

A Study on the Antibacterial Activity of Chitosan

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Abstract

Water-soluble chitosan and water-insoluble chitosan with molecular weight of 2,000,000, 500,000, 80,000, and 40,000 and more than 90% degree of deacetylation were controlled to evaluate the antibacterial activity of chitosan against a pathogenic bacteria, methicillin resistant *Staphylococcus aureus*(MRSA), which is being issued in the world. The Shake Flask Method and Modified Shake Flask Method were used to find out the antibacterial activities of 5 types of chitosan/acetic acid solution, and the other antibacterial activities test with the cotton filter treated with chitosan /acetic acid solution. Those test methods showed the great differences ,but the results of the antibacterial activites showed the same difference.

Introduction

There are many antibacteriocidals to get rid of the pathogenic bacteria. However, considering that a textile goods is the secondary skin, contacting human body every time, characteristics of antibacterial agents used in antibacterial treatment shall be also considered. It is desirable that rather antibacterial agents less harmful to human body even with low bacteriocidal activity than organic antibacterial agents more harmful to human body with more excellent bacteriocidal activity be used. Use of antibacterial agents with such safety promoted use of edible natural high molecular compound, and it enables the third function to fabrics itself as well as bacteriocidal activity.

Chitosan is a representative natural high molecular compound, and its bacteriocidal activity has been studied continuously. As Chitosan has nearly same structure with cellulose and -NH₂ with high chemical reactivity in molecular structure, it can receive antibacterial treatment for many textile materials.

In this study, experiments with the Shake Flask Method(SFM) and Modified SFM was performed to evaluate 1) the antibacterial activity by molecular weight of chitosan/acetic acid solution , and 2) that of cotton filter treated with chitosan/acetic acid solution against a pathogen MRSA. and the problems of test methods for antibacterial activity that are being commonly used in the world were verified by analysis of data obtained from a large quantity of experimental results.

Experiments and Results

1) Minimum Inhibitory Concetration(MIC) of Chitosan/acetic acid solution

Table 1. MIC Value of chitosan/acetic acid solution of antibacterial activities

Chitosan(MWt)	Shake Flask Method	Modified Shake Flask Method
2,000,000	0.002%* (0.2ppm)**	0.25% (25ppm)
500,000		
150,000		
80,000		
40,000		

* % represent concentration of chitosan/acetic acid solution for MRSA

** () represent MIC of chitosan/acetic acid solution

MIC shows the above results.

2) MIC of MRSA of the cotton filter treated with chitosan/acetic acid solution

Table 2. MIC value of MRSA of the cotton filter treated with chitosan/acetic acid solution

Chitosan (MWt)	Shake Flask Method	Modified ShakeFlask Method
2,000,000	0.05% (5ppm)* (cotton filter)	0.05% (5ppm) (cotton filter)
500,000		
150,000		
80,000		
40,000		

* () value is MIC of chitosan/acetic acid solution

Conclusion

To find the antibacterial activity of chitosan against a pathogenic bacteria MRSA.

2 types of chitosan(water-soluble, water-insoluble chitosan) were used, with more than 90% degree of deacetylation , and molecular weights were 2,000,000, 500,000, 150,000, 80,000 and 40,000. To find the antibacterial activity of the post-treated of 5 kinds of chitosan/acetic acid solution and chitosan/acetic acid solution padded on the cotton filter, the antibacterial activities were evaluated with the SFM and the Modified SFM. The results are as follows,

1. For antibacterial activity of chitosan/acetic acid solution, MIC was 0.2ppm in SFM and 25ppm in Modified SFM in the total 5 kinds.
2. Whereas, when chitosan is padded on cotton filter, even in Modified SFM provided with nutrient into inoculated bacterial solution, MIC of chitosan/acetic acid solution increased 25 times like SFM as 0.05%(5ppm). From the above results, it is concluded that the experimental methods have several problems. Those results were showed the low reliability. SFM , and the modified SFM did not point out the temperature and nutrient for culture . So it is far from the real condition.