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NONWOVEN TEXTILES WITH MEDICAL DESTINATION ROMANIAN PRODUCTION

BULACU Romulus[1], FARIMA Daniela[1], BARBU Ionel[2], FARIMA Madalina[3], CIOCOIU Mihai[1]

[1]Technical University "Gheorghe Asachi" Iasi, Romania, Textile-Leather and Management Industrial Faculty, Bld. D.Mangeron 53, 700050, E-Mail: d_farima@yahoo.com

[2]Aurel Vlaicu University, Arad, Romania, E-Mail: ionelbarbu@yahoo.com

[3] Institute of Cardiovascular Diseases Prof.dr.George IM Georgescu, Iasi, Romania, E-mail:madalina_farima@yahoo.com

Corresponding author: Farima Daniela, E-mail: d_farima@yahoo.com

Abstract: *The widest range of medical disposable from nonwoven textiles are: absorbent and hygiene products : (diapers, feminine care, incontinence) from the layered structures absorbent or impervious; use products such as hospital operating theaters sterile clothing (caps, gowns, masks, shoe coverings), materials for field operators, lab coats, packaging materials for hot or cold treatments, sterile materials (wipes, bandages, sterile bandages, etc.). Currently these materials, in their majority, are imported. This paper presents research done for getting, with the country equipment, disposable medical products from 40 g/m^2 nonwoven textile materials. The technology adopted for the purpose, in SC "Minet" S.A. Ramnicu Valcea, Romania consisted of the following steps:Carding - folding, the aggregate Spinnbau-Hergeth type, Germany, with major changes carding technology adjustment and folding, to obtain a fibrous layer with a mass per unit surface of about 40-50 g / m^2 and a width of 2,1 m;Pre-heat consolidation by pre-heating required only to ensure product stability required minimal interphase transport to final consolidation.*
Final thermal consolidation of the fibrous layer by thermal calendering at a temperature of 110°C and calenders cylinder speed of 2 m / min. The processing of the fiber by carding - folding and preliminary thermally consolidation and final by calendering.

Key words:*, nonwoven textile ,medical destination,protective cloth,disposable material,*

1. INTRODUCTION

Medical nonwoven textile materials are used for a very wide range of articles - from materials to protect wounds in protective clothing used in operating rooms. They accounted in 2008, according to David Rigby Associates, approx. 9.0% of world consumption of textile products [1,2]. Annual growth in 2010 was 4.5% [3].Widest range of disposable medical products, nonwoven textile [4,5,6] are:

- absorbent hygiene products (diapers, feminine care, incontinence) as a layered structure of absorbent or impervious;
- use products such as hospital operating theaters sterile clothing (caps, gowns, masks, shoe coverings), materials for field operators, lab coats, packaging materials for hot or cold treatments, sterile materials (wipes, bandages , sterile bandages, etc.).

2.RAW MATERIALS USED

Nonwoven fabrics with medical destination, with mass per unit surface of up to 40 g / m^2, are taken in this moment of import, so that their production in the country presents an economic interest. The reason for not occurred in the country is the lack of instalation capable to process the fibers having a linear density of 4.5 den and produce fiber veil with a weight of up to 40-45 g / m^2.

As such research focused on the one hand, the problem of adapting technological and mechanical adjustments of our installation to allow processing of fibers, on the other hand, the research aimed to compare the properties of materials obtained from Romanian fiber material with witness material imported, which meets the requirements of the user.

Raw materials and nonwoven materials technology adopted are determined by each product according to its specific properties and intended use.

The most widely used synthetic fibers are polypropylene, polyester and polyethylene fibers as a basic fibres or bicomponent fibers for consolidation thermal purposes fibrous layer [4, 5, 6,].

The research aimed to achieve two articles with medical destination, weight not exceeding 40 g / m², further identified by codes A1 and A2, while article witness has code A3 (table 1).

***Table 1:** The fiber composition of articles analyzed*

Code article that fiber and fiber characteristics	The fiber composition and fiber characteristics Participation rate (%)	Mass unit per surface (g/m²)
A1	- 70% polypropylene fibers standard 4den / 100mm; - 30% PE / PES 4 den / 50 mm, two-component core-sheath, PE-sheath-core PET 40-50	40 - 50
A2	- 70% standard polyester fibers, 4den / 64 mm; - 30% polyethylene fiber / polyester 4 den / 50 mm, two-component core-mantle-shell polyethylene, polyester-core 40-50	40 - 50
A3	100% polypropylene fibers, nonwoven product obtained by spunbonding process 40-50	40 - 50

Note that the material l used to compare the physical and mechanical properties of the samples obtained during research, is made of polypropylene continuous filaments by spunbonding process, which implies the existence of qualitative differences evident. The reason for this choice is given by the fact that in Romania, this not are type of fiber and spunbonding technology, but also non-woven textile items are found in disposable hospital gowns. And was needed a way to compare the obtained values , keeping the proportions.

Outside the point relating to raw materials and production technology should be noted that if the witness, the points of attachment between the filaments components are distributed randomly but in the body of the product, while for articles analyzed, because fiber used, the points of attachment account for only 10%, and they all random division, as seen from the diagram in fig.1.

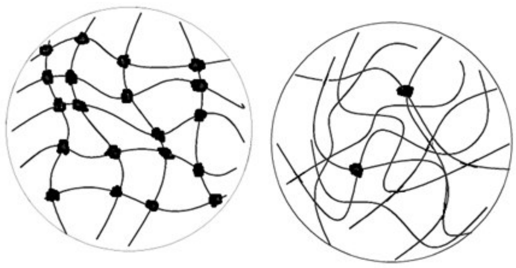

***Fig. 1**: The distribution of soldering points*

With regard to the process of obtaining nonwoven fabric is mentioon following:

Since insatation Spinnbau-Hergeth, from SC "Minet" SA is designed to processing 7.5 den fiber and obtaining a fibrous layer of at least 100 g / m², has required changes to the geometry of the carriage submission veil, and technological and mechanical of the installation adjustments . It was necessary this modifications for to obtine in view of the subject required for obtaining a non-woven material of 4.5 den fibres and mass of approx. 40 g / m².

Were required changes of the geometry of the folded assembly , because the fibrous layer mass was reduced and its submission next band was done irregularly. Due the currents "stray", appeared the oblique portions which generated mass and thickness irregularities of the fibrous layer. Reducing the distance in the area marked "A" for submitting the fibrous wave by folded organs, has determined the disappearance of these currents and consequently obtain a uniform fiber layer with the desired mass. Preliminary consolidation by passing the fibrous layer through a hot air of about 190º C, ensures the dimensional stability of the fibrous layer during interphase transport, for the final consolidation by thermal calendering.

3. EXPERIMENTAL RESEARCHES REGARDING MASS PER UNIT SURFACE AND THICKNESS FOR MEDICAL NONWOVEN FABRICS

Features mass per unit surface and thickness are the basic characteristics of a nonwoven textile fabric because because it determines the consumption of raw materials and thus their costs, and on the other hand determines their destination. The samples with dimensions of 100 mm x 100 mm, were weighed, with the balance Partner, with 0,001g accurately for determine the average weight.

The thickness was determined with textile DM-100 micrometer, with an accuracy of 0.01 mm. The measurements were performed for samples taken after different directions: 0º-180º, 30º-210º, 60°-240º, 90º-270º, 120°-300º şi 150°-330º. The samples were cut after these directions because the nonwoven textiles materials for disposable medical products, must have a random structure, so therefore the same physical and mechanical characteristics in all directions. These characteristics are influenced by the orientation of the fibers in the fiber layer but also the mass unit area and thickness.

The average results for the mass unit area and thickness of the material analyzed are presented in table 2.

Table 2: *The average values for mass per unit surface and thickness*

Direction of request	ArticleA1, polypropylene		Article A2, polyester		ArticleA3 witness	
	Mass per unit surface M1[g/m²]	Thickness d1[mm]	Mass per unit surface M2[g/m²]	Thickness d2 [mm]	Mass per unit surface M3[g/m²]	Thickness d3[mm]
0º - 180º	37,053	0,418	46,317	0,422	43,47	0,397
30º - 210º	31,324	0,408	39,155	0,384	43,88	0,367
60° - 240º	31,889	0,412	39,861	0,382	37,62	0,387
90º - 270º	32,608	0,454	40,760	0,378	43,47	0,397
120° - 300º	34,912	0,442	43,640	0,396	43,88	0,367
150° - 330º	31,434	0,440	39,293	0,398	37,62	0,387

For a better analysis of the results presented in table 2, was realised the polar and cartesian diagrams (fig.2 and fig.3).

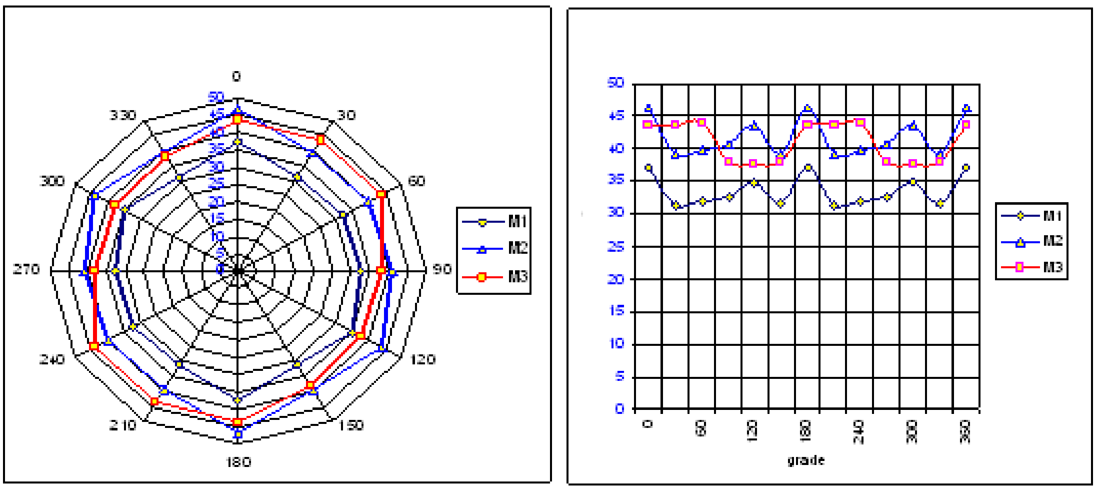

Fig.2: *Polar and cartesian diagram for the mass per unit*

From fig.2 it observes that the mass per unit surface for A1 article presents in average a difference of approx. 7.5 g / m^2 to the witness A3. This difference is due to lower specific density polypropylene fiber. As regards A2 article has a mass per unit area with 0.74 g / m^2 higher than the control sample A3, which is deemed statistically acceptable because it represents a departure from approx. 0.20% from the nominal value of 40 g / m2, required for the article in this category.

From fig. 3 can be observed that the thickness of articles produced is relatively uniform, and its variation is redused. The thickness of items A1 and A2 is uniform but larger than A3 witness article. This is due to the number of only 10% by weight of consolidation points as fiber. Thus, the difference in the thickness of the A1 article in comparation with A3 article is 0,43 mm and the thickness of the article A2 0.43 mm is 0.08 mm, which is in fact a diferernţă of 0.1% in the first case 0.02% in the second case. Therefore the articles A2 and A3 have the equal thickness.

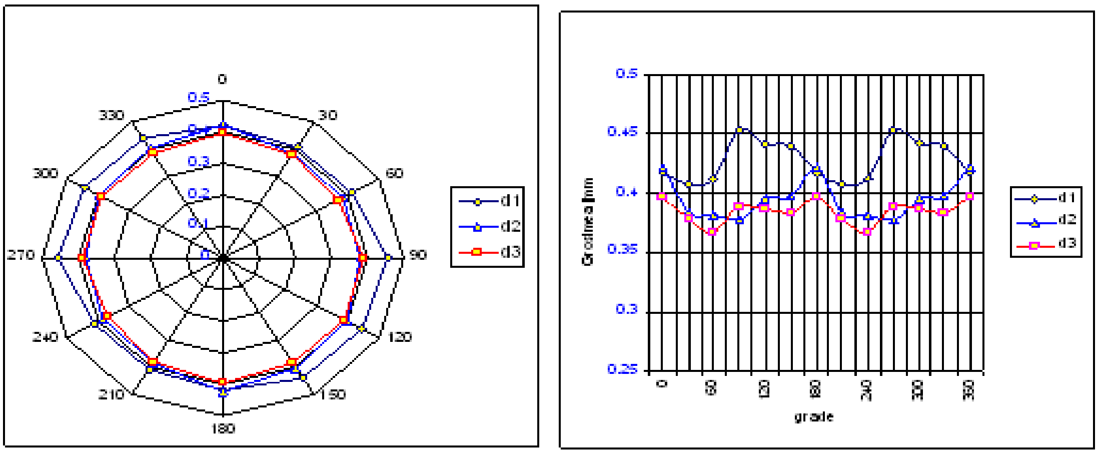

Fig.3: *Polar and cartesian diagram for the thickness*

The thickness for witness article is uniform because it has a filamentary structure by extrusion and thermal consolidation by pressing, with points in 100% of the intersections of filaments. In conclusion it can say that both articles analyzed, presented in terms of mass per unit surface and thickness values comparable to those of witness A3. Therefore these newly created articles can be used for the stated purpose.

4. CONCLUSIONS

The research aimed to achieve two articles from mixtures of fiber linear density of 4.5 den., for medical destination, disposable, with the weight not exceedi 40 g / m². The woven fabrics medical with 40 g / m2 mass per unit surface, are made from import, so their production in the country, and their use in disposable medical fabrics, has an economic interest.

According to the technical specifications of the installation constructive Spinnbau Hergeth from S.C.Minet SA. Ramnicu Valcea, it can not get fiber layers from fiber with a linear density of 7.5 den., by carding- folding process therefore no nonwoven fabrics with minimum mass per unit surface less than 100 g / m^2.

The witness sample imported, used to compare the physical and mechanical properties of the materials obtained during investigations, is made of polypropylene filaments by spunbonding process, which means there are obvious differences in terms of physical and mechanical properties. This method was chosen for comparison because in the country there is no raw material or production technology.

It can say that both articles A1 and A2, realized and analyzed in this paper, have values for the weight and the thickness comparable to those of witness A3.

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