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(54) Title: COMPOSITE STRUCTURE WIPE WITH IMPROVED CLEANING ABILITY

(57) Abstract: The present invention relates to a nonwoven fabric structure, formed by hydro entanglement of a precursor fibrous web, which has demonstrated Particular suitability for cleansing/WiPing applications. Testing has shown the present product to provide a desirable tactile impression with Users, which is believed to result from the disposition of relatively large denier fibers on the surface of the fabric structure. Such relatively large denier fibers have been found to provide good cleansing/Wiping performance.

COMPOSITE STRUCTURE WIPE
WITH IMPROVED CLEANING ABILITY

Technical Field

5 The present invention relates generally to nonwoven fabric structures, and more particularly to a nonwoven fabric construct having relatively large denier fibers at the surface thereof, to facilitate use in cleaning/wiping applications.

Summary of the Invention

10 The present invention relates to a nonwoven fabric structure, formed by hydroentanglement of a precursor fibrous web, which has demonstrated particular suitability for cleansing/wiping applications. Testing has shown the present product to provide a desirable tactile impression with users, which is believed to result from the disposition of relatively large denier fibers on the surface of the fabric structure. Such relatively large denier fibers have been
15 found to provide good cleansing/wiping performance.

 It is believed that use of such relatively large denier fibers at the surface of the nonwoven fabric structure is somewhat contrary to conventional practice, in which it has typically been believed that relatively small denier or fine fibers should be used for cleansing/wiping applications because of better softness
20 characteristics. The present fabric structure is believed to be desirably less “silky” in tactile impression, offering enhanced robustness for cleansing/wiping. The present fabric structure has been perceived as “not feeling wet”, even when the fabric structure is pre-moistened. It is believed that this may result from the relatively large denier fibers acting as a “spacer” between the user and the
25 interstitial regions of the fabric structure within which moisture is retained. It is believed that this effect is not comparably achieved by the use of relatively small denier fibers at the surface of a cleansing/wiping nonwoven fabric.

 In accordance with the preferred embodiment of the present invention, fiber deniers of 4 or greater are selected, with denier selected to be no more than
30 about 12, by virtue of the limitations in the ability to efficiently hydroentangle

such relatively large diameter fibers. Presently preferred fibers range in denier from about 6 to about 9.

In accordance with the present invention, a cleansing/wiping nonwoven fabric structure is formed by providing a precursor web comprising a fibrous matrix of relatively large denier fibers, preferably having deniers within the range of about 4 to about 12, and more preferably in the range of about 6 to about 9. The precursor web is positioned on a foraminous forming surface, which may be configured as a three-dimensional image transfer device, such as disclosed in U.S. Patent No. 5,090,764, to Drelich et al., hereby incorporated by reference. The precursor web is subjected to hydroentanglement by the direction of high-pressure liquid streams (water) against the web. Imaging and patterning of the web is effected by cooperation with the foraminous forming surface, whereby the entangled web forms the nonwoven fabric construct in accordance with the present invention.

It is presently preferred that fibers selected for use in manufacture of the present invention comprise a blend of cellulosic fibers (such as viscose rayon or cotton) and synthetic fibers (such as polyester and polypropylene). A fiber blend weight percentage ratio of approximately 50/50, cellulosic/synthetic, fibers is presently preferred.

Description

This invention relates to the specific product construction of nonwovens that provide an improved cleansing effect. These nonwovens are especially suitable as wet wipe substrate for skin/facial cleaning. Wet wipe substrate of the novel construction is also applicable for cleaning other surfaces for domestic and industrial uses.

There are various nonwovens wet wipe substrates manufacturing processes. One way is known as hydro-entanglement or spunlace.

Typical product construction for a wet wipe substrate for hydroentangling process is a homogeneous blend of cellulose fibres, like viscose rayon or cotton, and synthetic fibres, like polyester and polypropylene, etc., at a

blend ratio of approximately 50%. Fibre thickness is normally 1,7 D'Tex / 40mm (1 D'Tex: weight in g in 10,000m).

Spunlace energy used depends on the type of spunlace system available. Certain amount of spunlace energy is required to spunlace fabric to achieve the fabric strength/ toughness required for converting and during use. 475 Kj/Kg is typical for a spunlace system utilising *micro-perforated* sleeve, and approximately 2750 Kj/Kg is used for *normal perforated sleeve/belt* system.

Fabric made with conventional fabric construction – $\pm 50\%$ cellulose fibre/ $\pm 50\%$ synthetic fibre using micro-perforated sleeve + finishing belt system is normally smooth and soft. Wiping performance of this type of fabric is rated as average.

Patent –ref:WO97/00988 filed the process claim of using the low spunlace energy (low power jets water) with or without texture to improve the cleaning ability of the wet wipe substrate. The Patent claimed that by using low spunlace energy, loosened fibres portions tend to have the ability to remain away from the substrate surface, and this provides additional cleaning surfaces, especially as the cleaning process proceeds. The Patent does not quantify the exact improvement of cleansing.

The present invention describes the use of spunlace system equipped with *normal perforated sleeve/belt* system in making a wet wiping substrate. Wiping/picking-up property of wipe from any wiping surface is dominated by the surface characteristic of wipe as well as the total construction/composition of the wipe. The specially designed substrate is engineered to have special surface characteristic for good wiping/picking-up property. The cleansing property of this specially designed substrate is tested to be significantly better. Though the work carried out so far is mainly focused on the fabric being used as wet wipe substrate, the knowledge may also be applicable to dry wipes for specific end use.

Experiments have been carried out involving the use of normal to high spunlace energy hydro-entanglement or spunlace process of making plain fabric

surface, and slightly structured fabric surface. Product constructions and process conditions, and test method are fully described. Test results, expressed also in graphical form are shown.

SECTION 1 OF THE WORK DONE

5

| <u>Reference</u> | <u>Fabric Surface</u> | <u>Construction</u> | <u>g/m²</u> | <u>Composition</u> |
|------------------|-----------------------|---------------------|------------------------|---------------------------------------------------------|
| JSC-PGI | Fine Plain | Homogeneous Blend | 55 | 35% PET 1,7dtex/38mm 65% viscose rayon 1,7 dtex/40mm |

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| | | | | |
|-------|----------------|-------------------|----|---------------------------------------------------------|
| PGI 4 | Mid Fine Plain | Homogeneous Blend | 55 | 50% PET 1,7dtex/38mm 50% viscose rayon 1,7 dtex/40mm |
|-------|----------------|-------------------|----|---------------------------------------------------------|

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| | | | | |
|-------|----------------|-------------------|----|---------------------------------------------------------|
| PGI 3 | Mid Fine Plain | Homogeneous Blend | 55 | 50% PET 6,7dtex/38mm 50% viscose rayon 1,7 dtex/40mm |
|-------|----------------|-------------------|----|---------------------------------------------------------|

20

| | | | | |
|-------|----------------|--------------------|----|----------------------------------------|
| PGI 1 | Mid Fine Plain | Layer Construction | 11 | 35% PET 6,7dtex/38mm/65% viscose rayon |
| | | | 33 | 35% PET 6,7dtex/38mm/65% viscose rayon |
| | | | 11 | 35% PET 6,7dtex/38mm/65% viscose rayon |
| | | | 55 | |

25

| | | | | |
|-------|----------------|--------------------|----|----------------------------------------|
| PGI 2 | Mid Fine Plain | Layer Construction | 11 | 100% PET 6,7dtex/38mm |
| | | | 33 | 35% PET 6,7dtex/38mm/65% viscose rayon |
| | | | 11 | 100% PET 6,7dtex/38mm |
| | | | 55 | |

30

| <u>Reference</u> | <u>Fabric Surface</u> | <u>Energy (Kj/Kg)</u> | <u>Fabric Construction</u> |
|------------------|-----------------------|-----------------------|---------------------------------------------------------|
| JSC-PGI | Fine Plain | 2700 | 35% PET 1,7dtex/38mm 65% viscose rayon 1,7 dtex/40mm |

35

| | | | | |
|----|-------|----------------|------|----------------------------------------------------------------------------------------------------------------------------|
| 5 | PGI 4 | Mid Fine Plain | 3500 | 50% PET 1,7dtex/38mm 50% viscose rayon 1,7 dtex/40mm |
| 10 | PGI 3 | Mid Fine Plain | 3500 | 50% PET 6,7dtex/38mm 50% viscose rayon 1,7 dtex/40mm |
| 15 | PGI 1 | Mid Fine Plain | 3500 | 35% PET 6,7dtex/38mm/65% viscose rayon 35% PET 1,7dtex/38mm/65% viscose rayon 35% PET 6,7dtex/38mm/65% viscose rayon |
| 20 | PGI 2 | Mid Fine Plain | 4000 | 100% PET 6,7dtex/38mm 35% PET 6,7dtex/38mm/65% viscose rayon 100% PET 6,7dtex/38mm |

High energy input to the mid fine plain samples is to ensure no/minimum loose fibres sticking out from the fabric surface.

TEST METHOD -EVALUATION OF WIPING PERFORMANCE FOR WIPES

25 **Objective**

To determine the wiping performance of Nonwovens - pick-up on Nonwovens surface.

Principle

30 Wipes made out of Nonwoven processes can be used to wipe off dirt which can be in the form of dust, liquid, oil/cream/paste (combination of dust and liquid, and in some cases, oil and oil & liquid with emulsifier).

This test method is aimed at the paste removal performance from a surface after a standard wiping movement.

The paste specified for this test is the Baby Cream from PENATEN (*Baby Pflege- und Wundschutzcreme Weich*). This cream is chosen because of its low evaporation factor, and this gives better accuracy in the weight determination before and after tests. Also, the main objective is to evaluate the wiping performance of the wipe surface, and not the absorbency of the wipe which could be engineered via combination of raw material used besides the fabric surface engineering.

Test Conditions

The measurement should be conducted in a laboratory having

·relative humidity = 65 ± 1 %, and

·temperature = 21 ± 1 °C.

Test Apparatus

1. balance with accuracy of 0.001g
2. cutting board
3. Wipe-O-Meter as described
4. cream application template (made from Ultra-High Molecular weight PolyEthylene Plastic, 0,4 mm thick, punched with 105 holes evenly distributed in 4 x 6 cm²) and the scraping plate made also from the same UHMwPE material.
5. variable drive like Lab mixer or variable speed drive
6. stop watch
7. cream/paste as specified or any other medium

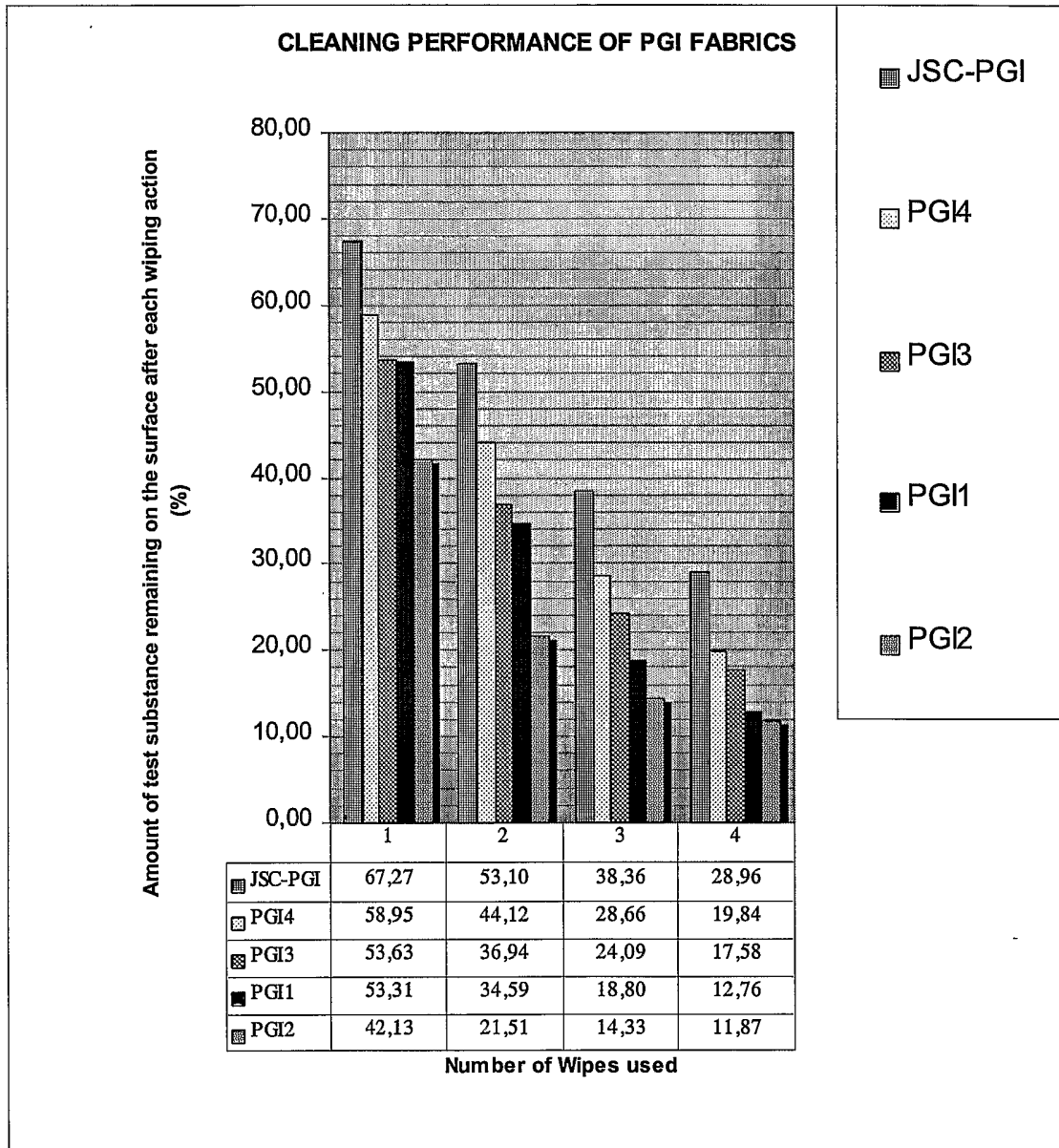
Procedure

1. Calibrate the wiping speed - control the connecting wire between the Wipe-O-Meter & variable drive spindle is well tightened. Adjust the spindle speed so that the roll from the start mark to the end mark on the wiping plate is between 5 sec \pm 10%.
2. Mount the test sample 10 X 40 cm on the rollers.
3. Place the PELD film (11cm w X 40 cm l) on the balance and tare the balance.

4. Position the application template 13.5 cm from one end of the PELD film, and apply on the template some cream. Spread the cream on the template so that a total of 105 holes of the template are covered with cream. Scrap off the excess cream on the
5 template.
5. Record the weight (W1) of cream applied on the film to 0.001 g accuracy.
6. Place the PELD film with cream dots in the Wipe-O-Meter without touching the test sample mounted on, and fix the film
10 with the clamp (Photo 2).
7. Start the wiping test by starting the drive of the calibrated variable speed motor.
8. Stop the motor as soon as the bottom roll with fabric sample is lifted from the film (photo 3).
9. Record the weight (W2) of the cream left on the film in 0.001 g
15 accuracy.
10. The difference (W3) = (W1) - (W2) is the amount of cream removed.
11. The ratio in % is sometime more meaningful in comparing wiping
20 performance for different fabrics.
12. Repeat test according to described procedures using new fabric and new film.

TEST RESULTS

5



CONCLUSIONS

- All samples developed with mid fine plain surface (slightly less smooth fabric surface), and in combination with
 1. slightly higher % of polyester fibres, and
 2. higher dtex polyester fibreare tested to have a significantly better wiping performance than the reference fabric with fine plain fabric surface and fine dtex polyester fibre.
- The best wipe is from the sample with layer construction - 100% high dtex polyester fibre as fabric surface. 25% less left over on the cleaning surface from the 1st wipe is achieved, and with minimum left over from the 4th wipe.
- Wipes from the *homogeneous construction* of 50% 6,7dtex polyester/50% 1,7 dtex viscose rayon, and the *layer constructions* as described under the reference PGI1 & PGI2 outperform samples described under reference JSC-PGI & PGI 4 in terms of substance left over after each wiping action.
- PGI 2 sample which has the wiping surface constructed of 100% 6,7 dtex has less wetness due to the non absorbent fibres used as surfaces, and this is preferred for reason of “woolen warm feel”. The “woolen warm feel” effect could be preferred for not giving the baby a COLD shock when the wet wipe is applied on the baby.

What Is Claimed Is:

1. A method of forming a cleansing/wiping nonwoven fabric structure, comprising the steps of:

5 providing a precursor web comprising fibrous matrix of relatively large denier fibers, having deniers within the range of about 4 to about 12;

positioning said precursor web on a foraminous forming surface;

10 subjecting said precursor web to hydroentanglement by the direction of high-pressured liquid streams against the web;

and thereby imaging and patterning said precursor web by cooperation with said foraminous forming surface to form said nonwoven fabric structure.

2. The method of forming a cleansing/wiping nonwoven fabric structure in accordance with claim 1, wherein said foraminous surface comprises a three-dimensional image transfer device.

15 3. The method of forming a cleansing/wiping nonwoven fabric structure in accordance with claim 1, wherein said precursor web comprises a blend of cellulosic and synthetic fibers.

20 4. The method of forming a cleansing/wiping nonwoven fabric structure in accordance with claim 3, wherein said blend of fibers comprises approximately 50/50, cellulosic/synthetic fiber blend.