

## Novel Recycling Technology of Ultra-fine Fibrous Materials

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### Introduction

Ultra-fine fibers are spun by expensive fiber spinning technology using special spinnerets. Ultra-fine fibrous materials have attracted considerable attentions because of their potential applications as high performance wiping cloths, water absorbents, acoustic absorbents, and moisture transfer sporting good. However, production cost of ultra-fine fibers is 5 to 7 times higher than that of general textile materials [1]. Therefore, ultra-fine fibrous material waste and scrap should not be dumped and re-extruded to save natural resources. Accordingly, it is important to develop novel recycling technology. [2-6].

The objective of this research is to develop cost effective recycling process to produce multi-functional ultra-fine fibrous material from textile waste and scrap. It is expected that high performance and cost-effective textile products can be developed using recycled textile scraps, thereby realizing the application as acoustic absorbents and wiping cloths.

### Experimental

The textile fabrics used for water absorption, oil absorption, and sound absorption measurements were prepared by mixing recycled textile scrap with 20 wt% low melting polyester. These webs were thermally bonded by 5 mm, 10 mm, 15 mm, and 20 mm bonding plate.

As the one end of textile immersed in water, the height of water absorbed was measured. Oil absorption was measured by the same method using petroleum. The capacity of sound absorption was measured by two-microphone impedance measurement tube (KS F2814) to calculate sound absorption coefficient. Air permeability (ASTM D737) was measured to estimate structural characteristic of acoustic absorbents.

### Results and discussion

The effect of fiber diameter of general polyester web, direct spinning polyester ultra-fine fiber web, and recycled ultra-fine fiber web on air permeability was investigated. The thickness of all samples was fixed to 25 mm varying different weight and porosity. The variations of sound absorption for various fibers are shown in Fig 1.

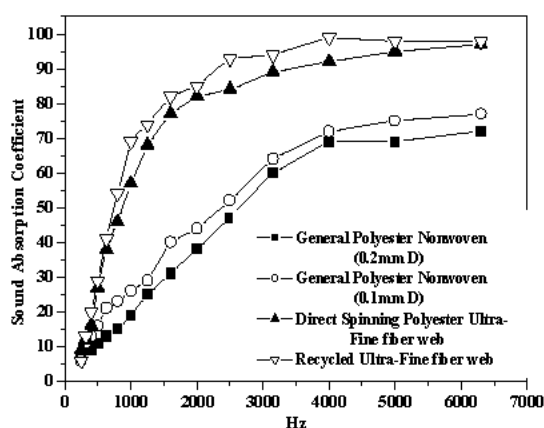


Figure 1. Sound absorption coefficients for various fiber webs.

The values of air permeability for general polyester non-woven and recycled ultra-fine fibers were estimated to be 220 and 17.6

cm<sup>2</sup>/cm<sup>2</sup>/sec, respectively. The air permeability value of recycled ultra-fine fiber was lower than that of general polyester non-woven. From the above results, it can be deduced that the air permeability was decreased with decreasing the diameter of component fibers, leading to the improvement of the efficiency of sound absorption.

Table 1. The results of water and oil absorption measurements

	Water	Oil
5mm	147.5%	154.5%
10mm	254.2%	341.4%
15mm	<b>420.8%</b>	<b>447.6%</b>
20mm	393.0%	<b>447.9%</b>
General polyester	<b>453.6%</b>	<b>3.5%</b>

The results of water and oil absorption measurements are summarized in Table1. The value of water absorption for recycled ultra-fine fiber, which was thermal-bonded at 15 mm intervals, was estimated to be 420.8%. In addition, the oil absorption values of recycled textiles thermal-bonded at 15 and 20 mm intervals were approximately 447%.

This result suggests that recycled textiles exhibit higher water and oil absorption values other than general wiping cloths. The recycled textiles produced by novel recycling technology are expected that they have significant potential application in various industrial fields, as well as the advantage to solve the environmental problems.

### Conclusions

The value of sound absorption for recycled ultra-fine fiber was higher than that of general polyester. Because of the efficiency of sound absorption for the recycled ultra-fine fiber increased with decreasing diameter of component fibers, which was attributed to the reduction of air permeability. The effect of the water and oil absorption of recycled ultra-fine fiber was observed superior than that of general polyester.

Based on the results of this research, it is expected that efficient oil absorption and water absorption can be achieved with wiping cloth. And sound absorption capacity can be accomplished soundproofing materials, absorbents to the interior of building and sound arresting wall.

### References

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