10 to 50 times lower CO_2 emissions, 15 to 20 times less ash, and there is almost no sulfur in the tailings. Pellets are twice as dense as ordinary wooden spheres and produce 3 times more heat energy when burned (FIK-96%).

Paulownia pellets do not ignite spontaneously when the temperature rises due to low fire risk during storage.

Due to the low moisture content, Paulownia pellets are lighter, thus reducing transportation costs. The pellets do not collect moisture from the air, so their high thermal conductivity does not decrease over time.

Paulownia for heating

Paulownia can be used as a raw material for the production of wood, pellets and bioethanol for heating houses, greenhouses and others.

When Paulownia grows as firewood for heating, 1,000 trees will be planted on an area of 10,000 square meters (1 ha). During autumn pruning (for an annual plant) up to 7 kg of dry matter is produced from each tree, so in 1 year you can get 7000 kg of dry matter per hectare! This allows the family to not have to spend money on fuel to heat their home and ancillary plots.

In the spring, the root system produces a new plant or several new plants that grow at the same height until the fall. Similarly, without planting new plants, annual trees can be grown for 15 years.

Analysis of fuel types

Fuel	**Humidity,%**	**ash, %**	**Volatile element yield,%**	**Energy value, (MDj / kg)**
Coal	2,83	20,08	28,33	34
Paulownia	7,74±1,65	2,63±0,87	68,68±0,36	22,96±0,17
Poplar	7,91	5,28	74,04	18,57

Another application of Paulownia is its use as a raw material for the production of bioethanol. American scientists have developed a new technology for the production of ethanol based on a combination of thermochemical and biotechnological methods, which results in the production of 511 liters of ethanol from one ton of dry wood. This is the reason why the tree is called the "Oil Well".

Another use of Paulownia is that the Paulownia tree is a great choice for landscaping and gardening.

Due to its rapid growth, large size and abundant flowering, Paulownia becomes an ornament of parks, squares, entire cities! The large leaves of the Paulownia act as a dust collector, and the accelerated metabolism along with the rapid growth turn it into an oxygen plant. Because Paulownia is a fast-growing tree, it is an excellent helper in creating wind protection belts and protecting the soil from erosion.

The size of the leaves reaches a diameter of 75 cm, so they are real "plants" of oxygen. The leaves of a single Paulownia tree absorb an average of 22 kg of carbon dioxide in 1 year and release 6 kg of oxygen, while purifying thousands of cubic meters of air. Due to its extraordinary qualities, Paulownia has become a necessary tree for gardens and orchards of great ecological importance not only in Asia but also in the United States and Europe. The mass of Paulownia leaves is used to feed livestock (cows, goats, etc.). Its qualities are close to those of the body. Green leaves contain about 20 % and fallen leaves contain about 12% of nutrients and are easily absorbed by livestock.

"A critical analysis of the state of our economy, its leading industries, shows that if we evaluate the unit cost of production achieved in the economically developed countries of the world, we have large reserves of unused raw materials and energy consumption of our products continues to be high.

We have not yet learned to take good care of the unique, non-renewable wealth provided by nature - oil, gas condensate, natural gas and other fuel and energy resources. The structure of their use is not as rational as usual, and large quantities are burned as fuel. Insufficient work is being done to find and introduce alternative energy sources. In general, there are many problems in this area that need to be addressed quickly.

During the study, cellulose synthesis was carried out in parallel from samples of Paulownia tree belonging to different years, i.e. delegenation was carried out in an autoclave under high pressure, as well as by hydrolysis at 95-100 ^{0}C.

In the process of cellulose synthesis, the balance of the 2nd, 4th, and 18-year-old stems of the Paulownia tree was used to make a stalk.

TABLE-1

Qualitative characteristics of cellulose obtained from the seedlings of "Paulownia" tree grown in different years Influence of NaOH concentration (0.5-2.0% HNO3 30 minutes 98-1000C hydrolysis)

№	Description	Expenditure of chemicals		Yield of cellulose, %	Ash, %	*DP	whiteness, %
		HNO_3, %	NaOH, г/л				
1	Paulownia 2 years	0,5	25	72	6,4	-	-
		1,0	**30**	**64**	**4,3**	**1280**	**66,73**
		1,5	35	62	4,0	1150	67,02
		2,0	40	56	3,8	980	69,24
2	Paulownia 4 years	0,5	25	69	5,3	-	-
		1,0	**30**	**66**	**4,1**	**1270**	**65,21**
		1,5	35	61	4,0	1090	67,02
		2,0	40	55	3,8	950	68,94
3	Paulownia 6 years	0,5	25	67	5,6	-	-
		1,0	**30**	**65**	**3,9**	**1320**	**68,10**
		1,5	35	60	3,7	1010	69,01
		2,0	40	51	3,1	870	69,98
4	Paulownia 18 years	0,5	25	64	4,7	1260	65,94
		1,0	**30**	**56**	**3,7**	**820**	**70,02**
		1,5	35	51	4,8	740	70,82
		2,0	40	48	5,4	640	72,30

***DP- degree polymerization**

It can be seen from Table 1 that the quality of cellulose obtained from the stems of trees of different years of the Paulownia tree is almost indistinguishable. On the contrary, the soft porosity of the structure of the Paulownia tree made it easier to delegate due to less chemical reagents and energy savings due to acid hydrolysis. That is, after hydrolysis of HNO_3 solution from 0.1% to 2.0%, the yield of cellulose under the influence of different concentrations of NaOH (from 25g /L to 40g / L) is 66%, the degree of polymerization is 1320, the ash content is 6.4 to 3, A decrease of 1%, the initial whiteness level of 69% without the action of cellulose bleaching reagents released at the end of the synthesis process was mastered as a result of experiments. From the quality indicators given in the table, it can be seen that the high reactivity of cellulose can be used for chemical processing, i.e. in the production of its simple and complex esters.

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