

## 고분자 전해질 콤플렉스 : 감마 히드록시부틸산과 키토산의 상호작용

이광순, 손태원, 김영훈, 정민기, 최용혁  
영남대학교 섬유패션학부

### Polyelectrolyte Complexes : Interaction between $\gamma$ -hydroxybutyric acid (GHB) and chitosan

**Kwang-Soon Lee, Tae-Won Son, Young-Hun Kim, Min-Gi Jeong, Yong-Hyeok Choi**  
School of Textiles, Yeungnam University, Gyeongsan 712-749, Korea

#### 1. Introduction

Oppositely charged polyelectrolytes are generally known to form stable interpolymer complexes. Such polyelectrolyte complexes are high practical relevance in industrial applications as flocculants, coatings, and binders, as well as in biological systems and in biomedical applications. Most insoluble polyelectrolyte complexes seem to exhibit 1:1 charge stoichiometry, independent of the charge density on the macromolecules and the structure of their backbones, provided that all charged groups are accessible for electrostatic interactions.

$\gamma$ -hydroxybutyric acid (GHB) is an endogenous metabolite present in most mammalian tissues at nanomolar concentrations that has been hypothesized to have a role as a neurotransmitter or neuromodulator. The synthesis in the brain involves  $\gamma$ -aminobutyric acid (GABA) or 1,4-butanediol as precursor substances. GHB can also be synthesized in the mammalian liver from  $\gamma$ -butyrolactone. A central nervous system depressant, which was first synthesized in 1960s, GHB has been used as an anesthetic and as a treatment for sleep disorder, alcohol withdrawal, and narcolepsy. GHB was widely sold in health food stores as a weight (to replace 1-tryptophan) loss drug and as an aid to muscle building and was subsequently recalled by the FDA in 1989.

Chitosan may be considered as a family of linear binary copolymers of (1 $\rightarrow$ 4)-linked 2-acetamido-2-deoxy- $\beta$ -D-glucopyranose and 2-amino-2-deoxy- $\beta$ -D-glucopyranose. Chitosan is one of a few natural cationic polysaccharides that can be obtained by alkaline deacetylation of chitin, a major component of the shells of crustacea such as crab, shrimp, crawfish, and lobster. Also, it is the second most abundant polymeric material in the earth. Chitosan has excellent biocompatibility and biodegradability. Especially, it shows mild antibacterial activity arising from its cationic residue, which is an important property in view of the wide use of chitosan as a biomedical polymeric materials. Therefore, it has been used to the biotechnology, production of cosmetic and medicine, textile and paper industry, agriculture, chemical industry, and wastewater treatment.

In this study, the chemical structures of polyelectrolyte complexes composed with GHB and chitosan were investigated through FT-IR spectroscopy.

#### 2. Experimental

##### 2.1 Materials

The  $\gamma$ -butyrolactone (GBL) purchased from Aldrich has purity of 99%+. Crab shell chitosan (Minimum 94% deacetylated, MW ca.  $11.26 \times 10^4$ ) sample was purchased from Tae Hoon Bio Co.

Ltd, KOREA and purified by the reprecipitation method.

## 2.2 Preparation of Polyelectrolyte Complexs

The  $\gamma$ -hydroxybutyric acid (GHB) was made through the hydrolysis of  $\gamma$ -butyrolacton (GBL) at 65 °C for 48 hours with stirring. 1 g of chitosan was dissolved in hydrolyzed 50 ml GHB solution with stirring at room temperature up to dissolution.

## 2.3 Measurements

Fourier-transform infrared (FTIR) spectroscopy is important for the investigation of polymer structure. The IR spectra of these materials vary according to their compositions and may be able to show the occurrence of complexation and interaction(s) between the various constituents. Infrared spectra exhibited in this work were taken with a Bruker IFS-66V/S in wavenumber region between 4000 and 400  $\text{cm}^{-1}$ .

## 3. Results and Discussion

Structure of polyelectrolyte complex of GHB and chitosan was confirmed by FT-IR spectra (Fig. 1). IR spectroscopy of GHB and chitosan complex appeared about 3500~3300  $\text{cm}^{-1}$  of N-H, O-H and 1750  $\text{cm}^{-1}$  of carbonyl group of ester group. N-H and C-O bending peaks appeared 1547  $\text{cm}^{-1}$  and 1148  $\text{cm}^{-1}$ , also  $\text{CH}_2$  peak appeared 1425  $\text{cm}^{-1}$ .

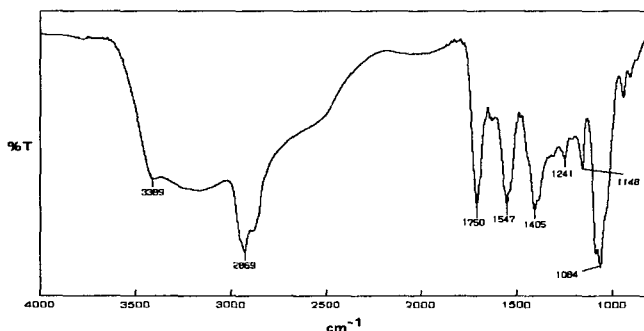


Fig. 1. IR spectra of polyelectrolyte complex of GHB and chitosan

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