International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

Local Raw Materials Waste-Based Paper Production Technology

Z. K. Galimova
Associate Professor Tashkent Institute of Textile and Light Industry

N. X. Tursunbaeva
PhD Student Tashkent Institute of Textile and Light Industry

Abstract

Paper is the most important basic material in the creation of printing products. The basis of the structure of paper is a frame made of fibrous bodies. Papermaking is the production of paper and cardboard, widely used in writing, printing and packaging.
The article demonstrates the possibility of extracting cellulose from unused soybean stalks to develop paper and cellulose production. Paper samples with high mechanical strength and whiteness were obtained.

Keywords: Paper structure, cellulose, mechanical strength, whiteness level, soybean, semi-finished product.

Introduction

The current trends in the development of paper and cellulose production are characterized by an increase in the volume of high-quality paper and cardboard types, which differ in their features and scale. The composition of paper can include intermediate products derived from cotton, flax, hemp, jute, fabric waste, rags, and old clothes [1]. Worldwide, the production of cellulose-paper products is steadily increasing, with over 403 million tons of paper and cardboard produced annually. By 2025, this figure is forecasted to grow by 2.1% on average, reaching 500 million tons [2].

The diversity of paper structure is explained by its multi-component nature (fibers, fillers, sizing agents, dyes, etc.), its composition, and the peculiarities of the production technology. As emphasized by Kirsankin A.A., Mixaleva M.G., Nikolskiy S.N., Musoxrapova A.V., Stovbun S.V., knowing the specific numerical values of the porosity and uniformity of the paper surface is essential for ensuring the high quality of printing products with practical significance [3].

Currently, the most important semi-finished products for paper manufacturing include wood cellulose, wood pulp, and cotton and flax fibers. The main raw materials for fiber-based semi-finished products are coniferous and broadleaf trees, fibers from annual plants, and the stalks, seeds, and cotton production waste [4]. In many countries, non-wood plants or secondary materials are used. For example, in the USA, 25% of paper is produced from waste paper, while in Spain, France, and the UK, wheat stalks (straw) are used; in China, one-third of cellulose products are made from rice and wheat husks [5].

International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

The development and improvement of technologies to solve urgent issues such as resource conservation and import substitution is a crucial direction. Import substitution technologies are of particular interest for the paper and cardboard industries in the Republic of Uzbekistan.

However, due to the shortage of cellulose raw materials in many countries, there is growing interest in low-cost and renewable raw material sources, such as grains (rice, wheat, etc.) and herbaceous plants (sugarcane, flax, straw, miscanthus), and other plants.

Soybean is becoming a rapidly growing multi-purpose raw material in our country. Soybeans (Glycine max) belong to the legume family and are a waste-free plant. Its seeds are used to produce oil and protein, while the stalks and leaves are used as animal feed. Soybean oil, which has valuable nutritional and medicinal properties, is extracted from the seeds, and the by-products are used as high-protein supplements in animal feed [6].

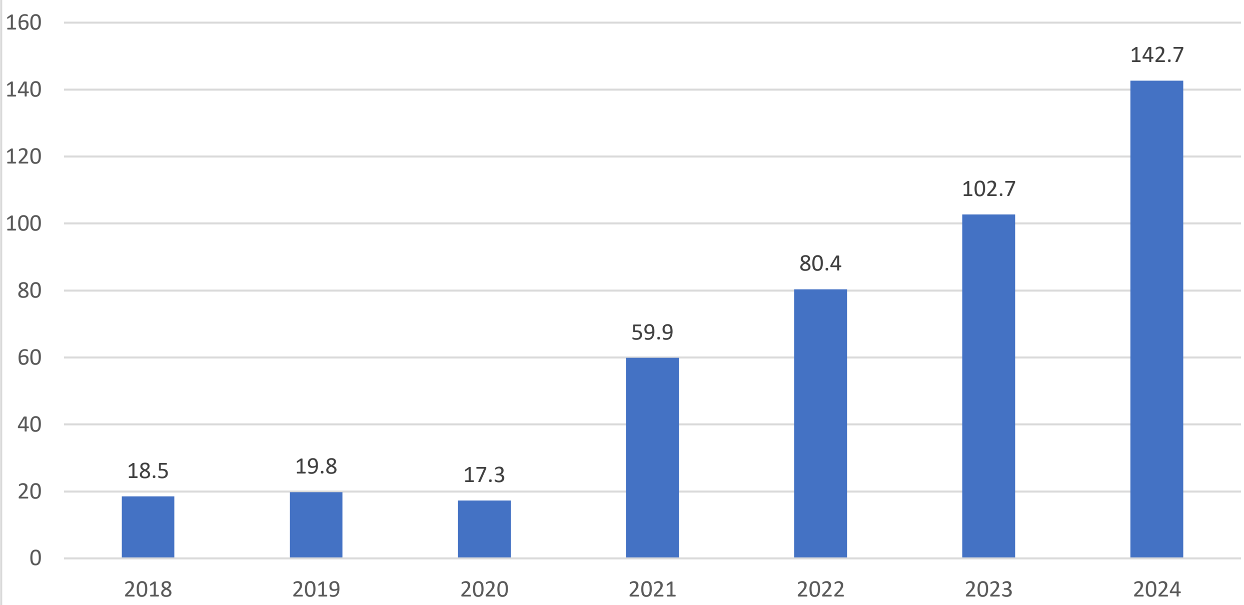
Currently, there are 27 soybean varieties available, such as "Arleta", "Baraka", "Victoria", "Madad", "Oltin toj", "Parvoz", "Nafis", "Genetic-1", "O'chmas", "Tumaris", "Mman-3", and others. Four of them, namely "Madaniyat B", "Zamin", "Zarbulok", and "Olmas", are considered promising [7].

In the regions of Uzbekistan and the Republic of Karakalpakstan, the existing soybean yield in 2019-2023 Table 1.

Information on the achieved yield of soybean cultivation in the regions of Uzbekistan and the Republic of Karakalpakstan in 2019-2023

№	Region	2019 year			2020 year			2021 year			2022 year			2023 year		
		area, (ha)	gross harvest, (tons)	performance, (c/ha)	area, (ha)	gross harvest, (tons)	performance, (c/ha)	area, (ha)	gross harvest, (tons)	performance, (c/ha)	area, (ha)	gross harvest, (tons)	performance, (c/ha)	area, (ha)	gross harvest, (tons)	performance, (c/ha)
1	Republic of Karakalpakstan	1600	2658	16,6	1600	2800	17,5	1000	1000	10,0	1506	1646	10,9	5000	6000	12,0
2	Andijan region	2000	3250	16,3	17000	6000	3,5	4132	13717	33,2	8175	10284	12,6	7000	11524	16,5
3	Bukhara region	1002	1368	13,7	341	568	16,6	920	1010	11,0	3000	3428	11,4	8000	14380	18,0
4	Jizzakh region	1799	316	1,8	1903	2664	0,0	6165	4633	7,5	1233	705	5,7	9000	21600	24,0
5	Kashkadarya region	500	518	10,4	2500	4580	18,3	10144	3381	3,3	177	183	10,4	7300	13140	18,0
6	Navoi region	200	11	0,6	121	300	24,8	517	1000	19,4	1841	2999	16,3	7000	9100	13,0
7	Namangan region	1232	1114	9,0	436	600	13,8	3415	11749	34,4	7967	10759	13,5	7000	9818	14,0
8	Samarkand region	1000	1532	15,3	1432	1855	13,0	5240	2167	4,1	7178	5559	7,7	10000	15100	15,1
9	Surkhandarya region	750	578	7,7	493	1010	20,5	1015	1000	9,9	1051	1342	12,8	7000	10500	15,0
10	Syrdarya region	403	287	7,1	40	80	20,0	1010	922	9,1	4544	6217	13,7	11017	15648	14,2
11	Tashkent region	1335	1542	11,6	609	990	16,3	22117	14069	6,4	8129	13068	16,1	10000	15254	15,3
12	Fergana region	1797	1833	10,2	1624	4039	24,9	3179	10491	33,0	6105	11183	18,3	7000	14000	20,0
13	Khorezm region	184	287	15,6	132	184	14,0	538	968	18,0	1802	2192	12,2	7500	9375	12,5
By republic		**13802**	**15294**	**11,1**	**28231**	**25670**	**9,1**	**59391**	**66107**	**11,1**	**52708**	**69565**	**13,2**	**102816**	**165439**	**16,1**

International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal



Soybean Cultivation (per thousand hectares of land) Growth Diagram for 2018-2024 Figure 1

The research subjects are paper sheets made from a composition of cotton cellulose (PS) and soybean stalk cellulose (SS), with a basis weight of 80 g/m² and a smoothness degree of 40°SR. The main properties of the paper samples are presented in Table 2.

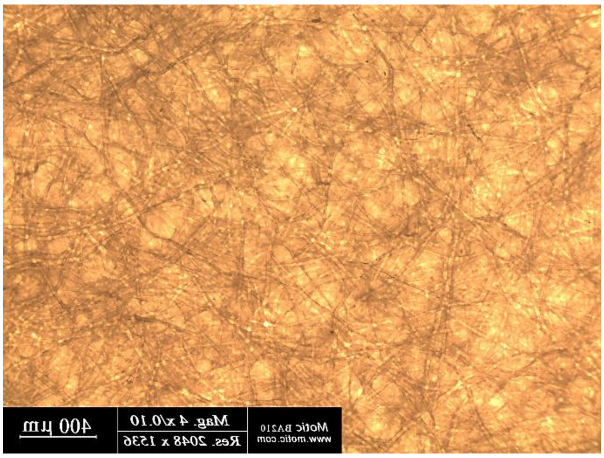
Table 2 Physical-mechanical Properties of Paper Samples

Composition of new paper composition- PS:SS, %	Tensile strength, N	Elongation length, m	Whiteness, %	Thickness, µm (micrometers)	Density, g/m^3
100:0	57	4850	83	165	0,55
0:100	50	4250	59	200	0,45
80:20	55	4812	74	165	0,55
60:40	55	4812	68	170	0,53
40:60	54	4592	64	184	0,49
20:80	52	4416	61	190	0,47

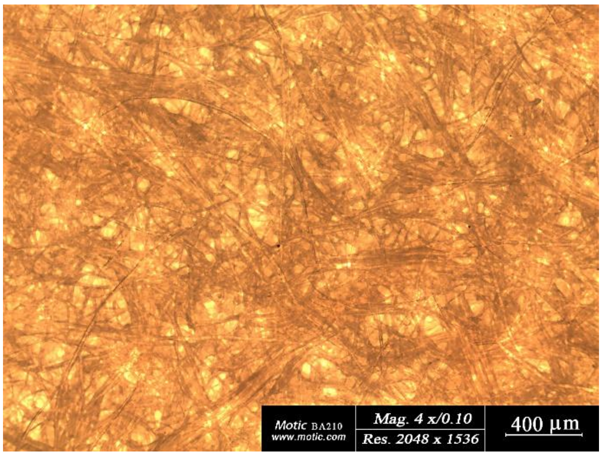
As seen from the table, cellulose derived from soybean stalks produces paper with excellent properties. The addition of soybean stalk cellulose to cotton cellulose strengthens the paper, resulting in a higher elongation length (4250 to 4850 m) with improved mechanical properties.

International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

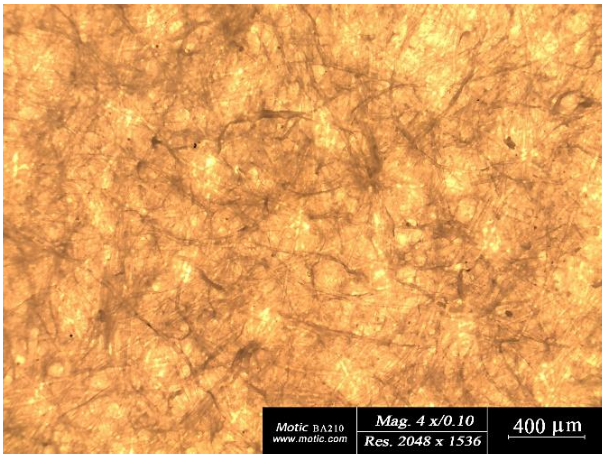
Microscopic Images of Paper Samples Composed of Cotton and Soybean Cellulose Figure 2



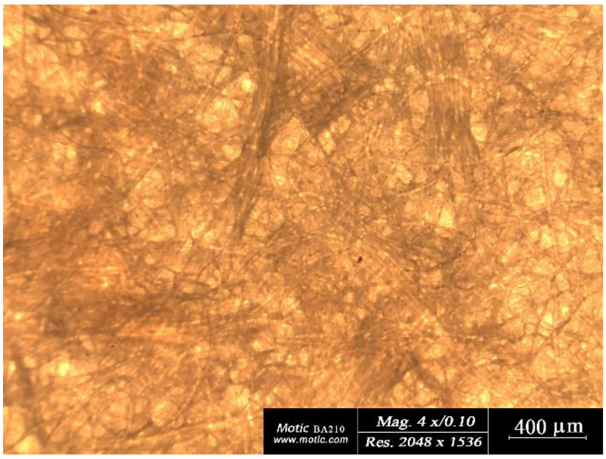
PS:SS, 100-0 %



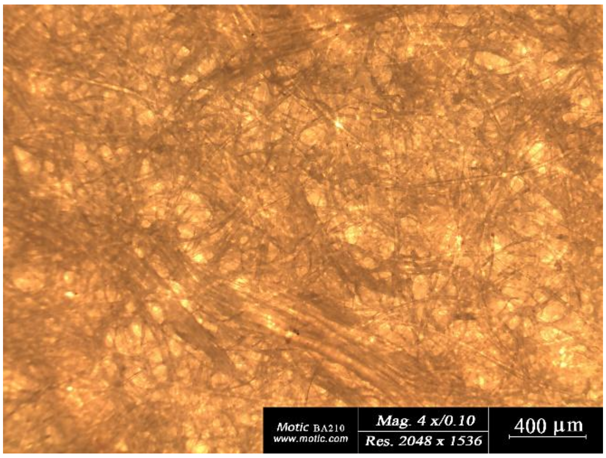
PS:SS, 0-100 %



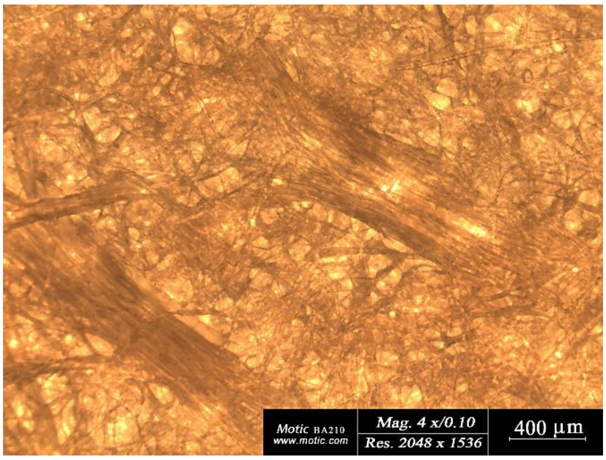
PS:SS, 80-20 %



PS:SS, 60-40 %



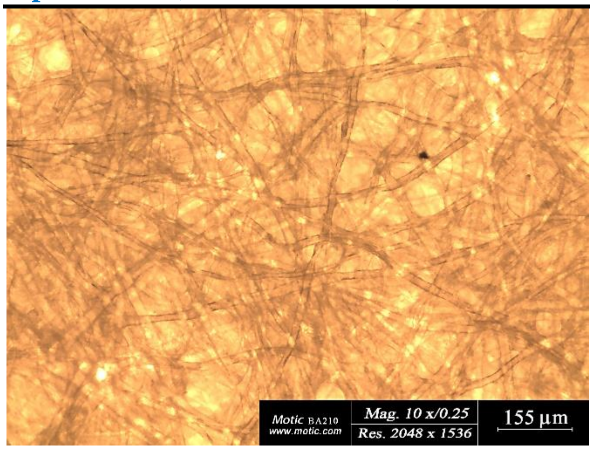
PS:SS, 40-60 %



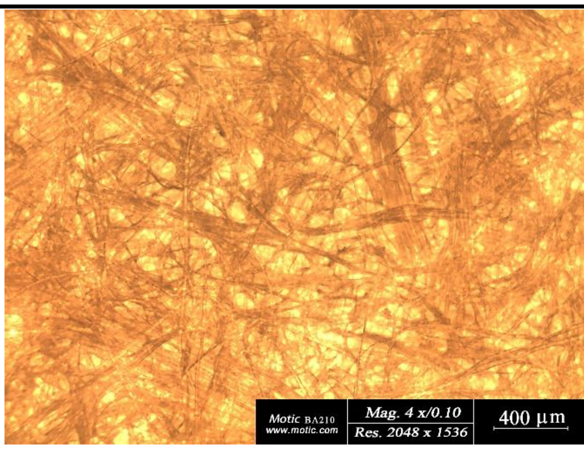
PS:SS, 20-80 %

Figure 2a. Microscopic image of paper samples with a fiber length of 200 µm.

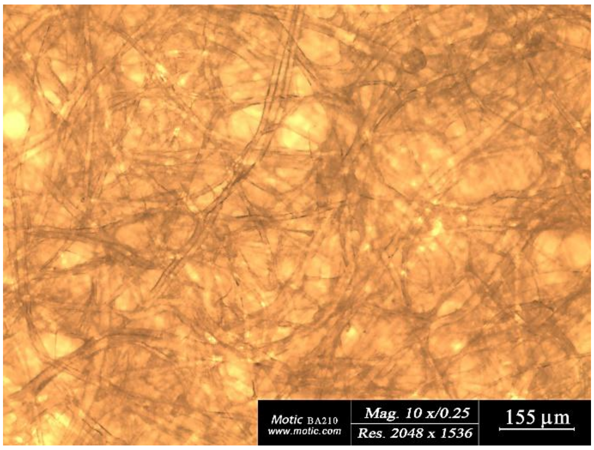
International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal



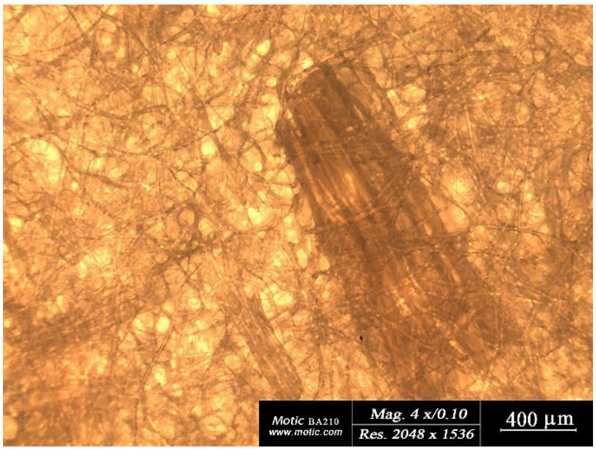
PS:SS, 100-0 %



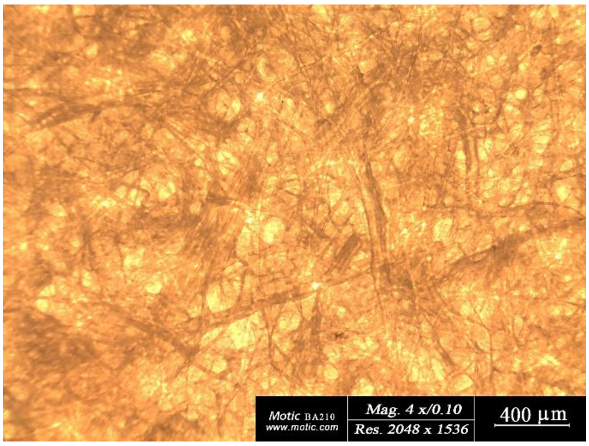
PS:SS, 0-100 %



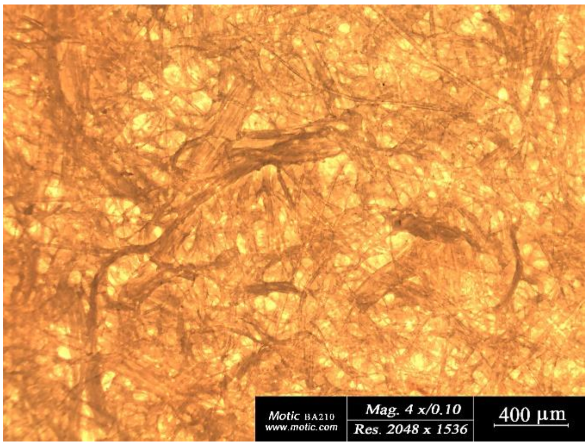
PS:SS, 80-20%



PS:SS, 60-40%



PS:SS, 40-60%



PS:SS, 20-80%

Figure 2b. Microscopic image of paper samples with a fiber length of 77 µm.

Figure 2 shows the microscopic images of the paper samples with fiber lengths of 200µm and 77µm. From these images, it is evident that the fibers are smooth, which contributes to the paper's high mechanical strength. If the fibers are excessively curly or deformed, they will have lower mechanical strength.

International Journal of Scientific Trends- (IJST)
ISSN: 2980-4299
Volume 3, Issue 12, December - 2024
Website: https://scientifictrends.org/index.php/ijst
Open Access, Peer Reviewed, Scientific Journal

References

1. Sabohat Kamolova. "Printing Materials: Educational and Methodological Guide." Tashkent, 2010.

2. Yeshbayeva Ulbosin Jamalovna. "Offset Paper with Synthetic Polymers and its Printing Characteristics." PhD Thesis, Tashkent, 2017.

3. Golunov A.V. "Expansion of the World Outlook in the Process of Offset Printing by Selecting Components of Printing Systems." Dissertation. Omsk, 2012.

4. Chernaya, N.V. "Synthetic Materials in Paper and Cardboard Production: Resource Conservation and Import Substitution." Minsk: BGTU, 2020.

5. Babakhonova, K.A. "Creation of the 'Raw Material-Paper-Print' System, Ensuring the Desired Printing Properties of Paper Containing Secondary Fibrous Materials." PhD Thesis, Tashkent, 2016.

6. Mavlyanova R.F., Zuev V.I., Kim V.V., Pirnazarov D.R. "Technology of Vegetable Soybean Cultivation in Uzbekistan." 2nd Edition, Tashkent, Uzbekistan, "Sylmo Servis" Publisher, 2013.

7. Soy in Uzbekistan: Varieties and Regions of Cultivation [Electronic Resource]. Accessed 06.03.2024. Available at: https://www.agro.uz/ru/11-0309.