

Selecting the best facial tissue with respect to customer's perspectives by using AHP

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Abstract

There are various facial tissues that are used in the country. The products are deferent together in quality and prices. Some of these products are made in local factories and almost of them are entered from another countries in mass form and then they are packaged in the internal firms and distributed among the sellers to final using. Of course all the products have to get acceptance stamp from the local organization before distributing. For selecting the best facial tissue with respect to customer's perspective, AHP method and Expert Choice software has been used to calculate weighing value of facial tissue criteria and alternatives priority. The results showed softness, time of absorption, appearance quality, basis weight and price criteria have high priority respectively, also C product has highest priority among 3 facial tissues with respect to customer's perspectives.

Keywords: facial tissue, customer's perspective, AHP, priority, criteria

Introduction

We did the current research to determine effective criteria in facial tissues which are used by the consumers. Acknowledgment of the tissues criteria with respect to the consumers is very important and will affect on the market demand.

Annual per capita of facial tissue in the world is 3 kg and annual per capita in the United States, Africa, Northern Europe, is 20, 0.36 and 15 kg, respectively.

In Iran there are 90 factories that produce facial tissue and nominal capacity of facial tissue is 43076 Ton/year. There are some parameters which affect on final price of facial tissue are as follows: utilized raw material, location of the units, kind of technology, man force costs and production capacity. Because there are different kinds of the products in quality and price it is necessary the customers who are users of the final product every day, get some information about specifications of the products. After this process they can suggest to improve the products to the factories and firms. There are 24 criteria for facial tissue which has been measured by Iranian industrial researches and standard organization.

In current research, for acknowledgment of effective criteria which effect on selecting facial tissue we got some information from facial tissue experts, marketing experts and Iranian industrial researches and standard organization in number of 627. Some of the important attributes which effects on facial tissue consumption are 8 group of criteria. The attributes considered most relevant from the customer's perspective are: (1) softness, (2) humidity, (3) price, (4) appearance quality, (5) brightness, (6) basis weight, (7) stretch, (8) tensile. The three kinds of facial tissues which have been evaluated are as follows: Narmeh (A) which is internal product, Cheshmak (B) and Softlan (C) which are import products, respectively. Specifications of the products have been showed in Attachment 14. Three level of intensity have been evaluated: high (H), medium (M) and low (L). To select the best facial tissue, AHP method was applied. This method was first invented by Thomas L. Saaty in 1970s, and it is used in decision making processes which have qualitative and quantitative criteria (Saaty, 2000). There is a comprehensive example how to make the decision on national missile defense program. The US government faces the crucial decision whether or not to commit itself to the deployment of a National Missile Defense (NMD) system. By applying an AHP model, deploying NMD alternative is the best alternative (Saaty, 2001). One of the main advantages of this method is its use in group decision making, in such a way that it will integrate the group members' decisions, so that the final and optimized decision contains the decisions of all members (Memariani and Azar, 1995). Azizi(2005) applied AHP method to determine effective criteria for selecting the best choice of raw material procurement in paper making factories in Iran. The decision has been done with base on benefits, costs, opportunities and risks. The results showed No harmful on environment has the highest priority in terms of benefits. Azizi et al. (2003) used AHP (Analytical Hierarchy Process) method to determine effective criteria for location selection of plywood and veneer units. They identified 25 criteria and sub-criteria in this research. Samari et al (2005) presented that how the analytical hierarchy process (AHP), as a multi-criteria decision-making techniques, can be effectively helpful in selecting on appropriate model for forestry extension. The result showed AHP technique, as employed in the research, reveals that present situations fail to regard privatized extension

Research Method

Features of the criteria affecting in selection of the facial tissue

The criteria are described as follows.

1. Softness: softness is very important specification which there are not any normal measurement for it. Every factory has especial method to measure it. One method is Hand feel which the criteria is measured with 2-6 ranking. Another measurement is inverse of softness which is ruggedness. In Iranian standard, amount of acceptable measurement is 110 milli Newton. The range of ruggedness is 20-50 milli Newton.

2. Humidity: humidity divided in two sub criteria as follows: Moisture content and absorption time.

2.1. Moisture content: In Iranian standard available moisture in the tissue is 8% maximum and the range of moisture content is 2.5-5%.

2.2. Absorption time: maximum time of absorption is 0.02 millimeter of 20+2 or 20-2 centigrade degree distilled water in one sheet of facial tissue. In Iranian standard this time is maximum 10" and range of time is 2-3".

3. Price: price of one box of facial tissue with 100 sheet and 2 layer is 4000-4500 rails.

4. Appearance quality: appearance quality divided in two subsections which are as follows: Box and tissue.

4.1. Box: the box is some characters includes design, appearance and color, packaging and variety.

4.2. Tissue: tissue has three character includes design, color and legend.

5. Brightness: In Iranian standard minimum of brightness in white facial tissue is 80% and in color facial tissue is 78%. The range is 95-80%.

6. Basis weight: basis weight is unit weight of the paper surface and is measured in g/m^2 . The range is 27-36 g/m^2 .

7. Stretch: pliature of the paper surface which is generated to increase of contact surface and give rise to increase of water absorption speed in the paper. The acceptable range is 8-18%.

8. Tensile: the tensile has three sub criteria which are as follows:

8.1. Dry tensile MD: the criteria is unit of resistance to tensile of one tissue sheet in dry position and in machine longitudinal side (MD) which is force gram on 15 millimeter of width. The acceptable range is 200-700gf.

8.2. Dry tensile CD: the criteria is unit of resistance to tensile of one tissue sheet in dry position and in machine latitudinal side (CD) which is force gram on 15 millimeter of width. The acceptable range is 70-350gf.

8.3. Wet tensile MD: the minimum of tensile resistance in machine longitudinal side (MD) and wet position is 15gf. With regard to the testing method we have only one range for this criteria and the maximum is 55gf.

The problem of selecting the product with the greatest overall consumer preference is solved in the following manner (8 steps):

Step 1: Determine consumer preference among the attributes by developing a matrix that compares attributes in pairs with respect to product desirability.

Step 2: Determine consumer preference among the intensities of the attributes by developing twelve matrices that compare intensity levels in pairs with respect to each attribute.

Now we want to synthesize these judgments to obtain the set of overall priorities that will indicate which product consumers prefer. The remaining steps take us through this process:

Step 3: Group the priorities of the intensities (H, M, L) for each of the 12 attributes in columns and enter the priorities of the attributes. Then multiply each column by the priority of the corresponding attribute to obtain the weighted vectors of priority for the intensities.

Step 4: Now select from each column the element with the highest priority to obtain the vector of desired attribute intensities:

H- Basis weight H- Stretch M-Dry tensile MD H- Dry tensile CD H- Wet tensile MD H- Softness M-Brightness M- Humidity (Moisture content) H- Humidity (time of absorption) L- Price H- Appearance quality (box) H- Appearance quality (tissue)

Then add this row and divide each entry by the total to get the normalized vector of desired attribute intensities.

Step 5: Determine the perceived product standings by developing matrices that compare the three Facial tissue (A, B, and C) in pairs with respect to the most desired attribute intensities (Attachments 2-13).

Step 6: Group the priorities of the facial tissue with respect to each desired attribute intensity in columns and enter the normalized priorities above the columns.

Then multiply each columns by the normalized priority of the corresponding attribute intensity to obtain the weighted vectors of priority for the desired attribute intensities for each facial tissue (Attachments 2-13).

Step 7: Add each of the three rows to obtain the overall priorities of the three facial tissues (Figure 3).

Step 8: Sensitivity analysis (Attachment 1).

Analytical Hierarchy Process

The AHP is basically a simple, efficient technique for problem solving . The following step by step example demonstrates this simplicity; it can also serve as a model for using the process to solve other problem. A firm wants to determine consumer preferences for three different kinds of facial tissue. Given the consumer's "bounded rationality" that is, the fact that consumers do not act on perfect or complete information and are satisfied with less than the economically most rational choice we can design best distinguish among the attributes by dividing them into this small number of intensity categories. The resulting hierarchy is shown in Figure 1.

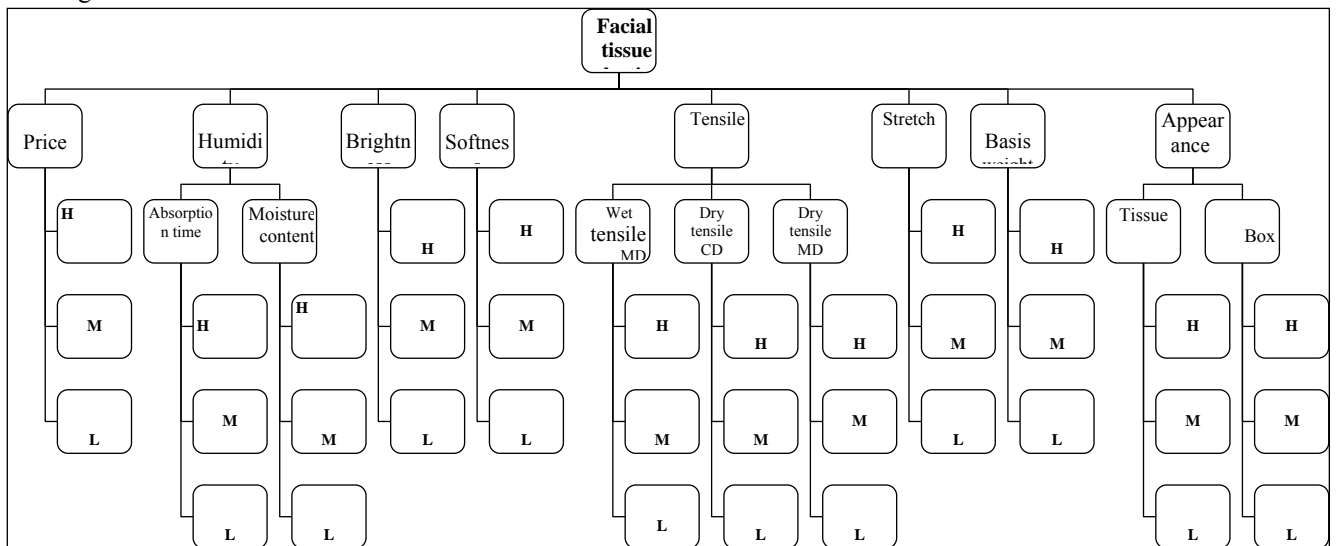


Figure 1: Hierarchy of effective criteria for Facial tissue selection (H: high intensity, M: medium intensity, L: low intensity)

Results

Weighting value of the effective criteria and the alternatives

Weighting value of the effective criteria and alternatives with the aid of Expert Choice Software 2000 (Figures 2,3).

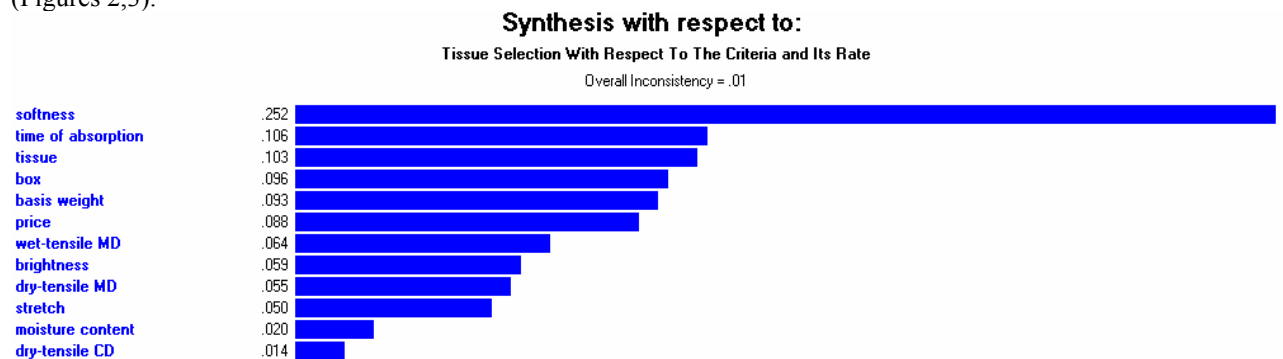


Figure 2: Result of final synthesis



Figure 3: Final outcome of facial tissue selection

Discussion and conclusion

This part is divided in two sections, first section has been described about the criteria priority and in second section we described about priority of the alternatives and sensitivity analysis.

First Section:

With respect to the result, softness criteria, has 0.252 weighing value which is the highest priority for the facial tissue and overall consistency ratio of the current research is 0.01. Of course to reach to proper softness with respect to customer' perspective and also holding of resistance level that is necessary for facial tissue performance we need high skillful in paper making process. There are several parameters which affect on facial tissue softness as follows: paper combination or furnish component, tensile resistance level of machine latitudinal side (CD), tensile ratio, tensile percent, kind of rumple, drying, volume of roller, accordingly to make of product which be acceptable, completely, have to be generate a balance among of the parameters with regard to customer's perspective. Time of water absorption has 0.106 weighing value with second priority. Capability of liquid absorption is a common and initial specification in all of the facial tissues. If the facial tissue has not enough capability of absorption it will has not desirability for final using. Some of the various pulps which are used for thin papers are very absorptive. For example in craft pulp's process many of hydrophobic materials are deleted and the pulp need to water and generates thin absorptive paper while sulfite pulps do not generate similar absorption capability sheet. To control of absorption capability of the thin papers and solve the problem usually is added moisturizer material in the pulp or with adjustment of the machine in the moisture final water system and the dryer part it will be possible. The tissues which are used to drying and liquid absorption have to storage the liquid similar to the sponge. Tissue and box criteria which are related to appearance quality have third and forth priorities with 0.103 and 0.096 weighing values respectively. A group of esthetic specifications are important in competition market. The demand for the tissues with ornament colors and designs which are compatible with kitchen, house and bathroom decoration is very high. Appearance fairness is very important for success of paper products in consumption market. Basis weight has fifth priority with 0.093 weighing value. Although there is minimum weight with regard to standard regulations for the tissues but fineness of the paper is not acceptable for the consumer, because of, with proportional increasing of the weight, capability of water absorption is increased, which is notable factor in Iran market. The price has sixth priority with 0.088 weighing value. The low price is important criteria to select of the final product but the price has not high priority in compare with what mentioned above criteria. Although the cheaper product is desirable to the consumer perspective but they do not agree with decreasing of the tissue quality. In past years there was not high pay attention to quality of the products in purchasing but at present the quality is very important factor and some of the firms has sale on a large scale in spite of high price of the product. The wet tensile MD has seventh priority with 0.064 weighing value. The softness is important factor for the tissue meanwhile the resistance and consumption capability is important factors too and during of consumption it does not have to cohere to the hands and face. If the tissue is very softness but it is not usable, it is unacceptable, of course, slight and tensely tissue which it has not softness is unacceptable too. The favorable softness is a combination of favorable surface delicacy and hardness which it procure rumple capability in consumption. On the other hand the weakness softness tissue has undesirable and hard surface delicacy and the sheet is tensely which in consumption there is not rumple and deformation capability. Almost the criteria were preferred with high priority, there is exception about the price, which has been preferred low priority that is usual. Some of the criteria were preferred with medium priority which are dry tensile MD, brightness and moisture content. With regard to paper making, when the formation is recognized and the furnish is not favorable procurement of tensile resistance is difficult

normally. The analysis indicated that high tensile CD give rise to weak softness and a reason for settling of resistance to dry tensile in CD direction.

Second section:

In second section we selected the best product with respect to customers perspective.

There are the three facial tissues in title of A, B and C. With respect to the results C product has 0.417 weighing value and highest priority to select of the customers after that, B and A products have 0.333 and 0.25 weighing value respectively.

From these results we would select product C as most desired from the customer's perspective. With respect to the results almost, the A product or internal facial tissue has lowest priority. Accordingly A product will need to improve in quality and price with respect to the effective criteria until it can compete with other products. Between B and C facial tissues, C has obtained higher priority criteria and it has the highest priority.

Since there may be different judgments on the comparison of priority rates of the criteria or their sub-criteria, to achieve stability and compatibility of the analysis, we apply sensitivity analysis (Saaty, 2001). Regarding the findings of criteria hierarchy, we find out that the ratios of the alternatives could change by increasing or decreasing one of the criteria. Accordingly it will be possible, giving of suggestions to the producers to procure their tissues with respect to the effective criteria.

Softness: There is not any change about the alternatives priority when the softness change or when the softness weighing value (w.v.) be changed from 0 to 1 the priority of alternatives is stable.

Appearance quality: Increasing of appearance quality weighing value to 0.7, effect on B and C products priority, in this regard B product will be the highest alternative with 0.395 w.v. and C product is the second with 0.393 w.v.. Increasing of appearance quality w.v. to 1, give rise to more different between B and C alternatives. A products will have not any change in this regard.

Tensile: Increasing of tensile w.v. to 0.692, effect on B and A products priority, in this regard A product will be the second alternative with 0.277 w.v. and B product is the third with 0.275 w.v.. With increasing of tensile w.v. to 1, difference of priority between A and B products will be the more. There is not any change about C product priority with respect to changes of the criteria w.v..

Stretch: Increasing of stretch w.v. to 0.202, effect on B and A products priority, in this regard A product will be the second alternative with 0.281 w.v. and B product is the third with 0.28 w.v.. With increasing of the criteria w.v. to 1, difference of priority between the alternatives will be the more. C product priority have not any change with decrease or increase of the criteria w.v..

Brightness: Increasing of brightness w.v. to 0.775, effect on B and A products priority, so that, A product will be the second alternative and with 0.295 and B product is the third with 0.294 w.v.. Increasing of the criteria w.v. to 1, give rise to more difference between A and B products priority but there is not any change with regard to C product priority.

Price: Increasing of price w.v. to 0.515, effect on B and C products priority, so that, B product will be the highest alternative with 0.376 w.v. and C product is the second with 0.374 w.v.. Increasing of price w.v. to 1, give rise to more different between B and C alternatives. A product will have not any change in this regard.

Humidity: There is not any change about the alternatives priority when the humidity change or when the humidity w.v. be changed from 0 to 1 the priority of alternatives is stable.

Basis weight: Priority of the alternative will have not any change with increasing or decreasing of basis weight w.v..

With respect to the results stretch and brightness criteria are not very important factors to select of the facial tissues. Also some of the criteria effect on together, for example to adjust of tissue resistance specifications will be needed to adjust of tissue humidity.

References

- Azizi M., 2005, " Decision making for raw material procurement in paper making factory", Proceeding of 8th International symposium of the AHP, University of Hawaii, USA
- Azizi M., Amiri S., Faezipour M., (2003), Using AHP method to determine effective criteria for plywood and veneer units location(case study Iran), Journal of the institute of wood science, Vol. 16, Num. 3, Issu. 93.
- Iranian melli Standard, 2002, properties and test methods, No. 627, Iranian industrial researches and standard organization.
- Samari, D. 2005, " Selecting an appropriate forestry extension model for the Zagros area in Iran through AHP", Proceeding of 8th International symposium of the AHP, University of Hawaii, USA
- Memariani, A., Kishore, N., Naziri, K., 1992, How to make decision in conflicting environment: Analytical Hierarchy Process. Udyog Pragati. January June, pp32-35.

Memariani, A. and Azar, A., 1995, AHP : A New Technique for Group Decision Making. Management Science. NO. 28, pp 22-32.

Ministry of mines and industries, 2001, planning of facial tissue production, Tehran

Saaty, T.L. , 2000, Decision making for leaders , RWA Publications, Pittsburg,PA.

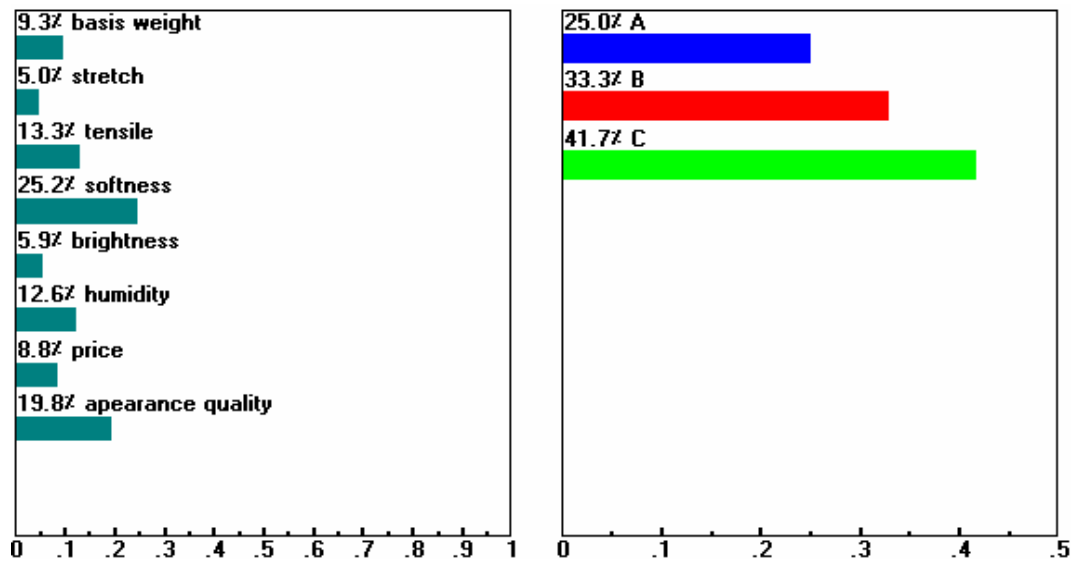
Saaty T.L. 1998, Decision Support Software, Expert Choice INC, Pittsburg, PA.

Saaty T. L., 2001 “Decision on National Missile Deffense Program”, The 6th International Symposium on the AHP in Bern, Switzerland.

Chen E. W., Li H., (2001), An approach to determine measures for business performance, Measuring Business Excellence, 3

Towfigh, F. Multi-criteria Evaluation in anatomical planning, Abadi, third year, No. 11, pp 40-43(1993).

Attachment 1: Sensitivity analysis of the alternatives



Attachment 2-1: Compare the relative importance with respect to basis weight/h

	A	B	C
A		1.73205	2.78316
B			2.27951
C			
Incon: 0.01			

Attachment 2-2: Priorities result of tissue selection with respect to basis weight\h



Attachment 3-1: Compare the relative importance with respect to Stretch\h

	A	B	C
A		2.71081	1.86121
B			3.40866
C			
Incon: 0.02			

Attachment 3-2: Priorities result of tissue selection with respect to Stretch\h



Attachment 4-1: Compare the relative importance with respect to dry tensile MD\m

	A	B	C
A		2.46621	3.27107
B			5.0133
C	Incon: 0.02		

Attachment 4-2: Priorities result of tissue selection with respect to dry tensile MD\m



Attachment 5-1: Compare the relative importance with respect to dry tensile CD\h

	A	B	C
A		1.0	1.18921
B			1.0
C	Incon: 0.00		

Attachment 5-2: Priorities result of tissue selection with respect to dry tensile CD\h



Attachment 6-1: Compare the relative importance with respect to wet tensile MD\h

	A	B	C
A		2.91295	3.4641
B			6.40217
C	Incon: 0.02		

Attachment 6-2: Priorities result of tissue selection with respect to wet tensile MD\h



Attachment 7-1: Compare the relative importance with respect to softness\h

	A	B	C
A		4.35588	6.40217
B			2.0
C	Incon: 0.01		

Attachment 7-2: Priorities result of tissue selection with respect to softness\h



Attachment 8-1: Compare the relative importance with respect to brightness\m

	A	B	C
A		2.0	3.0
B			3.0
C	Incon: 0.05		

Attachment 8-2: Priorities result of tissue selection with respect to brightness\m



Attachment 9-1: Compare the relative importance with respect to moisture content \m

	A	B	C
A		1.0	1.0
B			1.0
C	Incon: 0.00		

Attachment 9-2: Priorities result of tissue selection with respect to moisture content\m



Attachment 10-1: Compare the relative importance with respect to absorption time of water\h

	A	B	C
A		1.18921	1.31607
B			1.31607
C	Incon: 0.00		

Attachment 10-2: Priorities result of tissue selection with respect to absorption time of water \h



Attachment 11-1: Compare the relative importance with respect to price\l

	A	B	C
A		3.63424	2.15443
B			1.70998
C	Incon: 0.00		

Attachment 11-2: Priorities result of tissue selection with respect to price\l



Attachment 12-1: Compare the relative importance with respect to appearance quality of box\h

	A	B	C
A		4.40056	3.72242
B			2.05977
C	Incon: 0.03		

Attachment 12-2: Priorities result of tissue selection with respect to appearance quality of box\h



Attachment 13-1: Compare the relative importance with respect to appearance quality of tissue\h

	A	B	C
A		2.78316	3.13017
B			1.10668
C	Incon: 0.00		

Attachment 13-2: Priorities result of tissue selection with respect to appearance quality of tissue\ h



Attachment 14: Specifications of A, B and C facial tissues based on Iranian Standard:

	A	B	C
Basis weight(g/m ²)	27.3	27.9	28.13
Stretch(%)	10.2	8.2	12.5
Dry tensile MD(gf)	220	211	265
Dry tensile CD(gf)	70	70	72
Wet tensile MD(gf)	34	24	54
Inverse of Softness(milli newton)	40	30	26
Brightness(%)	94.7	93.82	95.01
Moisture content(%)	3.36	3.79	3.36
Absorption time(milli liter)	2.96	2.26	2.23
Price(rial)	4400	4100	4500