

Tissue Papers in Turkey and Some Physical and Optical Properties

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Anahtar Kelimeler

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Properties

Abstract: The objective of study was to determine some properties of tissue papers and identify the position in Turkey. Napkins, toilet papers and paper towels used in this study were supplied from 5 different companies. Physical and optical properties of these papers were investigated and compared them to each other. Grammage, moisture content, crepe, bulk, density, tensile strength, thickness, water retention value and water absorption time were determined as physical properties and brightness and whiteness values were measured as optical properties. According to obtained results, the best results in physical and optical properties of napkins, toilet papers and paper towels belong to C, E and A Company, respectively.

Türkiye’de Temizlik Kağıtları ve Bazı Fiziksel ve Optik Özellikleri

Keywords

Temizlik Kağıtları,
Tuvalet Kağıdı,
Peçete,
Kağıt Havlu,
Fiziksel ve Optik Özellikler

Özet: Bu çalışmada, temizlik kağıtlarının Türkiye’deki durumunu belirlemek ve bazı özelliklerini araştırmak amaçlanmıştır. Bu kapsamda çalışmada kullanılan peçete kağıtları, tuvalet kağıtları ve kağıt havlular 5 farklı firmadan temin edilmiştir. Bu kağıtların optik ve fiziksel özellikleri araştırılmış ve birbirleriyle karşılaştırılmıştır. Gramaj, rutubet miktarı, krep, hacimlilik, yoğunluk, çekme direnci, kalınlık, su tutma değeri ve su emme hızları belirlenmiştir. Optik özelliklerden ise parlaklık ve beyazlık değerleri ölçülmüştür. Elde edilen sonuçlara göre peçete kağıtları, tuvalet kağıtları ve kağıt havlulara ait en iyi optik ve fiziksel özellikler sırasıyla C, E ve A firmalarına ait olduğu tespit edilmiştir.

1. Introduction

Tissue paper is generally defined as low weight (14-40 gr m-2) and crepe paper. The main product groups constitute tissue paper;

- Toilet papers,
- Paper towels
- Napkins,
- Wipes.

Due to low weight, tissue papers are produced several layers. New technological developments in paper production have led to add new products as wet wipes, wet toilet papers.

It is thinking that first toilet paper was produced in the 14th century. The first factory production was launched by Joseph Cattey in the United States in 1857. The first wrapped roll phase of toilet paper was made in 1880. After World War II, it has been used in a wide

range. First entry into the market of toilet paper in turkey was in the 1970s [1].

World production of toilet paper per year is approximately 35 billion rolls. Given an average population of 6 billion people in the world, the world average is around 6 rolls per person. According to these data; Turkey remains below the world average annual consumption with 4 rolls per person. 40% recycled fiber (RCF), 45% chemical pulp, 1% mechanical pulp and 2% other materials were used for tissue paper production in the world. Turkey has 48 paper mills and tissue paper production was 461.936 tons. The production of tissue paper is a rapidly evolving field in Turkey. Reason of this, import of cellulose as a raw material for paper production draws attention to facilitate. Interest in tissue paper production was increased due to reduced costs. A great competition has begun in this field. Be over 90 the number of companies that produce waste paper press in Turkey is a figure showing the said competition [2].

In this present study, toilet papers, napkins and paper towels supplied five different companies in Turkey were used to determine physical and optical properties and to identify position in Turkey.

1.1. Export and import of tissue papers in the world

Export of tissue paper in the world was 22.1 billion dollars in 2009. It decreased to 14.5 billion dollars in 2013 (Figure 1a). Germany took the largest share of world exports in the tissue papers with 1.7 billion dollars in 2013. China and Italy follow Germany with 1.5 and 1.3 billion dollars, respectively Turkey takes the 12th place with 753.82 million dollars [3].

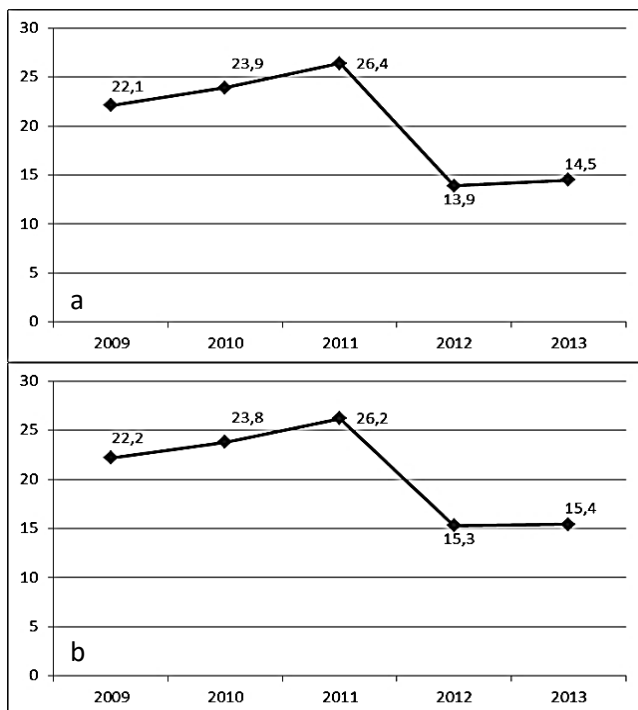


Figure 1. Export (a) and Import (b) of tissue paper in the world

Figure 1b shows that there was a high decrease after 2011 in import between the years 2009-2013. The import of tissue papers in the world, USA takes the first place in import with 1.5 billion dollars. Germany and Canada follow it with 1.38 and 0.88 billion dollars. Turkey takes the 21th place with 98 million dollars. Turkey does just the %0.63 of the import [3].

1.2. Export and import of tissue papers in the world

When looked at the last five years improvement, apart from the economic crisis in 2009, Turkey's tissue paper export shows a constant increase. Turkey's tissue paper exports in 2009-2013 were 523.2, 643.3, 753.5, 926.5 million dollars and 1.1 billion dollars, respectively. This means that there were increases from 2009 to 2013 about %110.3.

Turkey's export with a value of 1.1 billion dollars in this sector draws attention. Turkey's the highest export is to Iraq with 238.31 million dollars. Azerbaijan and USA follow Iraq with 75.49 and 70.86 million dollars, respectively.

Turkey, showing a wavy trend within its last 5 years in tissue paper import, has an 86.5 million dollars import in 2009 and 115 million dollars in 2013. Turkey's the highest import is to Poland with 31.7 million dollars. Germany and Hungary follow Poland with 17.6 and 14 million dollars, respectively [2, 4].

2. Material and Method

2.1. Material

This study was conducted at Kahramanmaraş Sutcu Imam University Faculty of Forestry, Pulp and Paper Production Laboratory.

Tissue papers supplied five different companies used for this study were toilet papers, napkins and paper towels. Physical and optical tests of papers were made according to the standard methods.

2.2. Some Physical and Optical Properties of Tissue Papers

Physical and optical properties of tissue papers were determined according to standards given in Table 1.

Table 1. Applied tests on tissue paper and standards [5, 6]

Tests	Standards
Grammage	ISO 12625-6
Moisture content	DIN 54540-9
Bulk	ISO 12625-3
Density	ISO 12625-3
Tensile strength	ISO 12625-4
Thickness	ISO 12625-3
Crepe	ISO 1924/2
Water retention value	ISO 23714
Water absorption time	ISO 12625-8
Whiteness	ISO 11476
Brightness	ISO 2470-1

Grammage, moisture content, crepe, bulk, density, tensile strength, thickness, water retention value and water absorption time are calculated as physical properties. Brightness and whiteness values were measured as optical properties. After applied these tests, physical and optical properties of companies' products were compared them to each other.

3. Results and Discussion

3.1. Some Physical and Optical Properties of Tissue Papers

Physical and optical properties of tissue papers obtained from five different companies were given in Table 2, 3 and 4.

Important physical properties of tissue papers were water retention value (WRV), crepe and water absorption time (WAT). Because of usage areas, tissue papers must be resistant to water.

WRV is defined as the ratio of the mass (weight) of water retained after centrifugation under specified conditions by a wet pulp sample to the oven dry mass (weight) of the same pulp sample. WRV test provides an indication of fibers' ability to take up water and swell.

The quality of the creped sheet is, in part, a function of the adhesion/release properties of the sheet, which are determined largely by the dryer surface coating [7].

In European and international trade, both water-absorption time and water-absorption capacity represent important parameters in the field of comparison of tissue products [8].

According to Table 2, the best result in water absorption time, water retention value, crepe and tensile strength of napkins were found as 4 seconds (C Company), 8.93 g/g (C Company), 11.3% (A Company) and 164 N.m/g (MD) (A Company).

In Table 3, some physical and optical properties of paper towels were given. B Company has the best WAT and WRV as 5.3 s and 7.9 g/g. The best result in tensile strength was found as 164 N.m/g (A Company). A and D companies have better crepe as 11.2%.

Table 2. Some physical and optical properties of Napkins

Companies	A	B	C	D	E
Grammage (gr/m ²)	18,0	16,6	17,4	16,4	16,7
Moisture (%)	5,50	6,90	7,80	5,60	6,80
Crepe (%)	11,3	10,6	10,4	10,8	10,7
Bulk (cm ³ /gr)	3,30	3,00	3,82	3,96	3,30
Density (gr/cm ³)	0,30	0,33	0,26	0,25	0,30
Thickness (micron)	60,0	50,0	65,0	65,0	55,0
Cross Direction (CD)	176	64,0	37,0	37,0	80,0
Tensile S. (N.m/g)					
Machine Direction (MD) Tensile S. (N.m/g)	216	117	96,0	129	164
Water Retention Value (g/g)	4.64	5.85	8.93	7.39	5.41
Water Absorption Time (second)	6:03	7:02	4:09	5:02	5:03
Brightness (ISO)	64,8	63,6	64,9	64,7	63,7
Whiteness (ISO)	67,0	65,9	67,2	66,9	66,1

Table 3. Some physical and optical properties of Paper Towels

Companies	A	B	C	D	E
Grammage (gr/m ²)	19,0	17,5	21,3	18,8	21,5
Moisture (%)	5,50	4,30	5,90	5,80	4,10
Crepe (%)	11,2	10,5	11,0	11,2	10,3
Bulk (cm ³ /gr)	3,69	4,02	3,75	4,00	4,20
Density (gr/cm ³)	0,27	0,25	0,27	0,25	0,24
Thickness (micron)	70,0	70,0	80,0	75,0	90,0
Cross Direction (CD)	112	52,0	48,0	46,0	57,0
Tensile S. (N.m/g)					
Machine Direction (MD) Tensile S. (N.m/g)	164	72,0	96,0	62,0	129

Water Retention Value (g/g)	5.31	7.90	6.87	6.55	6.37
Water Absorption Time (second)	5:00	4:08	7:07	7:06	7:03
Brightness (ISO)	64,3	63,6	65,6	64,8	65,2
Whiteness (ISO)	66,6	66,1	67,9	66,7	67,5

Table 4. Some physical and optical properties of Toilet Papers

Companies	A	B	C	D	E
Grammage (gr/m ²)	17,0	15,7	16,3	15,7	16,8
Moisture (%)	5,50	2,90	2,90	3,00	5,90
Crepe (%)	ND	ND	ND	ND	ND
Bulk (cm ³ /gr)	4,12	4,13	4,00	4,13	4,36
Density (gr/cm ³)	0,24	0,24	0,25	0,24	0,23
Thickness (micron)	70,0	65,0	65,0	65,0	70,0
Cross Direction (CD)	ND	ND	ND	ND	ND
Tensile S. (N.m/g)					
Machine Direction (MD) Tensile S. (N.m/g)	ND	ND	ND	ND	ND
Water Retention Value (g/g)	ND	ND	ND	ND	ND
Water Absorption Time (second)	5:05	6:01	5:02	8:01	4:03
Brightness (ISO)	65,5	63,2	64,3	64,2	65,2
Whiteness (ISO)	67,6	65,7	67,2	66,9	67,7

*ND: Non Defined

Some properties of toilet papers were determined in Table 4. Table 4 indicates that E company toilet papers have the best WAT (4 s) and whiteness (67.7). Companies with the best physical and optical properties of tissue papers were given Table 5.

According to Table 5, napkins of C Company, paper towels of E and A companies and toilet papers of E Company were found to be better.

While evaluating of napkins properties, WRV and WAT must have high values. WAT of napkins taken from B Company has the highest, C Company has the lowest.

Within tissue papers, the highest water absorption time in napkin samples taken from 5 different companies belongs to B Company. The lowest water absorption time belongs to C Company. As for towel papers, water absorption times within the companies C, D, E are similar to each other. The lowest water absorption time belongs to B Company. In toilet papers, D Company has the highest water absorption time. The lowest water absorption time was determined to be E Company with a time of 03:37.

Within tissue papers, the highest water retention value in napkins belongs to Company C, while the lowest belongs to Company A. Paper towel of Company B has the highest water retention value, while the lowest belongs to Company A.

Table 5. The best results in physical and optical properties of companies' tissue papers

Tissue Papers	Napkins	Paper Towels	Toilet Papers
Grammage (gr/m ²)	A	E	A
Moisture (%)	E	E	D
Crepe (%)	A-D	A-D	-

Bulk (cm ³ /gr)	D	E	E
Density (gr/cm ³)	B	A-C	C
Cross Direction (CD)	A	A	-
Tensile S. (N.m/g)			
Machine Direction (MD)	A	A	-
Tensile S. (N.m/g)			
Water Retention Value (g/g)	C	B	-
Water Absorption Time (second)	C	B	E
Brightness (ISO)	C	C	A
Whiteness (ISO)	C	C	E
Thickness (micron)	C-D	E	A-E

Within the tissue papers, brightness and whiteness values in napkin samples taken from 5 different companies were analyzed as shown in the table. According to the table Company C has the highest brightness and whiteness values in napkin samples. Company B has the lowest brightness and whiteness values.

In paper towels, according to brightness and whiteness values, Company C has the highest brightness and whiteness values. Company B was determined to have the lowest brightness and whiteness values.

In toilet papers, companies A and E have the highest brightness and whiteness values. Company A has higher brightness value than Company E. However, Company E is higher in whiteness value than Company A. According to the brightness and whiteness values results in toilet papers, Company B has the lowest values.

Within the tissue papers, according to crepe test results in napkin samples taken from 5 different companies, Company A has the highest while Company C has the lowest crepe test. In towel papers, Company A and D has the highest values in crepe test. The lowest belongs to Company E.

4. Conclusion

Optical and physical properties of napkins, paper towels, and toilet papers taken from 5 different companies were determined. Because tissue papers are in contact with water during use, crepe, WRV, and WAT of these papers are important. According to the results, Company C, Company A, and Company E have the best results in napkins, paper towels, and toilet papers, respectively.

Turkey, being the biggest 12th tissue paper exporter, by rapidly solving the issues in this sector will reveal its great power and maybe enable our country to be world's biggest tissue paper exporter.

There are some attempts for solving this sector's problems when approached respectively;

Two different ways may avail to get over the sector's excess capacity problem. Both promotional activities

must be increased to develop domestic marketing, and sector's export must be increased with new markets by increasing overseas markets. Any kind of activity for extending the usage of new markets, created both domestic and foreign, will greatly contribute to the sector's development.

For overcoming the problems in unfair competition, consumers' awareness must be heightened. It will be helpful to enable the consumers' preferences not according to rack rate but to quality.

Production cost of the sector will decrease if the sector is encouraged in raw material and energy supply.

Also, when ever-increasing tissue paper production and developments in sector are taken into account, promising with its wide product range, tissue paper sector, clearly carries a great importance in human health and hygiene. With these reasons in order to increase personal cleaning and hygiene awareness, to be the pioneer of modern, qualified and healthy life various activities must be carried out to inform the public, aiming to extend the usage of tissue paper.

When the advantage of Turkey's strategic position is taken into account the target's reality clearly reveals. Turkey exports to more than 170 countries in different continents; Europe at first then Middle East and Turkic Republics.

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