Bionanocomposites of Cellulose/Curdlan from Genetically Modified Gluconacetobacter xylinus

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Bionanocomposites of Cellulose/Curdlan from Genetically Modified *Gluconacetobacter xylinus*

(遺伝子組換えした酢酸菌によるセルロース／カードランバイオナノコンポジットの創製)

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論　文　内　容　の　要　旨

This research aimed at establish a biosynthesis approach of producing cellulose nanocomposites by the cooperation of cellulose and curdlan (β-1,3-glucan) biosynthetic system.

In Chapter 1, a curdlan synthase gene (*crdS*) was extracted and amplified from *Agrobacterium* sp. ATCC31749, followed by transformation into *Gluconacetobacter xylinus* AY201 by electroporation. After gene modification, secretion of curdlan from genetic-modified strain was successfully detected by staining method. A nanocomposite-producing machine was achieved by cooperation of cellulose and curdlan synthetic system.

In chapter 2, the obtained cellulose/curdlan nanocomposites were studied in yield, morphology, crystalline structure and surface hydrophilic/hydrophobic properties. The results indicated that the introducing of curdlan synthesizing system to *G. xylinus* did not disturb the cellulose producing function, but greatly change the morphology and surface property of the obtain nanocomposties. By the cover of curdlan substance on the surface of nanocomposites, water was difficult to permeate and diffuse into the nanocomposite network, which promise a broader application range of biomedical material.

In chapter 3, the secreting mechanism of gene-modified *G. xylinus* was investigated by observation of moving behaviors and the secretion deposition on a highly ordered cellulose template (NOC). The results showed that the secretion of curdlan greatly slow the movement rate of the bacterial cells by physically binding the cellulose microfibrils to the surface of NOC. Base on these results, it is hypothesized that curdlan were secreted accompanied with cellulose nanofibers, therefore changing the surface morphologies of the network of the nanocomposites.

This research is not only for obtain bacterial cellulose nanomaterial feasibly from the microorganism producer, but also explore an strategy for construct nanocomposites by the combination of material science and microbial biology.