[Transaction]

Journal of the Korean Society
of Clothing and Textiles
Vol. 31, No. 12 (2007) p.1662~1671

Functional Modification of Sanitary Nonwoven Fabrics by Chitosan Treatment (Part II) -Focused on Changes in Physical Properties-

Hyun-Sook Bae† · In-Sook Kang · Hye-Won Park · Eun-Jeong Ryou · Jay-Cheol Kwon*
Dept. of Clothing & Textiles, Changwon National University
*Dept. of Neurology, Changwon Fatima Hospital

키토산 처리에 의한 위생용 부직포의 기능성 개질화 (제2보) -물성 변화를 중심으로-

배현숙† · 강인숙 · 박혜원 · 류은정 · 권재철*
창원대학교 의류학과, *창원파티마병원 신경과

(2007. 6. 11. 접수)

Abstract

The change in physical properties of polypropylene nonwoven fabrics used as top sheet for disposable sanitary goods was carried out using chitosan that is a type of natural polymer and has excellent human affinity by varying the molecular weight and concentration of chitosan. Low molecular weight(LMW) chitosan treated fabrics were found to be evenly coated on fabrics and had better dyeability by apparent dye uptake and its deodorization rate increased over the time. On the other hand, high molecular weight(HMW) chitosan treated fabrics showed higher add-on ratio and its dynamic water absorption rate and represented an increase in water transport rate. With chitosan treatment, its air permeability was improved. Regardless of the type of bacteria and chitosan concentration, its antibacterial activity was excellent in the case of the HMW chitosan treatment. In this regard, chitosan treatments by using a relatively high molecular weight was found as an effective way in the functional improvement of moisture properties and antibacterial activity including their most important performance in sanitary nonwoven fabrics.

Key words: Sanitary nonwoven fabric, Chitosan, Antibacterial activity, Moisture properties, Deodorization activity; 위생용 부직포, 키토산, 항균성, 수분 특성, 소취성

I. Introduction

Recently, nonwoven fabrics have been fastly grown in textile industries and widely used for durable products or industrial materials as well as disposable goods. Nonwoven fabrics show a specific surface feature that can be easily modified to have porous wide surface area(Yang et al., 2003). In particular, certain demands on disposable sanitary goods, such as diapers, sanitary towel, and tissue, represent an increase in compliances with tastes of the modern pursuing convenience and hygienic living environment(Oh et al., 2004). In addition, senior industries

---

[†] Corresponding author
E-mail: hsbae@sarim.changwon.ac.kr

This work was supported by grant No.(R01-2005-000-10143-0) from the Basic Research Program of the Korea Science & Engineering Foundation.

have been activated according to the trend of aging society. Disposable diapers and incontinence pads are examples of essential senior goods of which demand increases substantially due to such an activation of senior industries. However, the development of senior goods was not activated than infant diaper. It was caused that the development of senior goods was started too late and the recognition of senior goods was not enough, so the consumption of senior goods was rarely increased(Jo et al., 1999).

Disposable diaper is used when the elderly shows some difficulties in movement due to functional disorder or chronic diseases and consists of nonwoven fabrics, filler, absorbent, and vinyl cover. Since top sheet nonwoven fabric used in disposable sanitary goods directly contacts the skin for a long period of time, it may cause several problems including skin rash due to microbe, chemical, moisture by urination and defecation, or friction(Boiko, 1999). The functional modification and touch of sanitary nonwoven fabrics are very important to improve such problems.

Microbe is generally harmless but some of them are able to penetrate into the body through air, food, or clothes. If it is pathogenic, it causes diseases or skin disorder. Even if it is not pathogenic, it serves as the cause of secondary infection together with offensive odor. Accordingly, the process of applied antibacterial activities to the textile products is to restrain inhabitation or propagation of microbe to prevent contagious diseases or to remove bad smell. It is to improve properties against the microbe while maintaining physical and chemical properties of textile as much as possible(Mohamed, 1971; Vigo & Benjaminson, 1981). However textile finished by chitosan has emerged because there is a strong tendency of preferring the method with excellent human affinity without causing environmental pollutions.

Chitosan [poly-β(1,4)-D-glucosamine] that is a type of cationic polysaccharide is obtained by the alkaline deacetylation of chitin and is the principal exoskeletal component in crustaceans. Because the combination of properties of chitosan is required, such as water-binding capacity, fat-binding capacity, bioactivity, biodegradability, nontoxicity, and biocompatibility. Chitosan and its modified analogs have found in many applications including medicine, cosmetics, agriculture, biochemical separation system, biomaterials, and drug controlled-release systems (Koyano et al., 2000; Qu et al., 1999). In particular, there has been a recent global trend of preferences towards methods with good affinity to human beings and fiber processing methods of the natural polymer chitosan. So far, because of the utilization of chitosan is not achieved continuously, it has been shown some difficulties in achieve outstanding results in the market even though chitosan shows excellent safety and antibiotics properties(Kim et al., 1997). However, it is considered that the cleaning of sanitary nonwoven fabrics is not a requirement, which may lead to the maximized efficacy in chitosan treatments. Also chitosan prevents the growth of several microbes including gram-negative and gram-positive bacteria, but it differs depending on type of bacteria(Seo et al., 1992; Uchida et al., 1992), and shows other trends depending on the molecular weight of chitosan(Shin & Min, 1998).

In the mean time, touch and moisture properties are important since sanitary nonwoven fabrics directly contact the skin for a long period of time. Since chitosan is cation polysaccharide and has water-binding capacity(Koyano et al., 2000; Qu et al., 1999), moisture properties are considered to increase after applying chitosan treatments and moisture properties are changed. Air permeability can be changed using the thin film coated on the fabrics and the sense of wearing may be affected. In addition, it is also required to prepare countermeasures for smell due to chemical actions of urination and defecation, or excretion of microbe.

In this regard, this study tried to modify the function of polypropylene nonwoven fabrics that is used as a coverstock for disposable sanitary goods treated with chitosan by varying its molecular weight and concentration. First of all, a gram-negative bacterium and a gram-positive bacterium were selected as bacteria to examine the antibacterial activity of modified nonwoven fabrics. In addition, this study examined the possibility of expanding their uses as a sanitary top sheet nonwoven fabrics with improved touch and performance by exploring air permeability, deodorization activity and moisture properties including

Table 1. Characteristics of chitosan

	Chitosan	Chitosan oligomer
Particle condition	powder	powder
Viscosity	36 cps	5.6 cps
Degree of deacetylation	95%	95%
Average molecular weight	30×10^4	1.5×10^4
Moisture content	6.0%	7.0%
Residue on ignition	0.13%	0.16%

moisture uptake, dynamic water absorption rate, and water transport rate of chitosan treated nonwoven fabrics.

II. Experimental

1. Materials

A 100% of polypropylene(thermalbonded, 0.16mm, $18.4 g/m^2$) provided by Korea Vilene Ltd. was used as a sample. Chitosan was provided by Chembio Co., wherein chitosan with a similar deacetylated degree but different molecular weights(HMW=30×10^4, LMW =1.5×10^4) was used. <Table 1> shows the characteristics of chitosan. Other agents, grade I or higher were used.

2. Methods

1) Chitosan Treatment

Chitosan was dissolved in a 5%(w/v) acetic acid sol'n with varying the chitosan concentrations, and the samples were immersed in the resulting solution for 1h. Afterward, its treatment with chitosan was completed by padding the sample to its wet pick-up at 100±2% and by heating 100°C for 3 minutes.

2) Add-on Ratio

To determine the add-on ratio after applying the treatment with chitosan, the sample was dried completely at 105°C, and weighed before and after the drying.

$$\text{Add-on ratio}(\%) = \frac{(W_1 - W_0)}{W_0} \times 100$$

W_0: dry weight of the sample before chitosan treatments

W_1: dry weight of the sample after chitosan treatments

3) K/S Value

C. I. Acid Red 88 was used to examine the cationization of chitosan treated fabrics in terms of apparent dye uptake. Composition of dyeing solution was a mixture of acid dye 2%(o.w.f.), Na_2SO_4 15%(o.w.f.), H_2SO_4 3%(o.w.f.), and CH_3COOH 5%(o.w.f.). The liquid ratio was 50:1. The specimen was put into the dyeing solution when it reached 40°C and was dyed for 60 minutes at 90~100°C. After soaping, washed 2 times, and then it was dried. The surface reflection rate was measured at the maximum optical density using a spectrophotometer(Minolta, CM-3600d) and evaluated as the K/S value. And the surface structure of chitosan treated fabrics were examined using the Scanning Electron Microscopy(JSM-5620, Joel) on the surface of fabrics.

4) Moisture Properties

To examine the moisture properties of chitosan treated fabrics, perfectly dried samples were put into 25°C, 95% RH constant temperature and humidity chamber, and the amount of moisture uptake in the sample contained in certain time intervals(10, 30, 60, 120, 360 min.) were measured.

$$\text{Moisture uptake}(\%) = \frac{(W_w - W_d)}{W_d} \times 100$$

W_d: weight of the dried sample

W_w: weight of the moistened sample in certain time

In addition, the dynamic water absorption rate of chitosan treated fabric was measured by using the KS K 0339 to examine the water absorption of specimen in liquid state. Since the permeability in vertical direction is important for the moisture properties of sanitary nonwoven fabrics, the basic structure of diaper was made with chitosan treated nonwoven fabrics, absorption cotton and vinyl cover, and the water transport rate was also measured. The water transport rate of sanitary nonwoven fabrics was evaluated by the weight change ratio of water absorbed to the absorption layer made up of cotton through nonwoven fabrics after applying certain amount of water was dropped at a certain distance.

$$\text{Water transport rate}(\%) = \frac{(W_1-W_2)}{W_1} \times 100$$

W_1: applying certain amount of water
W_2: amount of absorbed water to the nonwoven fabrics

5) Air Permeability

An air permeability tester(FX 3300, Textest, Switzerland) was used to measure the same specimen at 5 times under 125Pa using a Frazier method(KS K 0570), and its average value was obtained.

6) Deodorization Activity

Deodorization activity by ammonia gas was measured using a gas detective conduit method. The weight of the specimen in a measuring flask was set to about 1g, the amount of injected ammonia solution to 5, amount of gas inhaled 1 time to 100ml. The deodorization rate was measured using the following formula.

Deodorization rate(%) = (A-B)/A×100

A : gas concentration of blank
B : gas concentration under specimen existence

7) Antibacterial Activity

The shake flask method(KS K 0693-2001) that is a standard test method was used to measure the reduction rate in the number of colonies formed and provided our quantitative data. Staphylococcus aureus (ATCC 6538), a gram-positive bacterium and Klebsiella pneumoniae(ATCC 4352), and a gram-negative bacterium were used as the testing bacteria. The reduction rate in the number of colonies was calculated using the following equation.

Bacterial reduction rate(%) = (A-B)/B×100

A : number of bacteria recovered from the control specimen incubated for 18hours
B : number of bacteria recovered from the test specimen incubated for 18hours

III. Results and Discussion

1. Add-on Ratio

Since the actual amount of attachments affects the physical properties of nonwoven fabrics treated with different molecular weight chitosan, the add-on ratio was examined depending on chitosan concentration.

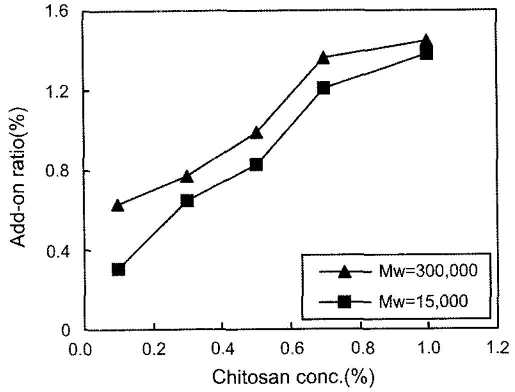

Fig. 1. Add-on ratio of nonwoven fabrics on the chitosan concentration.

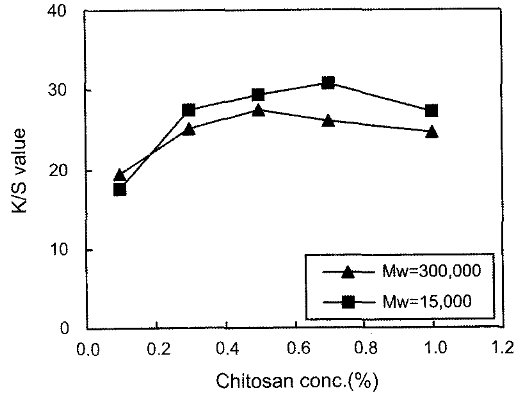

Fig. 2. K/S values of nonwoven fabrics on the chitosan concentration.

To indirectly examine the attachment of chitosan onto the fabrics, and the cationization of chitosan treated fabric was investigated by apparent dye uptake using acid dye.

<Fig. 1> shows the add-on ratio increased according to the increase in the concentration of chitosan. The add-on ratio of the HMW chitosan treated fabrics was higher than that of the LMW chitosan treated fabrics. As shown in <Fig. 2>, however, the LMW chitosan treated fabrics showed higher K/S values than the HMW chitosan treated fabrics, resulting in evenly coating effects when examining the add-on ratio of chitosan through apparent dye uptake by acid dye. In the end, the overall add-on ratio was higher at the HMW chitosan than the LMW chitosan. However the LMW chitosan was more evenly attached, so the K/S values of the LMW chitosan treated fabrics were high. In case of chitosan concentration over 0.7%, it was supposed that the lump of chitosan was increased without regard to chitosan molecular weight.

<Fig. 3> shows SEM photograps of the fabrics on the chitosan concentration. When the HMW chitosan was used, the attachment of chitosan at low concentrations on the surface of the fabrics resulted. When the LMW chitosan at low concentrations were used, traces of chitosan were rarely seen but the fabrics were evenly coated with chitosan.

2. Moisture Properties

While human wears clothes, human body transpires moisture in the form of sweat or insensible perspiration even if it does not feel it. Accordingly, the moisture transfer is directly related to the comfort of clothing in order to keep the comfortable clothing climate. In particular, the touch and moisture properties of fabrics are important since sanitary nonwoven fabrics contact the skin for a long period of time. However, the moisture properties of nonwoven fabrics are considered to change after applying chitosan treatments since an amino group of chitosan has a 16.8kcal/mol of hydration heat and represents high hydrophile property(Watt et al., 1959), compared to the hydration heat of hydroxyl group(5.7kcal/mol) in cellulose, and chitosan has water-binding capacity as

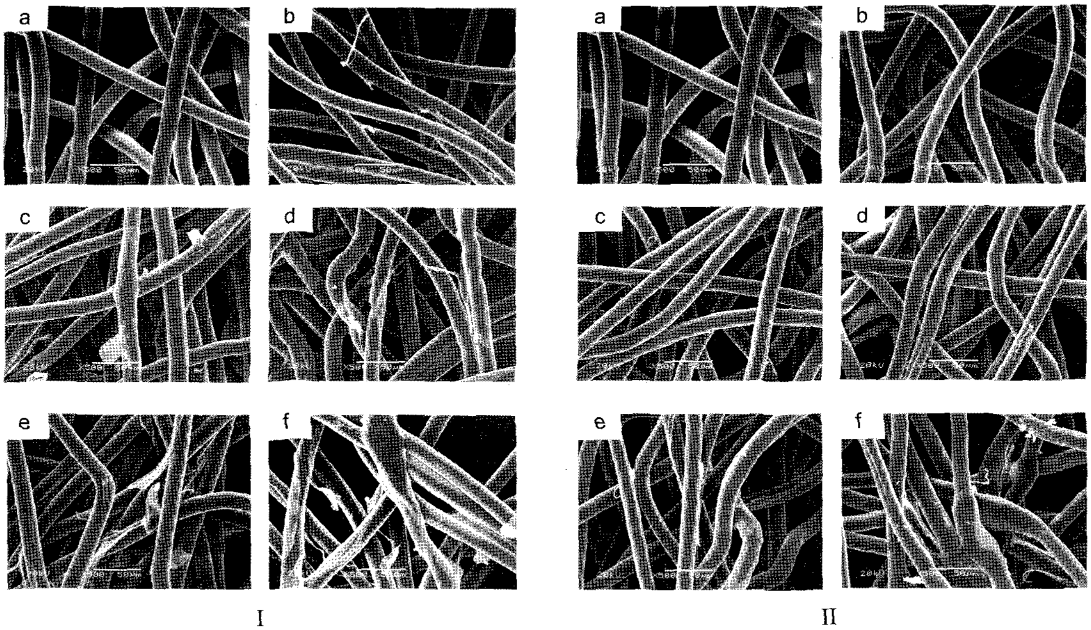

Fig. 3. Scanning electron micrographs(x500) of nonwoven fabrics on the chitosan concentration(I: $Mw=30\times10^4$, II: $Mw=1.5\times10^4$). (a) control, (b) 0.1%, (c) 0.3%, (d) 0.5%, (e) 0.7%, (f)1.0%.

cationic polysaccharide. As shown in <Fig. 4> and <Fig. 5>, the moisture uptake of chitosan treated fabrics was examined according to the time passage at 25, 95% RH. It showed that the moisture uptake slightly decreased at first and then moisture uptake with lapse of time of treated fabric increased in highly humid circumstance. It might show a low moisture uptake since it was unstable to transfer moisture contained at the initial period. According to hydrophilic chitosan treatment, chitosan treated fabrics might be changed in their structures that can hold more moistures over the time. Moisture uptake also increased as chitosan concentration increased. The moisture uptake of the LMW chitosan treated fabrics increased more than that of the HMW chitosan treated fabrics. It was probably because LMW chitosan which has water-binding capacity was more evenly attached to the surface of nonwoven fabrics.

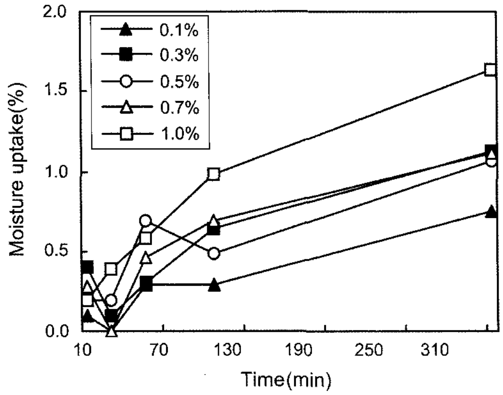

Fig. 4. Moisture uptake of nonwoven fabrics treated with the HMW chitosan(Mw=30x10^4).

The dynamic water absorption rate was measured to examine the water absorption rate of its liquid state. <Fig. 6> shows the dynamic water absorption rate that slightly increased when the HMW chitosan was processed according to the increase in chitosan concentration and slightly decreased when the LMW chitosan was processed. Since nonwoven fabrics were in bulky and loose structure with physical binding, its surface characterisic was not significantly changed, but it represented an increase in dynamic water absorption rate of the HMW chitosan treated fabrics by the attachment of chitosan in high concentration means the performance as a sanitary nonwoven fabrics improved as it gets easier to absorb moisture in liquid state.

In particular, it is required to rapidly move the moisture of fluid from human body to the part with absorption gel through top sheet nonwoven fabric and to dry itself immediately in order to keep the comfort since a diaper directly contacts the skin. In this study, regarding the diaper in the structure of chitosan treated fabrics, absorption cotton and vinyl cover were made and measured the weight ratio of water absorbed to the absorption layer. As shown in <Fig. 7>, the water transfer rate increased according to the increase in chitosan concentration and that of the HMW chitosan treated fabrics was higher than

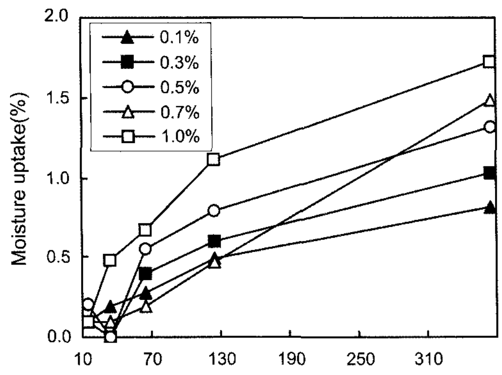

Fig. 5. Moisture uptake of nonwoven fabrics treated with the LMW chitosan(Mw=1.5x10^4).

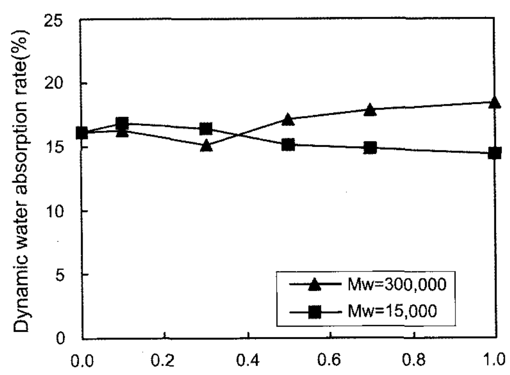

Fig. 6. Dynamic water absorption rate of nonwoven fabrics on the chitosan concentration.

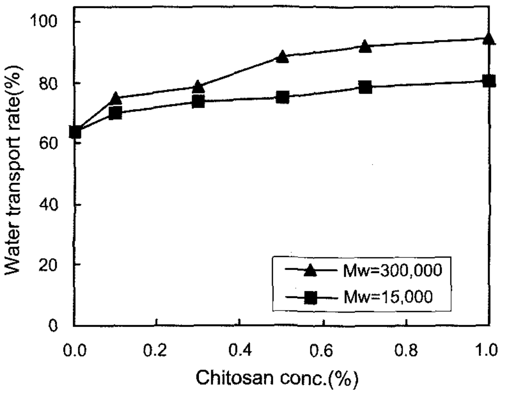

Fig. 7. Water transport rate of nonwoven fabrics on the chitosan concentration.

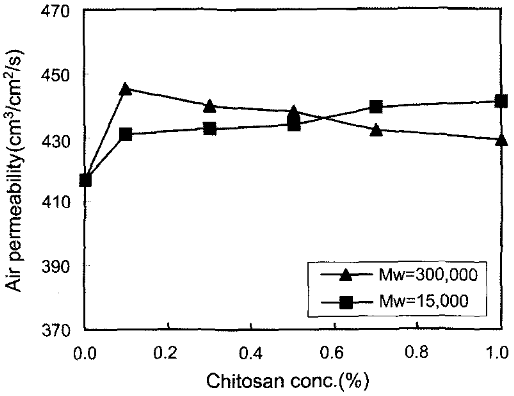

Fig. 8. Air permeability of nonwoven fabrics on the chitosan concentration.

the LMW chitosan treated fabrics. It means that moisture is easily moved to the absorption layer so that the wetting decreases in nonwoven fabrics and comfortable sense can be maintained.

3. Air Permeability

Air permeability of textiles is affected by the inter-yarn pore size of a fabric structure(Backer, 1948). In the case of sanitary nonwoven fabrics that directly contact the skin, changes in air permeability were examined according to the chitosan concentration since changes in air permeability were directly related to the comfort.

<Fig. 8> shows the air permeability of chitosan treated fabrics increased compared to untreated fabrics. The air permeability of the HMW chitosan treated fabrics was good when the applied chitosan concentration was below 0.5%, but if the chitosan concentration was over 0.5%, the air permeability of the LMW chitosan treated fabrics was found to be better. It was because textile surface was changed smoothly when chitosan solution was absorbed, coated, and dried, as increasing the air permeability. However, the air permeability of the HMW chitosan treated fabrics decreased over the high chitosan concentration because some pores were clogged by adding chitosan in which the LMW chitosan was uniformly attached without pore clogging in fabrics. These results were coincided in the SEM photographs<Fig. 3> of the LMW chitosan treated fabrics. In the end, an increase in the air permeability of chitosan treated fabrics was found to have positive effect on the improvement of comfort of sanitary nonwoven fabrics.

4. Deodorization Activity

Deodorization is to remove unpleasant smells in a space and is required for pursuing comfortable and healthy life. In the aging society, disabled elderly or incontinence patients mainly use disposable diapers. Since top sheet nonwoven fabrics of the disposable diaper directly contact the skin for a long period of time, it causes unpleasant smells due to urination and defecation or excretion of microbe, and affects comfortable sense. Even if diapers are replaced frequently, deodorization effects using chitosan treatments may result in the improvement of quality of elderly patient life. Deodorization activity of nonwoven fabrics treated with chitosan was measured using the ammonia gas as a standard evaluation way since the extinction speed of ammonia may be similar to the speed of smell in the human body.

<Fig. 9> shows the deodorization activity of HMW chitosan treated fabrics and <Fig. 10> shows that of LMW chitosan treated fabrics. According to the results, the deodorization rate increased over the time and with higher chitosan concentration and deodorization effects were better when it was processed with the

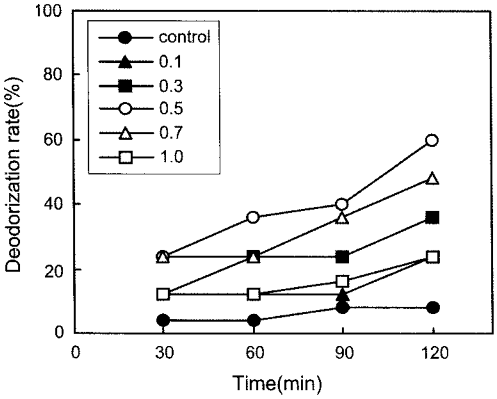

Fig. 9. Deodorization rate of nonwoven fabrics treated with the HMW chitosan(Mw=30×10^4).

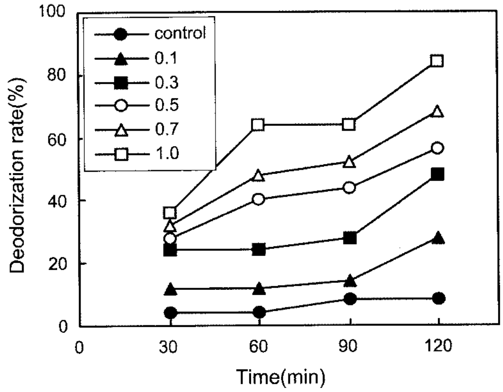

Fig. 10. Deodorization rate of nonwoven fabrics treated with the LMW chitosan(Mw=1.5×10^4).

LMW chitosan(maximum of about 80%) than that of the HMW chitosan. It implied that the LMW chitosan was uniformly distributed to the nonwoven fabrics as shown in the results of the apparent dye uptake, resulting in better deodorization effect by chitosan. In the end, it was the most effective way to process the LMW chitosan with a high concentration if only the deodorization effect was considered, but given other performances, it was the most effective way to use the HMW chitosan with a concentration about 0.5%.

5. Antibacterial Activity

Microbe benefits the human sometimes and harms other times in our daily life. It inhabits the textile products that are deeply related to our life or human body, causing bad smell, damage to textile, or harm to our health. In this regard, antibacterial finishes restrain the inhabitation or propagation of bacteria or mold in textiles while it retains the physical or chemical property of textile products, contributing to the protection of human body or hygienic living environment. Since sanitary nonwoven fabrics directly contact human skin, it is important to select the antibacterial agent that doesn't badly affect to human body even though it has lower sterilization than organic bacterial agents with excellent sterilization.

The antibacterial activity of chitosan with excellent body affinity was revealed by the effects of a cationic amino group. It shown that -NH_2 in the -C_2 position of glucosamine and the structural unit of chitosan turns into -NH_3^+(Katsumasa & Takao, 1994). That is, it decreases the freedom degree of microbe and blocks the growth of microbe according to the ionic bond between an amino group of cationic chitosan and negative charges of the phospholipid of microbe cell walls, resulting in antibacterial activity (Seo et al., 1992). Accordingly, antibacterial effect continues as long as the cationic ammonium ion of chitosan can contact the microbe. While chitosan blocks the growth of several microbes including gram-negative and gram-positive, it shows certain differences depending on the type of bacteria(Seo et al., 1992; Uchida et al., 1992), and shows different patterns depending on the molecular weight of chitosan(Shin & Min, 1998). In this study, the antibacterial activity was investigated depending on the molecular weight of chitosan, using Staphylococcus aureus (ATCC 6538), a gram-positive bacterium that commonly inhibits in the skin or textile(one of pyogenic bacteria) and Klebsiella pneumoniae(ATCC 4352), and a gram-negative bacterium.

As shown in <Fig. 11>, it was the antibacterial activity of the HMW chitosan treated fabrics. In general, chitosan has different growth inhibitory concentrations(MIC) depending on the type of bacteria (Shin & Min, 1997). As a result of this experiment, however, the antibacterial activity was differed depending on the molecular weight of chitosan rather than the type of bacteria. That is, the antibacterial activity

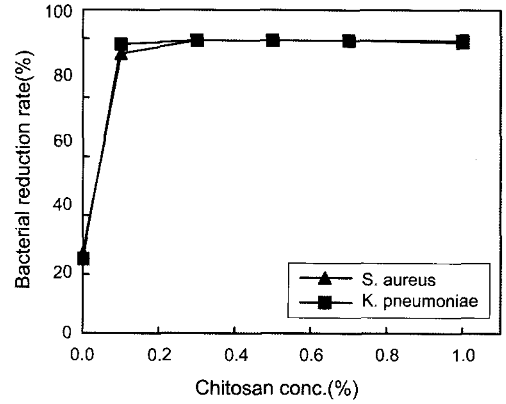

Fig. 11. Antibacterial activity of nonwoven fabrics treated with the HMW chitosan($Mw=30\times10^4$).

was excellent with the HMW chitosan treatment regardless of the chitosan concentration and type of bacteria. Since it implies that the HMW chitosan is effective for inhibiting the growth of bacteria, it is better to use chitosan with a relatively high molecular weight to improve the antibacterial activity, one of the most important performance of sanitary nonwoven fabrics, which is consistent with the reporting outcome of Shin and Min(1998).

IV. Conclusions

The functional modification of polypropylene nonwoven fabrics used as a coverstock for disposable sanitary goods was carried out using chitosan that is a natural polymer and has excellent human affinity by varying the molecular weight and concentration of chitosan. Moisture properties including dynamic water absorption rate and water transport rate, air permeability, and deodorization activity and antibacterial activity were examined. Followings are the results of the examination of the possibility of expanding its use as sanitary top sheet nonwoven fabrics with improved touch and performance.

1. Add-on ratio was higher when the HMW chitosan was treated and increased as the chitosan concentration increased. However, the LMW chitosan treated fabrics had better dyeability by apparent dye uptake, it was more evenly attached than the HMW chitosan treated fabrics.

2. Moisture uptake slightly increased when the LMW chitosan was used. Dynamic water absorption rate and water transport rate increased when the HMW chitosan was used, resulting in easier moisture absorption in a liquid state and moving absorbed moisture fast and improved performance as sanitary top sheet nonwoven fabrics.

3. Air permeability was improved with chitosan treatments. When chitosan concentration was below 0.5%, air permeability of HMW chitosan treated fabrics was better, but when chitosan concentration was over 0.5%, that of LMW chitosan treated fabrics was better. Deodorization rate increased over the time with higher chitosan concentration.

4. Antibacterial activity was excellent when the HMW chitosan was used, regardless of the type of bacteria or concentration of chitosan. Since that means a high molecular weight is an effective way for preventing the growth of bacteria, it is better to use chitosan with a high molecular weight in order to improve the antibacterial activity and the most important performance of sanitary nonwoven fabrics.

References

Backer, S. (1948). The relationship between the structural geometry of a textile fabric and its physical properties (Thermal Resistance). *Textile Res. J.*, 18, 650–658.

Boiko, S. (1999). Treatment of diaper dermatitis. *Dermatol Clin.*, 17, 235–240.

Jo, J. S., Kim, S. R., & Choi, J. H. (1999). A study for the development of disposable diapers for the elderly in need. *J. Korean Home Economics Association, 37*(7), 29–43.

Katsumasa, T. & Takao, H. (1994). Preparation and antibacterial activities of N-trimethylammonium salts of chitosan. *Sen-I Kagaku, 50*(5), 215–220.

Kim, J. J., Jeon, D. W., & Kwon, Y. K. (1997). A study on the change of hand of chitosan-treated fabrics (III): -Effect of chitosan treatment conditions-. *J. Korean Fiber Soc., 34*(10), 689–700.

Koyano, T., Koshizaki, N., Umehara, H. Nagura, M., & Minoura, N. (2000). Surface states of PVA/Chitosan blended hydrogels. *Polymer, 41*, 4461–4465.

Mahomed, R. S. (1971). Antibacterial and antifungal finishes. In Mark, H., Wooding, N. S., & Atlas, S. M. (Eds.), *Chemical aftertreatment of textiles* (pp. 507-512). New York: John Wiley & Sons.

Oh, K. W., Hong, K. H., & Kang, T. J. (2004). A study of surface properties and handle of nonwovens for disposable diaper. *J. Korean Soc. Clothing and Textiles*, *28*(3/4), 491–498.

Qu, X., Wirsen, A., & Albertson, A. C. (1999). Synthesis and characterization of pH-sensitive hydrogels based on chitosan and D, L-Lactic acid. *J. Appl. Polym. Sci.*, *74*, 3193–3202.

Seo, H., Mitsuhashi, K., & Tanibe, H. (1992). *Advances in chitin and chitosan*. In Brine, C. J., Sandford, P. A., & Zikakis, J. P. (Eds.). London and New York: Elsevier Applied Science.

Shin, Y. S. & Min, K. H. (1997). Chitin/Chitosan: Antimicrobial properties and applications. *Polymer Science and Technology*, *8*(5), 591-595.

Shin, Y. S. & Min, K. H. (1998). Antimicrobial finish of nonwoven fabric by treatment with chitosan. *J. Korean Soc. Dyers and Finishers*, *10*(3), 50–56.

Uchida, Y., Izume, M., & Ohtakara, A. (1992). *Advances in chitin and chitosan*. In Skjak-Braek, G. (Eds.). London and New York: Elsevier Applied Science.

Vigo, T. L. & Benjaminson, M. A. (1981). Antibacterial fiber treatments and disinfection. *Textile Res. J.*, *51*(7), 454–465.

Watt, I. C., Kenett, K. H., & James, J. F. P. (1959). The Dry weight of wool. *Textile Res. J.*, 29, 975–981.

Yang, J. M., Lin, H. T., Wu, T. H., & Chen, C. C. (2003). Wettability and antibacterial assessment of chitosan containing radiation-induced graft nonwoven fabric of polypropylene-g-acrylic acid. *J. Applied Polymer Science*, *90*, 1331–1336.

요 약

일회용 위생용품의 탑시트로 사용되는 폴리프로필렌 부직포에 천연고분자이며, 인체친화력이 우수한 키토산을 분자량과 농도를 변화시켜 처리하므로써 기능성 개질화된 부직포의 항균성을 비교하고, 소취성과 공기투과도 및 흡습성, 흡수량 등의 수분 특성을 살펴보았다. 키토산의 처리농도가 증가하고, 고분자량일수록 부착률이 컸으며, 저분자량 키토산 처리포의 경우 겉보기 염착량에 의한 염색성이 더 좋게 나타났다. 수분 특성의 경우, 고분자량의 키토산 처리시 동적흡수율과 흡수량이 더 증가하였다. 키토산 처리로 공기투과도는 모두 향상되었으며, 키토산 처리농도가 증가하고 시간이 경과함에 따라 소취율이 증가하였고, 저분자량의 키토산 처리시 소취효과가 더 우수하였다. 박테리아 균주의 종류와 키토산의 농도에 상관없이 고분자량의 키토산 처리시 항균성이 아주 우수하여 위생용 부직포의 성능 중 가장 중요한 항균성과 수분 특성의 기능성 향상을 위해서는 비교적 분자량이 큰 키토산이 효과적이었다.