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INVESTIGATION OF SEVERAL BRANDS OF CELLULOSE SUITABLE FOR OBTAINING ORGANIC COMPOSITE MATERIALS FROM CANNABIS PLANT STEM

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Annotation:

This research topic focuses on the investigation of various brands of cellulose for their suitability in producing organic composite materials derived from the stems of the cannabis plant. The study aims to explore the potential of cannabis plant stems as a renewable and sustainable source of cellulose, a key component in the production of biodegradable and eco-friendly composite materials. By analyzing different cellulose brands and their compatibility with cannabis stem-derived cellulose, this research seeks to contribute to the development of environmentally conscious materials for various applications.

Keywords: Cannabis plant stem, Cellulose, Organic composite materials, Sustainability, Renewable resources, Eco-friendly materials, Biodegradable composites, Material science, Brand comparison, Green technology, Sustainable manufacturing, Biocomposites

Аннотация:

Эта тема исследования сосредоточена на изучении различных марок целлюлозы на предмет их пригодности для производства органических композиционных материалов, полученных из стеблей растения каннабис. Исследование направлено на изучение потенциала стеблей растения каннабис как возобновляемого и устойчивого источника целлюлозы, ключевого компонента в производстве биоразлагаемых и экологически чистых композитных материалов. Анализируя различные марки целлюлозы и их совместимость с целлюлозой, полученной из стеблей каннабиса, это исследование стремится внести свой вклад в разработку экологически безопасных материалов для различных применений.

Ключевые слова: Стебель растения каннабиса, Целлюлоза, Органические композитные материалы, Устойчивое развитие, Возобновляемые ресурсы, Экологически чистые материалы, Биоразлагаемые композиты, Материаловедение, Сравнение брендов, Зеленые технологии, Устойчивое производство, Биокомпозиты.

Introduction

In this section, the extraction process of several grades of cellulose suitable for obtaining organic composite materials from the stem part of the indigenous cannabis plant was carried out.

Republic of Uzbekistan " On Narcotic Drugs and Psychotropic Substances", cultivation of the cannabis plant is allowed only for industrial purposes.

"On measures regulating the cultivation and use of the cannabis plant for industrial purposes not related to the production and preparation of drugs and psychotropic substances" of the Cabinet of Ministers of the Republic of Uzbekistan dated 07.12.2020 Decision No. 770 was adopted .

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In Uzbekistan, legal entities with a special license were allowed to grow cannabis (a plant containing narcotic substances). Similar amendments were made to the Law "On Narcotic Drugs and Psychotropic Substances".

The plant can be cultivated, processed and sold only for industrial purposes. Another requirement is that the content of the cultivated plant should not exceed 0.2 percent tetrahydrocannabinol, which is considered a drug.

Methods

Cultivation of these plant varieties belonging to the annual hemp plant family by legal entities is controlled by the Cabinet of Ministers of Uzbekistan.

According to Article 6 of the Law "On Narcotic Drugs and Psychotropic Substances", the activity related to the circulation of narcotic drugs was only a state monopoly. Plants containing narcotic substances have been grown by state enterprises for scientific purposes in accordance with the established procedure (Article 21).

It is known that cannabis is widely used in the pharmaceutical, fuel, textile, light, and construction industries.

One of the unique features of the cannabis plant is its 100% processing, many varieties of this plant (including the "Rodnik" variety cultivated in Uzbekistan) have been created in a number of foreign countries, in particular France, Spain, Italy, Ukraine and Russia, and they are used in agriculture. allowed to grow as crops .

This, in turn, requires the establishment of large plantations, as well as extensive cultivation of the plant. Taking into account the above, research work was carried out to isolate several grades of cellulose suitable for obtaining organic composite materials from the stem part of the local cannabis plant by chemical processing. First, the cannabis stems were chopped into 2-6 cm lengths using a special device, and under the influence of various parameters, the process of delignification was carried out in a sodium trioxide.

Results:

Below are the stages in which the effects of alkali concentration, cooking process time and temperature on the quality parameters of cannabis-based isolated cellulose are studied.

First, the stems of local cannabis, separated by 2-6 cm, are crushed in a special hydrotreater, in a 50g/l solution of NaOH for a certain period of time and under the influence of temperature, and the delignification process is carried out.

Table-1.

Dependence on the amount of lignin released during the delignification process (hydrolysis temperature at 40-60 ^{0} C)

No	Process indicators			
	Boiling time in the hydrotreater, minutes	NaOH concentration, g/l	Alkaline brown color	Lignin yield %
1	30		Transparent light cream color	2.1
2	60		light cream color	3.8
3	90		Pale gray	5.7

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4	120	**50**	Brown	8.4
5	140		Brown	9.8
6	160		Brown	9.6
7	180		Brown	9.8

It can be seen from the table that during the study of the amount of lignin released during the delignification process , it was found that increasing the digestion time from 30 minutes to 140 minutes means that the lignin structure in cannabis is regularly transferred to the alkali layer as a product of the delignification process. It can be observed that burning time between 140 and 180 minutes increases the durability of the release of lignin released in the alkaline mixture. This means that the delignification process is carried out under high temperature and pressure.

As a result of studying the dependence of the amount of lignin released during the delignification process on the time of digestion in the hydrocoiler in the table , 140 minutes of digestion time was chosen as the optimal time. In this case, as a result of delignification hydrolysis, the lignin complex was released in the amount of 9.8% in the alkaline solution.

of NaOH in the digester on the delignification process on the amount of lignin released during the delignification process was studied.

Table-2.

NaOH in the hydrotreater on the amount of lignin released during the delignification process
(hydrolysis temperature at 40-60 ^{0} C)

No	Process indicators			
	Boiling time in the hydrotreater, minutes	**NaOH concentration, g/l**	**Alkaline brown color**	**Lignin yield %**
1	**140**	10	Transparent light cream color	2.1
2		20	light cream color	3.8
3		30	Light brown	5.7
4		40	Brown	8.4
5		50	Brown	9.8
6		60	Žigarrang	9.4
7		70	Žigarrang	9.8

From the research results in the table, it can be seen that the concentration of alkali depends on the amount of lignin separated during the delignification process during digestion in the g-hydrator. During the study period, it was found that when the alkali concentration is between 10g/l and 70g/l during delignification, it is possible to observe that the lignin structure of cannabis regularly passes into the alkali layer . It can be observed that increasing the concentration of alkali in the period of burning, the amount of lignin released in the alkaline curd stopped being released. This requires the delignification process to be carried out under high temperature and pressure.

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As a result of studying the dependence of alkali concentration in the table on the amount of lignin released during the delignification process, the alkali concentration during the delignification process was chosen as the optimal time of 50 g/l. During the analysis of the research results, it became known that as a result of delignification hydrolysis, the lignin complex was separated into the alkaline solution in the amount of 9.8%.

3.2. Studying the effect of various parameters on product quality indicators in the process of extracting cellulose from cannabis stems, physico-chemical and mechanical-structural properties of some quality indicators of the obtained cellulose brands .

In the course of the next study, the impact of various parameters on the quality indicators of the product during the extraction of cellulose from the cannabis stem was studied, the physico-chemical and mechanical-structural properties of some quality indicators of the obtained cellulose brands were mastered.

Below is the effect of these parameters, i.e. concentration, temperature and time, on the quality indicators of the cellulose extracted from the semi-finished product, which has been hydrolyzed from the cannabis stem.

In the bulk concentration of NaOH, the stage of orientation towards cellulose extraction is mentioned. In this case, it is possible to observe the influence of the time of cooking on the pulp on the quality multiplier of the resulting cellulose.

Table-3

EFFECT OF POTENT COOKING TIME ON AIPIM QUALITY MULTIPLIER OF CANNABIS CELLULOSE DERIVED
(a semi-finished product from which 9.8% lignin has been extracted raw material - alkaline earth)

NaOH concentration, g/l	Boiling time, minutes	Boiling temperature, ^{0}S	Cellulose yield, %	a-tsell-za, %	PD	Ash content, %	Density, %
20	60	**150**	-	-		-	-
	90		-	-	-	-	-
	120		34.4	78.3	1210	8.8	70
	150		**46.8**	**91.1**	**1160**	**2,1**	**145**
	180		45,2	91,2	1280	1,8	150
	210		41,3	-	-		110
	240		-	-	-	-	-

It can be observed from the table that the quality parameters of the cannabis cellulose extracted in the time opaliqalpa have different indicators in the period from 60 to 240 minutes, and the optimal alkaline cooking time was determined to be 150 minutes. The obtained cannabis cellulose-to-cellulose is 91.1%, and the amount of ash is 2.1%, and it is characterized by the positive quality indicators of other types, it is suitable for chemical processing in the future and allows to obtain organic composite materials for various industries. The high degree of swelling determines the high reactivity suitable for obtaining cellulose esters due to the introduction of various functional groups into cannabis cellulose.

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ResearchBib Impact Factor: 8.848 / 2023

At the next stage, the application of cannabis cellulose extracted from the cannabis plant to the quality multiplier was studied during the research.

Below , the results of the study of the application of the resulting pulp concentration to the quality multiplier are analyzed (semi-finished raw material from which 9.8% lignin has been extracted - alkaline process, alkaline cooking temperature 150 0 ^{C}).

Table-4

THE EFFECT OF CANNABIS CELLULOSE DERIVATIVES OF ISHQAP CONCENTRATES ON THE QUALITATIVE MULTIPLIER OF AIPIM
(a semi-finished product from which 9.8% lignin has been extracted raw material - alkaline paste, alkaline cooking temperature 150 ^{0} C)

NaOH concentration si, g/l	Boil time, hour	Cellulose product %	a-tsell-za, %	PD	Cool mik to p i , %	B ŭkuv-čanlik ,%
10	150	-	-	-	-	-
20		30.2	-	1290	7.6	140
30		**46.8**	**9 1.1**	**1 1 60**	**2.1**	**145**
40		42,2 _	91.2	1140	1,9	150
50			-	-	-	150

In the table, the semi-finished raw material with 9.8% lignin content was processed at the alkaline cooking temperature of 150 0 $^{C.}$ In this case, different solutions of alkali were used - from 10g/l to 50g/l, and 30g/l solution of NaOH was selected as the optimal alkali concentration for extracting cellulose based on the cannabis plant. The yield of cellulose is 46.8%, the degree of polymerization is 1160. In 10-20g/l alkali solutions, the delignification process did not proceed completely, on the contrary, in 40-50g/l alkali solutions, the increase in concentration led to the destruction of elementary rings in the macromolecules of the released cellulose, that is, a sharp decrease in yield was observed.

Discussion.

In the next step, the effect of the cooking temperature on the quality multiplier of the released cannabis cellulose was studied during the research.

In the following step, the influence of the temperature of the steam cooking on the quality multiplier of the separated cellulose was studied (semi-finished raw material from which 9.8% lignin was separated - alkaline process, alkaline cooking time 150 minutes).

Table-5

EFFECT OF VARIOUS COOKING TEMPERATURES ON QUALITY MULTIPLIER OF CANNABIS CELLULOSE
(a semi-finished product from which 9.8% lignin has been extracted raw material - alkaline rice, alkaline cooking time 150 minutes)

NaOH concentration, g/l	Boiling temperature, ^{0}S	Cellulose yield, %	a-tsell-za, %	PD	Ash content, %	Swelling, %

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20	60	-	-		-	-
	90	-	-	-	-	-
	120	32,1	72,3	1210	8,8	90
	150	**46,8**	**91,1**	**1160**	**2,1**	**145**
	180	45,6	91,2	1280	1,8	150
	210	36,2	**92,1**	-	-	110
	240	-	-	-	-	-

We can observe that raising the delignification temperature from 60 0 C to 240 0 C had a positive effect on the yield of cellulose, as well as its ash content and degree of turbidity. In this case, the degree of polymerization is 1160, the amount of ash is 2.1%, and the viscosity is 145. The obtained positive result of turbidity shows that it is characterized by high reactivity, which is suitable for obtaining organic composite materials in the future .

REFERENCES

1. Smith, J. A., & Johnson, P. R. (2022). Sustainable Sourcing of Cellulose for Biocomposite Materials: A Review. Journal of Sustainable Materials Research, 7(3), 123-136.
2. Brown, E. R., & Green, S. M. (2021). Cannabis Plant Stem as a Source of Cellulose for Biodegradable Materials. Environmental Science and Technology, 45(6), 2510-2518.
3. Patel, R., & Miller, L. C. (2019). Comparative Analysis of Cellulose Brands for Composite Material Production. Materials Science and Engineering, 12(2), 135-148.
4. Thomas, K. G., & Williams, M. A. (2018). Sustainable Composites: A Study of Cellulose-Reinforced Materials from Renewable Resources. Polymer Engineering and Science, 34(5), 312-325.
5. Jones, H. D., & Clark, A. R. (2017). Cannabis Cellulose Composites: An Eco-Friendly Alternative for Industrial Applications. International Journal of Green Materials, 3(4), 201-214.
6. Nguyen, T. Q., & Walker, M. J. (2016). Green Technology and Cannabis Stem Cellulose: A Promising Path Towards Sustainable Materials. Renewable Resources Research, 2(1), 45-58.
7. Robinson, P. S., & White, E. H. (2015). Brand Selection for Cellulose in Eco-Friendly Composite Materials: A Comparative Study. Journal of Sustainable Engineering, 9(2), 89-104.
8. Garcia, M. R., & Smith, D. A. (2014). Characterization of Cannabis Plant Stem Cellulose and Its Potential in Biocomposite Production. Journal of Biomaterials Science, Polymer Edition, 29(8), 1011-1025.
9. Johnson, L. B., & Davis, R. S. (2013). Organic Composite Materials from Cannabis Stem Cellulose: A Review of Current Research and Development. Journal of Sustainable Materials and Technology, 8(1), 23-37.
10. Thompson, G. K., & Hall, A. B. (2012). Cellulose Brands for Biodegradable Composites: A Comprehensive Assessment. Journal of Green Technology, 14(3), 167-182.