

Clothes Filtration

Miyagi Prefectural
Sendai Daisan High School group3

Many kinds of natural disasters frequently hit Japan. When natural disasters occur, it would stop supplies of tap water. If water supplies shut off, we have to get clean water by ourselves. So we focused on filtration. Simple filtration systems have already been researched and developed. However, there is no description of clothes which are material of this device. If we can filter the water by clothes, we can get clean water more easily and more safely in an emergency. So we examined the filtration performance of cloth. We used our casual clothes as clothes that are close at hand in times of disaster. As a result, jeans were the best for filtration.

1 Introduction

Many kinds of natural disasters frequently hit Japan. When natural disasters occur, it would stop supplies of tap water. If water supplies shut off, we have to get clean water by ourselves. As a way of getting the clear water, there is filtration. A simple filtration system has already developed. Figure 1 is one example of simple filtration systems. It was created with several materials. Such as gravel, carbon and cotton. However, this previous research doesn't have detailed descriptions about clothes, so we focused on this point. If we can filter the water with our clothes, people can clean water more easily and safely. So we thought we could filter muddy water through our clothes and we researched them.

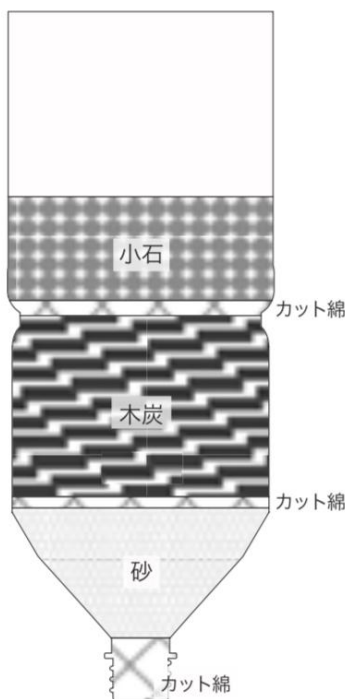


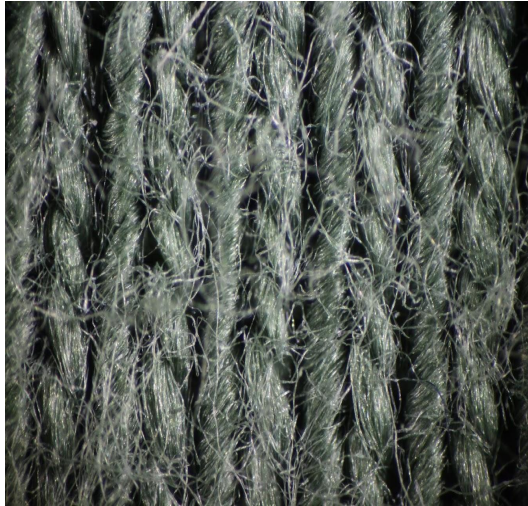
Fig1, Common
filtration
system

2 material and way

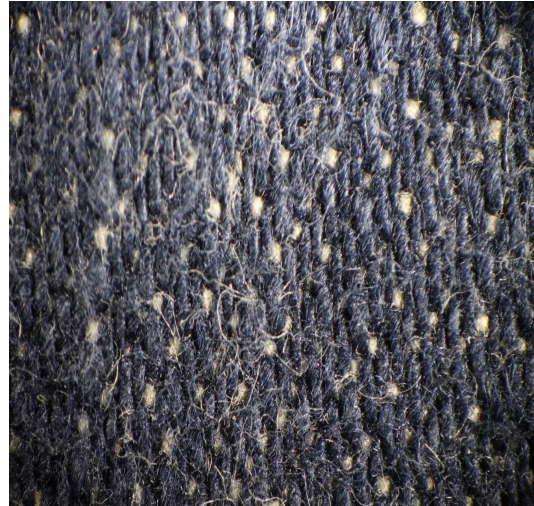
As a hypothesis, we think the finer cloth is better for filtration. And also the degree of absorption

affects filtration. So we thought jeans or shirts are best because time which is taken to pass the water is shorter than others. We prepared kaolin, plastic bottles, and five types of clothes (T-shirt, knitwear, meshes, jeans and shirt) for our experiment. Fig2. our device





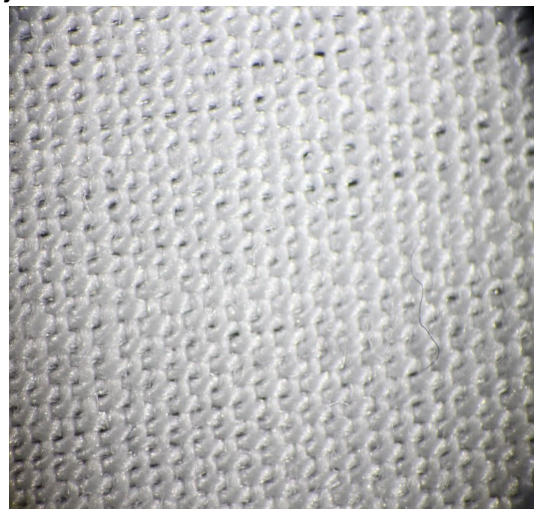
(T-shirt)



jeans)



knitwear)

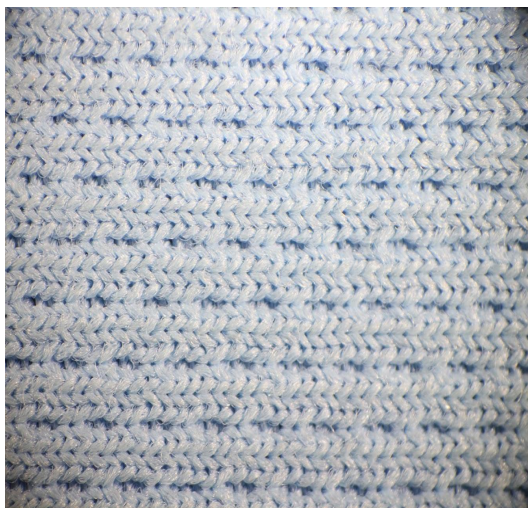


shirt)

These are pictures which we saw and took with an electrical microscope.

Table1.Filtration clothes thickness

| Material | Cloth thickness |
|-----------|-----------------|
| cottons | 0.8mm |
| knitwears | 0.8mm |
| meshes | 0.65mm |
| jeans | 0.8mm |
| shirts | 0.2mm |



meshes)

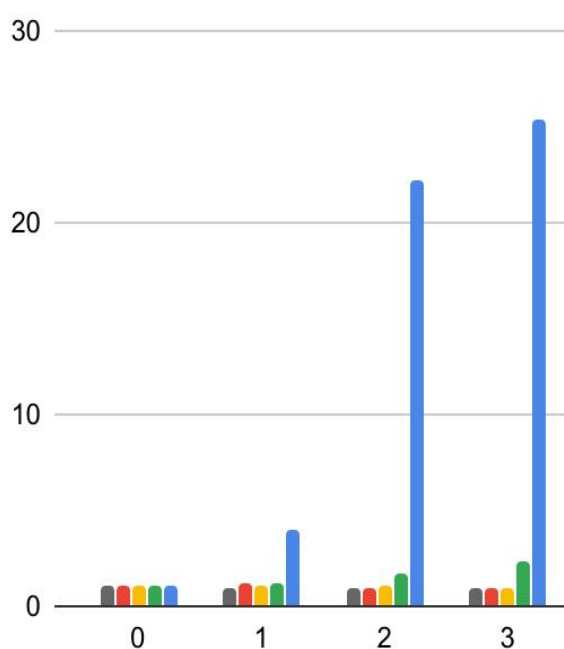
We used the same size of clothes cut 10 cm per square. Plastic bottle's mouth was 2.16cm. We covered it with them. The thickness of each cloth is shown in this table1. After that, we prepared kaolin water instead of dirty water. Kaolin water was created by mixing water and kaolin. How much Kaolin water? We compared muddiness before one with after one. We measured them with transparency meter. We did a second experiment to find if absorption was related to filtration. We found out how much kaolin is caught by each thread. In this experiment, We soaked each thread of five cloth types in kaolin water and measured the difference in weight between after and before the experiment. We dried the cloth after soaking it in kaolin water.

3 Result and Conclusion

We graphed the difference of the horizontal axis between before and after the experiment.

As a result, jeans are the most suitable for filtration. We could clear the kaolin water well with only jeans. Also, we found we can increase the effect of filtration, if we increase the layers of clothes.

Graph1. (Y axis: cm, X axis: number of cloth)



As a hypothesis, We thought both shirts and jeans would be the best for filtration of

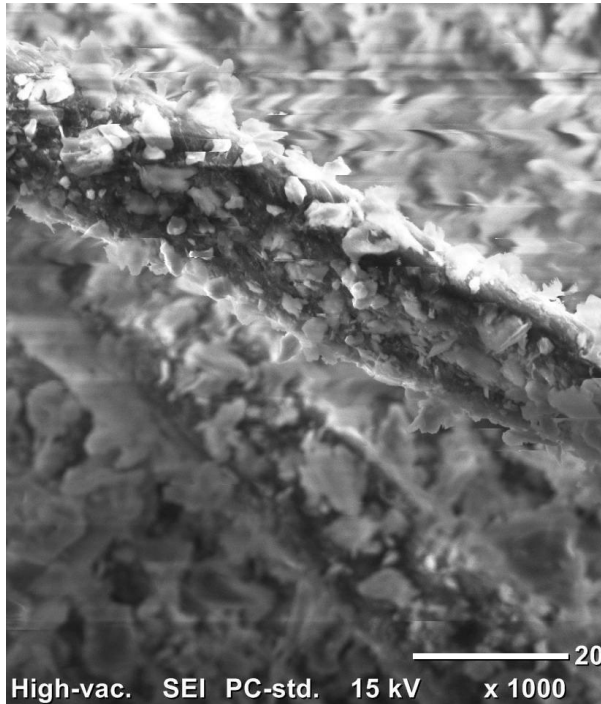
five clothes. However, while jeans showed good results, shirts were not so good for filtration. We predicted the degree of absorption of the material and the way of weaving are related, not fine.

Table2 Weigh of cloth

| | Before (g) | After (g) |
|--------------|------------|-----------|
| Cottons | 0.502 | 0.507 |
| Knitwears | 0.500 | 0.525 |
| Methes | 0.518 | 0.525 |
| Jeans(Warp) | 0.508 | 0.522 |
| Jeans(Woof) | 0.513 | 0.521 |
| Shirts | 0.513 | 0.522 |

This table shows second experiment results. Even if the weight is the same there was a difference depending on the material. So, filtration performance may depend on surface area.

According to experiments, jeans were the best for filtration of all clothes. Why jeans are superior to others? The differences of each clothes were material, weave and filtering speed. Also, when we conducted a second experiment, jeans didn't have the best results. So, we think jeans have a structured weaving method which is suitable for filters.



Verification of filtration effect by a simple filtration system

Published in 2013

They are the pictures of kaolin stuck in clothes. we saw them using the electronic microscope. In all of the clothes, fragments of kaolin stuck in the fiber, not adsorbed. According to this picture, we can see the kaolin sticks in the clothes. At first, we think clothes absorb kaolin. However, kaolin is actually a sharp fragment and can pierce into cloth.

4 Future work

In the future, we will conduct similar experiments on the same cloth material but different weaving method, and vice versa, to investigate what kind of difference it has from this research, and what kind of weaving, structure, and thread type. I would like to find out if kaolin grains are sticking easily. Furthermore, we would like to conduct similar experiments with materials other than those used in this study. In this study, filtration was evaluated from a physical point of view, but we would like to evaluate these from a chemical point of view to further improve their practicality. We would also like to investigate the filtration performance of disposable masks, which have been in increasing demand recently.

5. References

Masanori Nomura, Hiroo Ariyoshi, Daqing Eto