

4. INTERNATIONAL CAPPADOCIA SCIENTIFIC RESEARCH CONGRESS

April 16-17, 2023 / Nevşehir-TÜRKİYE

EDITOR

Prof. Dr. Murat TAŞ

THE PROCEEDINGS BOOK

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Moderator: Ayla ARSLAN

Meeting ID: 832 6081 0607 / Passcode: 161718

Ankara Local Time: 10:00 – 12:00

| TITLE | AUTHOR(S) | AFFILIATION |
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| SYNTHESIS OF METAL OXIDE CATALYSTS AND INVESTIGATION OF THEIR ELECTROCATALYTIC BEHAVIOR PERFORMANCE IN HYDROGEN PRODUCTION | <i>İlayda KARAMAN Dr. Karolina KORDEK-KHALIL Assoc. Prof. Bilge COSKUNER FILIZ Prof. Dr. Aysel KANTURK FIGEN</i> | Yildiz Technical University |
| OPTIMIZATION OF ULTRASOUND-ASSISTED EXTRACTION OF PHENOLIC COMPOUNDS FROM KULTIK KERNEL USING CHOLINE CHLORIDE: ETHYLENE GLYCEROL | <i>Çağlar Mert AYDIN</i> | Munzur University |
| INVESTIGATION OF CHANGES IN TOTAL PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY OF THE WALNUT VARIETY CULTIVATED IN OVACIK DISTRICT OF TUNCELI BY YEAR | <i>Çağlar Mert AYDIN</i> | Munzur University |
| ENVIRONMENTALLY FRIENDLY DYEING OF WASTE CELLULOSE FIBER WITH NATURAL DYE EXTRACT OBTAINED FROM WALNUT SHELL (JUGLANS REGIA) | <i>Sude Sara KAYA Derya DOĞRU Shahid ADEEL Meral ÖZOMAY Zafer ÖZOMAY</i> | Government College University Marmara University |
| INVESTIGATION OF SONOCHEMICAL TREATMENT OF TELON RED MGWN TEXTILE DYE | <i>Elif TEKMAN Eylem TOPKAYA Mustafa Alperen KURT Ayla ARSLAN</i> | University of Kocaeli |
| PROPERTIES, CLASSIFICATION, DETECTION AND REMOVAL METHODS OF MICROPLASTICS | <i>Sinem KURU Ayla ARSLAN</i> | University of Kocaeli |

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ÖZET

Kağıdı imalatında önemli bir yere sahip hammadde selülozdur. Selüloz, liflerin keçeleşmesi, saçaklanması, su emerek şişmesi ve belirli işlemlerden geçmesi sonucunda bu liflerin birleşmesiyle oluşmaktadır. Bitkisel liflerin işlenmesiyle de kağıt elde edilmektedir. Kullanımı tamamlanmış atık durumunda olan kağıtların, yapısındaki selülozun geri kazanılmasıyla tekrardan kağıt üretiminde kullanılabilmesi de mümkündür. Yeniden değerlendirilme imkanı olan bu atık kağıtların fiziksel veya kimyasal işlemlere tabi tutularak ikinci bir hammaddeye dönüştürülmesine geri dönüşüm denmektedir. Sürdürülebilir olmasının yanında kağıt geri dönüşümünde kullanılan hammadde miktarında önemli oranda tasarruf sağlanmaktadır. Ayrıca yapılan bu tasarruf hammaddenin pahalı olmasından dolayı ekonomik açıdan üretime fayda sağlamaktadır.

Bu çalışmada sürdürülebilirliği arttırmak amacıyla geri dönüştürülen selülozlardan kağıt üretimi yaparken doğal boya bitkileri ve doğal boyama yöntemleri kullanılmıştır. Sentetik boyaların karbon salınımını arttırmamasından kaynaklı olumsuzlukları engellemek için doğal boyama yöntemi tercih edilerek kağıt üretiminde kullanımını arttırmak amaçlanmaktadır. Doğal boya bitkileri kendilerinden veya atıklarından üretildiği için çevre kirliliği oluşturmamakta ve geri dönüşüm için avantaj sağlamaktadır.

Yapılan bu çalışmada selüloz lifleri ceviz kabuğu kullanılarak doğal boyama yöntemi ile renklendirilmiştir. Böylece lifler arasında ceviz kabuğu ile renklendirilen numuneler ve renklendirilmeyen numuneler olarak iki farklı koşulda incelenmiştir. Numuneler iki farklı havuz içerisinde 5 L ve 8 L olarak ve belirlenen sabit oranlarda katı madde oranıyla hazırlanmıştır. Hazırlanan konsantrasyon içerisine daldırma yöntemi kullanılan elek ile kağıt sayfaları oluşturulmuş ve aynı zamanda numuneler belirli oranda lifleri azaltılarak teknik özellikleri incelenmiştir. Numuneler; gramaj, renk ölçümü, ışık haslığı, kontak açısı, yüzey düzgünlüğü, hava geçirgenliği bakımından ölçülüp çıkan veriler ile karşılaştırılmıştır.

Anahtar kelimeler: Atık kağıt, Geri dönüşüm, Doğal boyama, Sürdürülebilirlik

**ENVIRONMENTALLY FRIENDLY DYEING OF WASTE CELLULOSE FIBER
WITH NATURAL DYE EXTRACT OBTAINED FROM WALNUT SHELL
(JUGLANS REGIA)**

ABSTRACT

Cellulose is an important raw material in the manufacture of paper. Cellulose is formed by the felting, fringing, swelling by absorbing water of the fibers and the combination of these fibers as a result of certain processes. Paper is also obtained by processing plant fibers. It is also possible to reuse the waste paper, which are completed in utilization, in paper production by recovering the cellulose in its structure. Recycling is the process of transforming these waste papers, which can be reused, into a second raw material by subjecting them to physical or chemical processes. In addition to being sustainable, significant savings are achieved in the amount of raw materials used in paper recycling. In addition, this saving is economically beneficial to production due to the high cost of raw materials.

In this study, natural dye plants and natural dyeing methods were used to produce paper from recycled cellulose with the aim of increasing sustainability. In order to prevent the negativities originating from the increase in carbon emissions that synthetic dyes cause, it is aimed to increase the use of natural dyeing methods in paper production. Since natural dye plants are produced from plant itself or its waste, they do not cause environmental pollution and provide advantages for recycling.

In this study, cellulose fibers were colored with natural dyeing method using walnut shell. Thus, between the fibers, samples colored with walnut shells and samples that were not colored were examined under two different conditions. Samples were prepared in two different ponds, 5 L and 8 L, with a fixed ratio of solids. Paper sheets were formed with the sieve using the dipping method in the prepared concentration and at the same time, the technical properties of the samples were examined by reducing the fibers at a certain rate. Samples were measured in terms of weight, color measurement, light fastness, contact angle, surface smoothness, air permeability and compared with the data obtained.

Keywords: Waste paper, Recycling, Natural dyeing, Sustainability

INTRODUCTION

Paper is the easiest writing surface for transmitting experiences, events, and information across generations. Although paper was first discovered about two thousand years ago [1,2], it plays a significant role in our daily lives. The newspapers and magazines we read, the letters we write, the notebooks and books used in schools, the packaging of consumer goods we buy, paper towels, and the money we use are all made of paper. Paper is an indispensable requirement of our civilization today [3,4].

In the globalizing world, with the impact of industrialization and urbanization, resources are being used recklessly, and this consumption results in waste [5,6]. The increasing waste problem affects society, families, and individuals [7]. Recycling, which involves the collection, processing, and reuse of previously collected materials, plays an important role in today's world [8,9,10].

The recovery of waste paper is not only important for the cellulose and paper industry sector but also for the country's economy [13,14]. The use of waste as a secondary raw material will reduce the consumption of primary raw materials [15]. For example, it takes 15-17 adult trees to be cut down to produce 1 ton of paper. Recycling paper reduces the need to cut down trees in forests [16].

Synthetic materials with a complex molecular structure and products made from synthetic materials cause environmental pollution [17].

Nowadays, the understanding that many synthetic dyes are toxic, carcinogenic, and cause environmental pollution has brought natural dyeing back into the agenda [18,19]. Natural dye plants are non-toxic and non-carcinogenic, especially annual or biennial plants that do not create environmental pollution [20].

In history, many civilizations recognized the walnut plant and used it as a dye. The coloring properties of walnut fibers in dyeing allowed all countries to recognize it and engage in trade [21,22]. The green shell of the walnut fruit and its leaves contain tannins, volatile oils, and a substance called juglone, which have coloring properties [23]. Dye substances are produced from the leaves and fruit shells, which are widely used in our country [24].

There are many advantages to using natural dyes: they are environmentally friendly and the dyeing waste can be returned to the soil as fertilizer [25], they are not toxic or carcinogenic, and they have antibacterial properties [26,27]. Water consumption is minimized in the use of natural dyes, the amount of wastewater is very low, they are suitable for recycling, and energy can be saved during their use [28,29].

In this study, natural dye was obtained from brown walnut shells and handmade paper was produced using this dye and paper waste obtained from factories. In this way, the study aims to draw attention to waste types, waste management, recycling, and sustainability.

MATERIAL-METHOD

Material

In this research, paper trimmings obtained from a paper factory were used. Paper trimmings are the cut-off portions of paper that are not printed or have been printed but are not usable, and are processed into notebooks, envelopes, and books. They are the highest quality ink-free waste paper obtained from factories. The properties of the paper used in this study are given in Table 1.

Table 1: Characteristics of paper mill waste used as waste paper

| Gramaj | Smoothness | Air Permeability | Contact Angle | Color Measurement | | | | | Light Fastness | | | | |
|------------------|------------|-------------------|---------------|-------------------|------|-------|-------|------|----------------|------|------|------------|--|
| | | | | L | A | B | Gloss | Renk | L | A | B | ΔE | |
| g/m ² | ml/min | $\mu\text{m/pas}$ | $^{\circ}$ | | | | | | | | | | |
| 41.2 | 549 | 2,95 | 75.0 | 91.26 | 1.33 | 11.96 | 15.8 | | 84.6 | 3.59 | 29.7 | 19.56 | |

Method

Preparation of Extract

| | |
|--------------|----------------------|
| Flotte | : 1:20 |
| Dye material | : 17 g walnut shells |
| Temperature | : 100 ⁰ C |
| Time | : 60 ' |
| Waiting Time | : 60 ' |

To obtain the extract, walnut shells (*Juglans Regia L.*) were weighed and boiled in a beaker containing distilled water at 100°C on a hot plate for 60 minutes. After boiling, the extract was allowed to sit in the water bath for 1 hour. Then, it was filtered to remove the walnut shells from the extract.

Obtaining pulp from paper waste scraps:

| | |
|-------------------------|-------------------------------|
| Waste paper scraps | : 425 g |
| the Amount of dyestuffs | :%25 |
| Water used for pulp | : 800 ml (100 ⁰ c) |
| Blender setting | : 1000 W |

Blender blending time : 3 '

425 g of waste paper scraps were shredded and added to a blender. 800 ml of boiling water was added to the blender. The shredded paper was left in the boiling water for 15 minutes. After the waiting period, the shredded paper was blended in the blender at 1000 W for 3 minutes, resulting in a pulp. The prepared extract was added to the pulp and mixed thoroughly in the blender at 1000 W for another 3 minutes to ensure that the pulp absorbed the extract fibers. The resulting pulp was placed in a glass jar and left to stand for one week.

Obtaining paper from scrap paper waste:

Water used in pulp container : 5000mL – 8000mL

Pulp container : 30-L tank with dimensions of 27x40 cm

Screen size : 19x25 cm

Type of screen : metal screen

400 g of the pulp obtained after a week-long waiting period was transferred to the blender. Then, 400mL of boiling water was added to the blender. The mixture of pulp and water was blended for 3 minutes with a 1000 W blender. The resulting mixture was transferred to the pulp chamber. Two different measurements, 5000mL and 8000mL, were used to add water to the pulp chamber, in order to observe the effect of water on the different volumes of paper pulled using the same pulp. Additionally, four paper samples were pulled from the same pulp by reducing the fibers in each subsequent sample. A comparison was made between these samples, taking into account the reduction in fiber content, and the differences were noted.

Color measurement: According to the CIELAB system, measurements were performed using a Konica Minolta CM-700d spectrophotometer with a 10° standard observer under D65 daylight. L*, a*, b*, and gloss values of the samples were determined after drying, and ΔE calculations were made along with L*, a*, b*, and gloss measurements of the samples after lightfastness, as shown in Table 3.

Color differences with ΔE^* , ΔL^* , Δa^* , and Δb^* values were calculated using the following formulas.

$$\Delta e^*_{ab} = (\Delta l^{*2} + \Delta a^{*2} + \Delta b^{*2})^{1/2} \quad \text{formula 1}$$

$$\Delta l^{*2} = (l^*_2 - l^*_1)^2 \quad \text{formula 2}$$

$$\Delta a^{*2} = (a^*_2 - a^*_1)^2 \quad \text{formula 3}$$

$$\Delta b^{*2} = (b^*_2 - b^*_1)^2 \quad \text{formula 4}$$

L = lightness – darkness, a = redness – greenness, b = yellowness – blueness, gloss indicates the shininess, ΔE represents the total color difference. As ΔE values move away from 0, the color difference increases.



Figure 1: The color universe

Surface smoothness measurement: Smoothness was measured using the Lorentzen & Wettre Bendtsen tester, which applies constant pressure air (98 kPa) according to the UM 535 standard test method, using the Bendtsen method, and the results are shown in Table 4.

Contact angle measurement: Contact angle is the angle between a solid surface and the liquid that contacts it. Contact angle measurements are used to determine the wettability and surface tension of a surface. An increase in the angle indicates that the paper surface is hydrophobic and has a high surface tension, while a decrease towards 0° indicates that the paper surface is hydrophilic and has a low surface tension.

To examine the changes in contact angle that arise from the surface energies and roughness of the samples, measurements were taken using a PGX+ portable surface tension measurement device (goniometer). The goniometer was used to measure the contact angle of the samples, which were painted with walnut and drawn in different volumes, taking into account the order of the drawings. The measurements were taken by dropping a 3µl volume of distilled water onto the textured surface of natural paper in a static state, with the goniometer held horizontally, and measuring it 200 times per minute. The measurements are shown in figures and the angle values are given in Tables 4 and 5.

Lightfastness measurement: Lightfastness was evaluated using the Δe^* total color difference between the test samples and the untested sample, with blue wool references, according to the TS 1008 ISO 105-B02 standard, using a lightfastness testing device (Solarbox 1500E), and measured with a spectrophotometer.

FINDINGS

This section includes the findings related to the paper pulp we prepared, including the differences between the samples extracted with and without extract when soaked in 5000mL-8000mL water, surface smoothness, air permeability, contact angle, color measurements (CIELAB), gloss, ΔE values, and lightfastness.

Table 2: Sample preparation conditions

| Colored Sample | The water used in the pulp tank. | Unpigmented Sample | Water Used in the Pulp Tank |
|----------------|----------------------------------|--------------------|-----------------------------|
| SP-C-1a | 5L | SP-3a | 5L |
| SP-C-1b | | SP-3b | |
| SP-C-1c | | SP-3c | |
| SP-C-1d | | SP-3d | |
| SP-C-2a | 8L | SP-4a | 8L |
| SP-C-2b | | SP-4b | |
| SP-C-2c | | SP-4c | |
| SP-C-2d | | SP-4d | |

Table 3: Color measurements and light fastness results of the samples made.

| Sample | Color Measurement | | | | | After Light Fastness | | | | | ΔE |
|--------|-------------------|------|-------|-------|-------|----------------------|------|-------|-------|-------|------------|
| | L | a | b | Gloss | Color | L | a | b | Gloss | Color | |
| 1a | 81.26 | 1.73 | 12.41 | 14.37 | | 79.5 | 4.19 | 26.77 | 10.24 | | 14.9 |
| 1b | 80.61 | 1.92 | 12.47 | 11.32 | | 79.18 | 4.3 | 27.28 | 8.66 | | 15.1 |
| 1c | 80.32 | 1.95 | 12.44 | 8.75 | | 79.06 | 4.58 | 27.84 | 9.39 | | 15.6 |
| 1d | 80.79 | 1.79 | 11.96 | 9.69 | | 80.79 | 4.4 | 27.11 | 11.06 | | 15.3 |
| | | | | | | | | | | | |
| 2a | 80.78 | 1.74 | 12.39 | 9.49 | | 80.17 | 4.52 | 28.08 | 8.97 | | 15.9 |
| 2b | 80.65 | 1.8 | 12.19 | 8.13 | | 79.52 | 4.84 | 28.9 | 8.8 | | 17.02 |
| 2c | 80.94 | 1.72 | 11.88 | 9.76 | | 80.31 | 4.71 | 29.7 | 8.81 | | 18.08 |
| 2d | 81.63 | 1.98 | 12.27 | 12.93 | | 80.73 | 4.85 | 30.63 | 8.64 | | 18.6 |
| | | | | | | | | | | | |
| 3a | 87.95 | 0.14 | 13.29 | 9.99 | | 84.46 | 1.98 | 20.43 | 13.13 | | 8,15 |
| 3b | 86,10 | 0.86 | 14,30 | 9.71 | | 83.63 | 2.20 | 20.87 | 10.22 | | 7,14 |
| 3c | 85.16 | 1.08 | 14.88 | 10.63 | | 84.26 | 1.99 | 20.54 | 10.20 | | 5,80 |
| 3d | 84.99 | 1.02 | 14.75 | 10.58 | | 83.80 | 2.08 | 21.15 | 9.66 | | 6,58 |
| | | | | | | | | | | | |
| 4a | 87.29 | 0.63 | 13.26 | 9.88 | | 85.61 | 1.48 | 19.44 | 7.30 | | 6,46 |
| 4b | 87.21 | 0.54 | 13.39 | 9.53 | | 85.20 | 1.58 | 20.21 | 11.11 | | 7,18 |
| 4c | 85.78 | 0.64 | 13.59 | 8.99 | | 85.24 | 1.40 | 20.34 | 11.21 | | 6,81 |
| 4d | 87.85 | 0.43 | 13.04 | 10.27 | | 84.81 | 1.68 | 20.86 | 9.80 | | 8,48 |

Based on the results shown in Table 3, when we examine the L values in terms of lightness and darkness, there is no significant difference in the values of the colored samples. However, it can be seen that there is a more significant decrease in the L values of the uncolored samples.

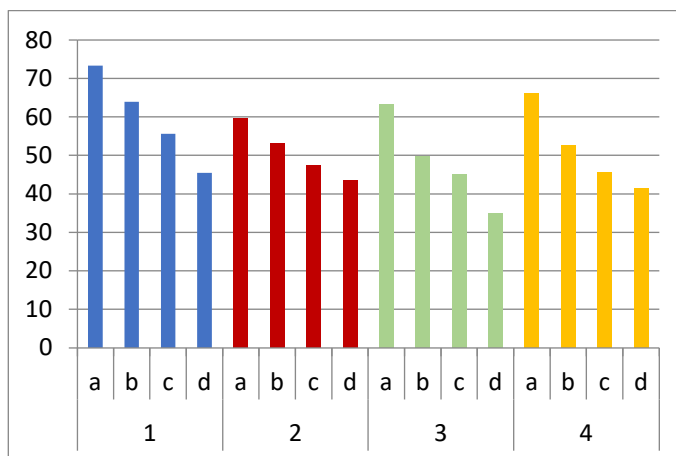
After the lightfastness test, when we look at the results, the red and yellow values of the samples have increased significantly. When we examine the A value, it is determined that the red and yellow values of the colored samples have increased significantly, but this increase is less in the uncolored samples.

When we look at the gloss values, we generally see a significant decrease in the values. ΔE shows the difference between the Lab values measured before and after the lightfastness test. It can be seen that the ΔE value of the colored samples is higher than the uncolored samples.

Table 4: Measurement of weight, surface smoothness, air permeability, and contact angle of samples.

| Sample | Weight (g/m ²) | surface smoothness ml/min | Air Permeability µm/pas | Contact Angle |
|--------|-------------------------------|---------------------------------|-------------------------------|------------------|
| 1a | 73.3 | 4,028 | 9,8 | 39.5 |
| 1b | 63.9 | 4,141 | 9,9 | |
| 1c | 55.6 | 4,709 | 14,5 | |
| 1d | 45.5 | 4,062 | 17,1 | 55.0 |
| 2a | 59.7 | 7,148 | 10,5 | 38.4 |
| 2b | 53.2 | 6,449 | 12,9 | |
| 2c | 47.5 | 5,143 | 15,4 | |
| 2d | 43.5 | 4,882 | 15,6 | 49.2 |
| 3a | 63.3 | 2,762 | 8,01 | 47.1 |
| 3b | 49.7 | 2,578 | 11,7 | |
| 3c | 45,1 | 2,414 | 13,6 | |
| 3d | 34.9 | 2,092 | 15,4 | 44,3 |
| 4a | 66.2 | 2,864 | 12,2 | 41.6 |
| 4b | 52.6 | 2,782 | 13,3 | |
| 4c | 45.5 | 2,711 | 14,1 | |
| 4d | 41.4 | 2,342 | 15,3 | 46,8 |

When Table 4 is examined, it is determined that the decrease of fibers is directly proportional in each group considering the weight measurements of the samples. When the surface smoothness is examined, there is a correlation between the groups. The best results are observed in the 1st and 2nd groups. Thus, it is determined that coloring fibers with walnut increases the surface smoothness. When the results of air permeability test are examined, it is observed that the higher the fiber ratio in each group, the less air permeability it has and as the fibers decrease, the air permeability increases.

**Figure 2: The obtained grammage values**

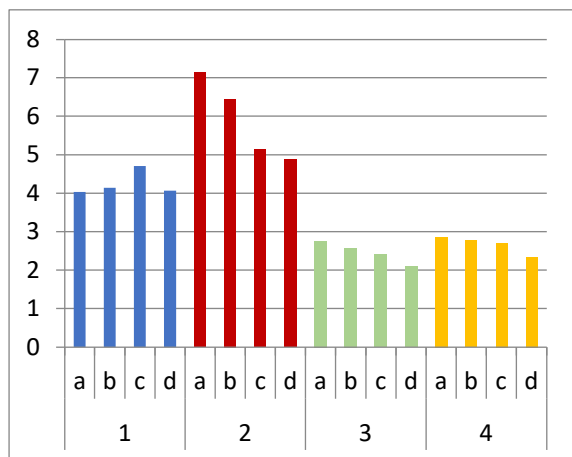


Figure 3: Surface smoothness

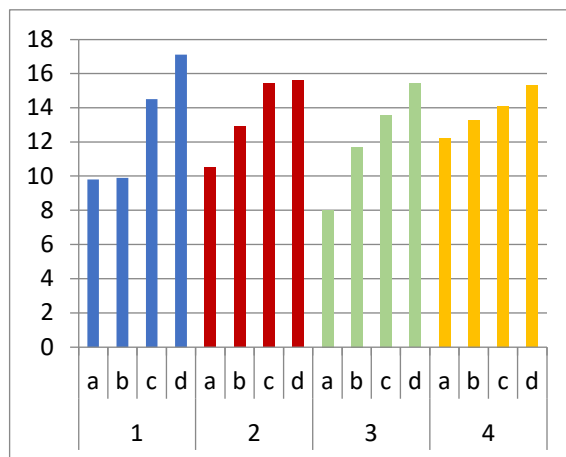


Figure 4: Air permeability

Table 5: Contact angle values of the samples

| | | | |
|----|------|----|------|
| 1a | 39.5 | 3a | 47.1 |
| 1d | 55.0 | 3d | 44,3 |
| | | | |
| 2a | 38.4 | 4a | 41.6 |
| 2d | 49.2 | 4d | 46,8 |

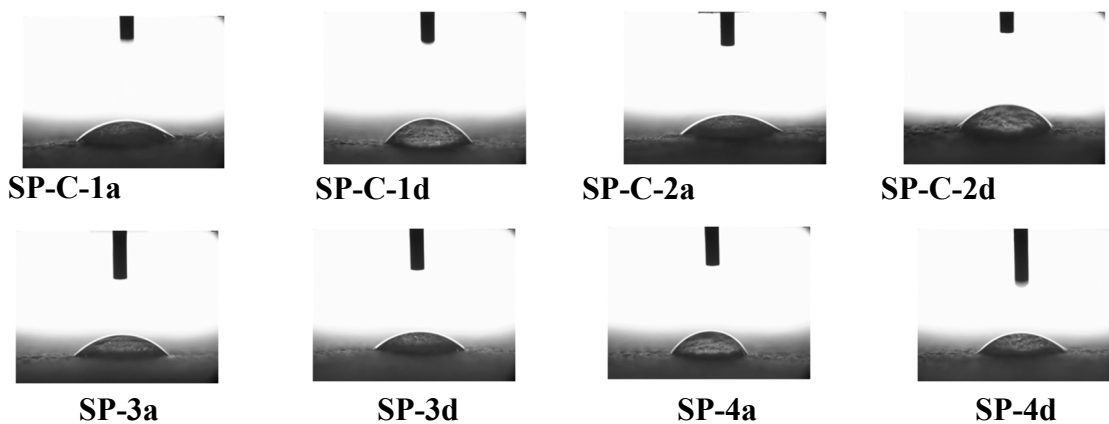


Figure 5: Absorption of droplet by surface (contact angle test)

Upon examining the values in Table 5, it can be observed that the contact angles of the samples with walnut extract coloring in groups 1 and 2 have increased with the decrease in fiber content compared to the sample with higher fiber content. It has been determined that as the contact angle increases, the surface energy of the samples increases and at the same time, their water absorbency property improves. The tensile strength allows water to adhere better to the fibers, resulting in an increase in contact angle.

Groups 3 and 4 were not colored with walnut extract. Looking at the contact angle results, we can see the differences in tensile strength in 5L and 8L. In 5L, the contact angle of the sample with higher fiber content is higher, while the contact angle of the sample with reduced fiber content decreases. In 8L, however, the sample with reduced fiber content has acquired a hydrophilic property compared to the sample with higher fiber content.

When the values in the table are examined, it is determined that the best contact angles are obtained with the samples colored with walnut extract, and the best result is obtained with the sample with reduced fiber content in 5L.

Table 6: Differences between colored samples in 5L and 8L

| Sample | Weight (g/m ²) | surface smoothness ml/min | Air Permeability µm/pas | Contact Angle |
|--------|-------------------------------|---------------------------------|----------------------------|------------------|
| 1a | 73.3 | 4,028 | 9,8 | 39.5 |
| 1b | 63.9 | 4,141 | 9,9 | |
| 1c | 55.6 | 4,709 | 14,5 | |
| 1d | 45.5 | 4,062 | 17,1 | |
| 2a | 59.7 | 7,148 | 10,5 | 38.4 |
| 2b | 53.2 | 6,449 | 12,9 | |
| 2c | 47.5 | 5,143 | 15,4 | |
| 2d | 43.5 | 4,882 | 15,6 | |

When examining the samples colored with walnut extract, it can be seen that the withdrawal order of the sample is important and effective in the weight of the samples. As the samples are taken from the pulp tank, the paper fibers decrease and a proportional decrease is observed in the weights of the samples. When the surface smoothness of the samples taken in 5L is examined, it is found that they give similar results. However, in the samples taken in 8L, it is observed that as the sample is withdrawn, the surface smoothness decreases while the sample with high fiber ratio has better surface smoothness compared to the other samples. Thus, it is assumed that in 8L, as the fibers in the water decrease, the surface smoothness also decreases. It has been determined that the air permeability of the samples taken in 5L and 8L is better in the samples with high fiber ratio, and the air permeability increases proportionally as the withdrawal order increases.

Table 7: Differences of uncolored samples in 5L and 8L

| Sample | Weight (g/m ²) | surface smoothness ml/min | Air Permeability µm/pas | Contact Angle |
|--------|-------------------------------|---------------------------------|----------------------------|------------------|
| 3a | 63.3 | 2,762 | 8,01 | 47.1 |
| 3b | 49.7 | 2,578 | 11,7 | |
| 3c | 45,1 | 2,414 | 13,6 | |
| 3d | 34.9 | 2,092 | 15,4 | |
| 4a | 66.2 | 2,864 | 12,2 | 41.6 |
| 4b | 52.6 | 2,782 | 13,3 | |
| 4c | 45.5 | 2,711 | 14,1 | |
| 4d | 41.4 | 2,342 | 15,3 | |

When Table 7 is examined, it is observed that the increase and decrease of fiber ratio is important and effective in the weight of uncolored samples. It has been determined that this is not related to coloring with walnut extract. Similar results were found when the surface smoothness of samples taken in 5L and 8L was examined. A decrease in surface smoothness is observed with a very small decrease in fibers.

It has been determined that the air permeability of samples taken in 5L and 8L is better in samples with high fiber ratio and air permeability increases inversely with decreasing fiber ratio.

RESULTS

When examining the colored and non-colored samples, it was found that the colored samples gave better results in terms of surface smoothness. It was observed that the air permeability increased as the fibers decreased, regardless of whether the samples were colored or not. It was determined that the fibers decreased by a certain amount when looking at the gramages. When looking at the results of all the tests performed on the samples, it was found that two groups, namely the samples colored with walnut extract and those taken at 8L, gave better results.

When examining the results of the air permeability test, it was observed that the sample with a higher fiber content in each group had less air permeability, and the air permeability increased as the fibers decreased. It was found that the colored samples gave better results in terms of surface smoothness. To obtain darker colors, the amount of coloring agent can be increased. Similar studies can be conducted using different coloring agents. In natural dyeing, the mordanting process, which is commonly used to increase the binding of coloring agents, can be performed.

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4. INTERNATIONAL CAPPADOCIA SCIENTIFIC RESEARCH CONGRESS



ACCEPTANCE LETTER

REF : Akademik Teşvik

15/05/2023

İLGİLİ MAKAMA

4. ULUSLARARASI KAPADOKYA BİLİMSEL ARAŞTIRMALAR KONGRESİ 16-17 Nisan 2023 tarihleri arasında Nevşehir / Türkiye’de 22 farklı ülkenin (Türkiye-167, Diğer Ülkelerden-184) akademisyen/araştırmacılarının katılımıyla gerçekleşmiştir. Kongre 16 Ocak 2020 Akademik Teşvik Ödeneği Yönetmeliğine getirilen “Tebliğlerin sunulduğu yurt içinde veya yurt dışındaki etkinliğin uluslararası olarak nitelendirilebilmesi için Türkiye dışında en az beş farklı ülkeden sözlü tebliğ sunan konuşmacının katılım sağlaması ve tebliğlerin yarıdan fazlasının Türkiye dışından katılımcılar tarafından sunulması esastır.” değişikliğine uygun düzenlenmiştir.

Bilgilerinize arz edilir,
Saygılarımla

Mustafa Latif EMEK
On behalf of Organizing Board