



## The Pre-set Peeling Testing Method of the Hydroentangling Wood Pulp-PET Fiber Composite Web Materials

Si Zhao

Tianjin Key Laboratory of Fiber Modification and Functional Fiber  
Textile School, Tianjin Polytechnic University, Tianjin 300160, China  
Tel:86-22-2458 6123 E-mail:corrie930@yahoo.com.cn

### Abstract

Hydroentangling wood pulp-PET fiber web, which is an excellent wipe material. But some fate short coming-particle peeling, arising when it used as wipes, and the peeling particle would do harm to some devices. Therefore, this case even worse when the fabric damping. The four pre-set peeling tests have been signed for this phenomenon, which have imitated some situations of the pre-set peeling under the mechanics functions. The statistics from these tests, combined the analyzing of the different raw materials and processes of the hydroentangling wood pulp-PET fiber web, are regular and convincible. So it is indicate that the pre-set peeling conditions can be explained well by these four testing methods, which are reasonable and feasible.

**Keywords:** Spunlace nonwovens, Wood pulp-PET fiber web, Pre-set peeling, Pre-set peeling test

Hydroentangling wood pulp-PET fiber web is an excellent wipe material, for it has good flexibility, drapability, moisture absorption and dust absorption (Xing, 2003, p.165-178). But its particle peeling is deadly short coming. For example, there will be some particle peeling when wiping the precision electronic products, that seriously affect the performance of the electronic product, especially after absorbing moisture (Shen, 2003, p.105-114). Some wood pulp-short fiber is easily floating, for it is not fully entangled with polyester fiber in spunlacing district (Ma, 1999, p.25-27), that is why wood pulp cloth easily particle peeling by outside force. But now there is none usefully testing method and uniformly standard by international. It makes factory and customers inconvenient.

In this paper, it is mostly analysis the problem of wood pulp composite cloth's particle peeling. The four pre-set peeling tests have been signed for this phenomenon, which have imitated some situations of the pre-set peeling under the mechanics force. The statistics from these tests, combined the analyzing of the different raw materials and processes of the hydroentangling wood pulp-PET fiber web, are regular and convincible.

### 1. Experimental

#### 1.1 Materials

Six sample of hydroentangling wood pulp-PET fiber web (the wood pulp fiber > 2mm more than 90%); sample A, B, C and D has the same rational number of spunlacing (6-8), E has 11-14, F more than 15; sample A and E is 70g/m<sup>2</sup>, B, C, D and F is 68g/m<sup>2</sup>; the ration between wood pulp tissue and polyester is 55:55 (A, B, E), and 60:40 (C, D, F).

#### 1.2 Experimental Instrument

Y522 Disk Fabric Abrasion Machine (Changzhou Fabric Mechanism Factory), YG7011A-1 Automatic Washing Machine (Wuxi Fabric Machine Factory), Y802A Eight Basket Oven (Changzhou Fabric Machine Factory), FA2104 Electronic Scales (precision: 0.0001g, made by Shanghai Precision & Scientific Instrument Co., Ltd), electric fan, cloth web, adhesive tape etc..

### 2. Design of Particle Peeling Testing Method

Samples should be prepared by the treatment of gas conditioning before test, 24h (Guo, 1998, p.22-23) in the state of standard atmosphere or in the same condition. The test must be repeated three times, and calculate the average.

#### 2.1 Disk Abrasion Method

It is imitated the situation of grating. There is two abrasion method: grinding wheel and wrapped by cloth grinding wheel abrasion. The first method produce: weigh the disk sample ( $\Phi 11$ , signed  $W_1$ ), choose 280# grinding wheel, 6r/min, 5min, signed  $W_2$  after abrasion, then calculate the particle peeling ratio.

2.2 Beat Method

It is designed for the state of mechanical colliding. The sample (30\*30cm) signed  $W_1$ . Hanged the sample, connected vertical sample by electric fan, beat 5min. Weighed the sample after particle peeling and signed  $W_2$ .

2.3 Garment Wash Method

Hydroentangling wood pulp-PET fiber web sometimes need to be dropped liquid, as operating coat would be adhibited blood and liquid medicine. This case makes different particle peeling. The test is imitated the particle peeling in the flexibility of damp. The sample (30\*30cm) signed  $W_1$ . washed in the fabric web. The conditions see as table 1. Dried, Weighed the sample after particle peeling and signed  $W_2$ .

Table 1. The washing conditions

| Method of flexibility | Load (N) | Temperature (°C) | Water level (cm) | Washing time (min) | Water level (cm) | First washing time (min) | Water level (cm) | Second washing time (min) | Dehydrati on time (min) |
|-----------------------|----------|------------------|------------------|--------------------|------------------|--------------------------|------------------|---------------------------|-------------------------|
| normal                | 19.6     | 40               | 10               | 3                  | 13               | 3                        | 13               | 2                         | 3                       |

2.4 Adhesive Tape Affix Method

Some wood pulp-short fiber is easily floating, for it is not fully entangled with polyester fiber or itself, that is why wood pulp cloth easily particle peeling by outside force. The adhesive tape affix the Hydroentangling wood pulp-PET fiber web, then separate, the tape would take floating short fiber away. The mount of short fiber is to estimate the particle peeling.

The sample (5\*20cm) signed  $W_1$ , took the same size tape affix fiber, then planished and separated, repeated three times, then weighed the fiber signed as  $W_2$ .

3. Validation of the Testing Method

3.1 Result of Test

The ratio of peeling can be seen from Table 2. The result accord the product characteristics. The different methods fluctuate the ratio a lot or have no rule. For example, the peeling ratio of sample E (beat method) is 0.07%, least, compared with other samples, also with other methods. It is showed that the peeling of the product is little, and any method can illuminate the characteristics.

Table 2 also shows that the ratio of peeling is related with the techniques. Sample C and D (68g/m<sup>2</sup>, wood pulp tissue and polyester is 60:40, same rational number of spunlacing), sample D has a row in the forth rational number, and sample C has two, which entangles closer, it makes the ratio peeling of sample C is smaller than sample D. By garment wash method, sample D is 13.19% and C is 5.73%. otherwise, seen from sample E and F, the rational number of E is little than F, but E is 70g/m<sup>2</sup>, wood pulp tissue and polyester is 60:40, and F is 68 g/m<sup>2</sup>, 60:40, it makes the ratio peeling of E is smaller than F. For instance, E is 0.09% and 0.02%, compared with F being 0.21% and 0.09%, by disk abrasion method.

Table 2. The pre-set peeling percentage of different tests (%)

| Hydroentangling Wood Pulp-PET Fiber Web Sample | Disk Abrasion Method    |  | Beat Method | Garment Wash Method | Adhesive Tape Affix Method |
|--|-------------------------|--|-------------|---------------------|----------------------------|
|  | Grinding Wheel Abrasion | Wrapped by Cloth Grinding Wheel Abrasion |             |                     |                            |
| A  | 0.60                    | 0.26                                     | 0.22        | 9.08                | 2.72                       |
| B  | 0.85                    | 0.38                                     | 0.26        | 13.04               | 2.90                       |
| C  | 0.48                    | 0.16                                     | 0.18        | 5.73                | 1.58                       |
| D  | 0.90                    | 0.55                                     | 0.29        | 13.19               | 7.86                       |
| E  | 0.09                    | 0.02                                     | 0.07        | 3.2                 | 0.19                       |
| F  | 0.21                    | 0.09                                     | 0.15        | 3.34                | 0.87                       |

In conclude, the four testing methods can reflect the degree of the product particle peeling, the statistics from these tests, according with the characteristics, are regular and convincible. So it is indicate that the pre-set peeling conditions can be explained well by these four testing methods, which are reasonable and feasible.

### 3.2 Comparison of Experiment

There is none available method in domestic research, the aim of the experiment is to imitate some condition, reflect the degree of hydroentangling wood pulp-PET fiber web. The four methods have their own specialty. The disk abrasion method imitates the mechanical friction, it is mostly close to the practical situation, reflect the particle peeling truly, but it is too cockamamie, losing little (especially fiber itself), the scales changes little, so it requires instrument precision. The garment wash method is changed much after washing, it can imitate actually circumstance by agitating and kneading, mostly adapt to inspect product for medical treatment and sanitation. Because the product needs to absorb blood and medicine liquid, also it is bear outside force. The beat method uses instrument easily but the ratio of particle peeling is smaller than disk abrasion method, adhesive tape affix method is mostly simpleness and have better effect, the loss is only lower than garment wash method. This method is used by some medicine treatment manufacture which is clung together easily.

In a word, the comparison can be concluded by table 3.

Table 3. The four pre-set peeling tests comparison

| Method                     | Aim   | Result                                       | Characteristic  | Suitable Product   |
|----------------------------|---|--|---|--|
| Disk Abrasion Method       | Inspect situation of mechanical friction                          | higher ratio of peeling, reflect truly       | Method is regular, operation is complexity, needs higher precision    | Classic industry wipes   |
| Beat Method                | Inspect situation of mechanical beat                              | little ratio of peeling, reflect unobviously | Simple instrument, but control hardly                                 | Barrier cloth, curtain   |
| Garment Wash Method        | Inspect situation of kneading in certain temperature and humidity | highest ratio of peeling, reflect obviously  | More conditions, operation is complexity, close to actual environment | Functional product moistened by blood, as operation cloth, operation overclothes and so on |
| Adhesive Tape Affix Method | Inspect the ratio of peeling in static                            | ratio of peeling is normal, reflect truly    | Most basic  | wood pulp spunlaced nonwoven   |

### 3. Conclusion

- (1) There is no standard and available method in testing peeling of hydroentangling wood pulp-PET fiber web. The design can solve two problem: firstly, imitate some peeling situations, secondly, extend methods to other nonwovens.
- (2) By the analysis of experiment, it is indicated that the four methods are realistical, reasonable and feasible.
- (3) The four testing methods have their own characteristics, can inspect different functional hydroentangling wood pulp-PET fiber web, and select different method for different request, using reasonable.

### References

Chen, Longmin & Chen, Ji. (2001). Spunlace Composite Technique. *Technical Textiles*. 2(5).

Guo, Bingchen. (1998). *The capability and testing of nonwoven*. Beijing: China Textile & Apparel Press. 21-23.

Li, Ganlin. (2006). Main Factors Affecting Linting and Dusting of Paper in Printing and the Practical Strategies to Improve Surface Strength. *China Pulp & Paper.*, 12(25).

Ma, Dianping & Chen Ji. (1999). The Development and Application of Wood Pulp Spunlaced Nonwoven. *Industry Textile*. 3(2): 25-27.

Shen, Zhiming & Hu, Jie. (2003). *New techniques of nonwoven*. Beijing: China Textile & Apparel Press. 105-114.

Xing, Shengyuan. Zhang, Jianchun & Qiu, Sujuan. (2003). *Nonwoven*. Beijing: Chemical Industry Press. 165-178.

Wang, Jvhua. (1999) *The Characteristic and Micro-mapping of China Pulp Paper & Fiber*. Beijing: China Light Industry Press.