



● Starting Stage

(Fiscal Year 2004-2006)

# Hirosaki Area

Proteoglycan-Application Research Project

## Hirosaki University

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## Core Research Organization

Hirosaki University

- Major Participating Research Organizations
  - Industry: Kakuhiro Co., Ltd., Otsuka Chemical Co., Ltd., Glyco Japan Co., Ltd., and others
  - Academia: Hirosaki University
  - Government: Aomori Industrial Research Center

## Main Results of City Area Program

- Findings of the immunosuppressive effect and therapeutic effect of proteoglycans (PG) on inflammatory bowel disease**

When PG was administered orally, an anti-inflammatory effect on colitis was recognized by observations of the hemorrhage state, hematological examination, and pathology.

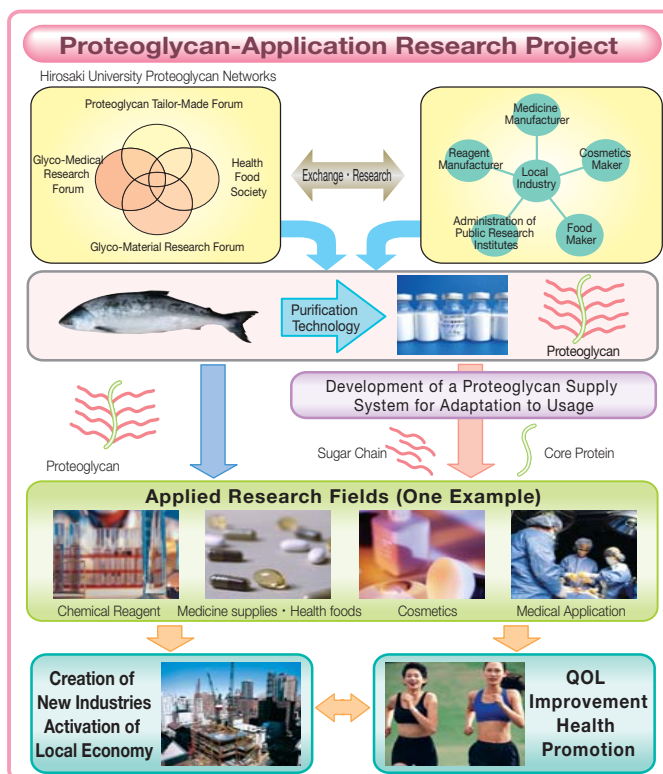
  - Applications are expected in medicines with no side effects and safe long-term use.
  - Applications are expected in specially designated health foods and foods for sick patients.
- Success of the development of low-cost proteoglycan (PG) production**
  - The contamination of lipids in the purification process of proteoglycans is a long-established problem. We sought to develop a simple procedure to separate lipids from proteoglycans, thereby enabling low-cost proteoglycan production. We hope to establish a preparation method for lipid-free dried powder proteoglycans that can be applied to functional foods or food materials.



Hirosaki University Natural Proteoglycan Powder

## Approaches after Completion of Project

- 'Custom-made proteoglycans'**
  - In order to establish a custom-made technology, we attempted to construct a proteoglycan sugar chain library. We sought to prepare an artificial (super) proteoglycan using enzymatic and chemical reconstruction technology. We then sought to develop a novel glycoengineering technique.
  - We established a preparation method for foam card gel containing proteoglycan for the cartilage culture system, based on applied research into proteoglycans for medical use.
  - Applied research focused on diagnosis technology that includes the proteoglycan as the target. We developed a novel, selective detection method of the glycosaminoglycan of proteoglycans.
  - These results suggest the possible application of proteoglycans for medical use.
- Progress in the application of proteoglycans to functional foods**
  - In regard to functional foods, we focused on inflammatory bowel disease, and evaluated the utility of the proteoglycan to ensure that quality specifications matched usage requirements. We confirmed the protective efficacy by oral administration of the proteoglycan based on mouse models of chronic inflammatory bowel disease.
  - We considered the purity and price issues regarding "the proteoglycan" as a food material.



The contamination of lipids in the process of proteoglycan purification is a major problem to be overcome; however, we finally succeeded in removing the lipids from the proteoglycan preparation using a simple method that made it possible to provide the product at a low cost.

The development of preparation methods of lipid-free dried powder and its application to functional foods and materials are expected to be established as a business venture.

● Starting Stage

(Fiscal Year 2004-2006)

# Ehime Eastern Area

Development of an Intelligent Functional Material and its Application

Toyo Industrial Creative Center

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**Core Research Organizations**

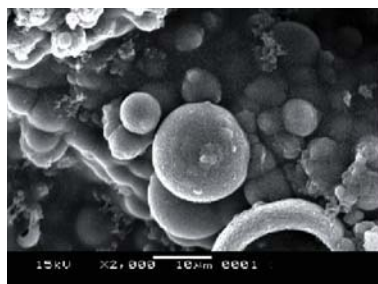
Niihama National College of Technology,  
Paper Industrial Research Center of Ehime Prefecture

- Major Participating Industry: Unicharm Corporation, KAMI-SHOJI CO., LTD., Nissen Chemitec Corporation, and others
- Research Organizations Academia: Niihama National College of Technology, Ehime University, and others
- Government: Paper Industrial Research Center of Ehime Prefecture, Industrial Research Center of Ehime Prefecture, and others

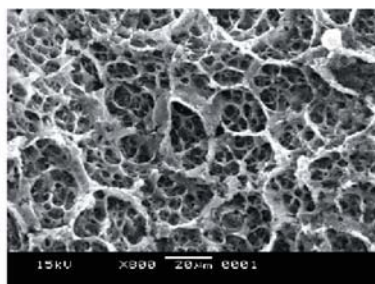
## Main Results of City Area Program

### 1. Development of a preparation technique for nylon polymer with the morphology of a microcapsule, porous material, and fiber on a paper surface

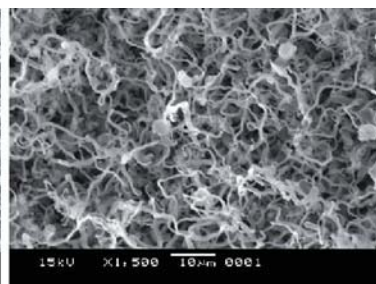
We studied the fixation of an intelligent material on a paper surface using the interfacial polymerization technique, with the aim of retaining the function of the intelligent material. We succeeded in developing a basic technique for the fixation and formation of the functional materials on the paper surface. The interfacial polymerization technique is expected to be a useful method for the fixation of intelligent material onto paper.



Formation of a nylon microcapsule on a paper surface



Formation of nylon porous material on a paper surface



Formation of nylon fiber on a paper surface

### 2. We succeeded in developing a preparation technique for high-performance photocatalytic paper

Titanium dioxide (TiO<sub>2</sub>) is well known as a photocatalyst, and has been applied to various products in the paper industry. However, the photocatalytic activity of TiO<sub>2</sub> fixed to paper tends to decrease due to overlapping by various binders. The TiO<sub>2</sub> rapidly decomposes the organic fibers of the paper. To solve these problems, we attempted to prepare photocatalytic paper with a multi-layer structure by overlapping two layers. One of the layers was designed to improve the physical strength, and the other to enhance the photocatalytic function. The paper prepared using this technique showed high photocatalytic activity and physical strength.

■ Air-purification performance of a honeycomb-shaped filter

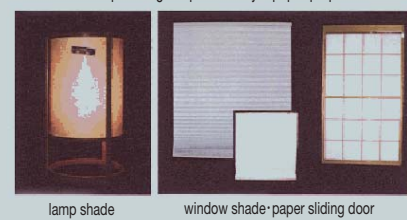


■ [Experimental condition]

We placed an air purifier into a reaction vessel (1.25 L volume) and sealed the vessel. Various organic gases were injected to the vessel at given concentrations. After a set time, the gas concentration in the reaction vessel was analyzed and the purification capability of the photocatalytic paper evaluated. The rate of air circulation in the vessel was about 0.5 m<sup>3</sup>/min.



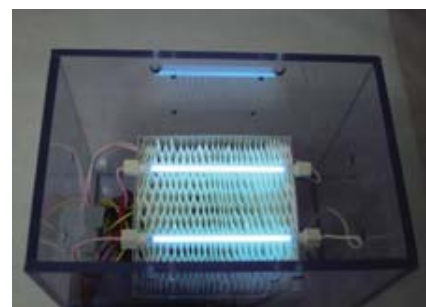
■ Commercial sample using the photocatalyst paper prepared in this study



## Approaches after Completion of Project

● Development of a deodorizing device

Three companies in our local area are developing a deodorizing device for pet shops and nursing homes using our high-performance photocatalytic paper and a supplementary system.



Experimental instrument equipped with a cold cathode fluorescent lamp