

The Nitto Denko Group combines its core technologies – adhesion, coating, polymer function control and polymer analysis and evaluation – with new technologies to carry out research and development primarily focused around our growth strategy of “Green, Clean and Fine”

Environmentally Friendly MARINGLIDE™ Film Protects Ship Hulls

If you look at the hulls of ships and boats, you will often see many marine organisms, such as barnacles. How did they get there? The larvae of these organisms were floating in the ocean and attached themselves to the hull of the vessel as it passed by. Once they have attached themselves, then they rapidly grow in size and not only look bad, but also increase water resistance, which in turn has a major impact on fuel consumption and speed. Because they become attached so firmly, in some cases the hull is damaged when they are scraped off.

Up until now, antifouling paint has been the main method of preventing barnacles from attaching themselves to the hulls of vessels. However, it is feared that the substances contained in such paints to repel barnacles may have a detrimental effect on the environment.

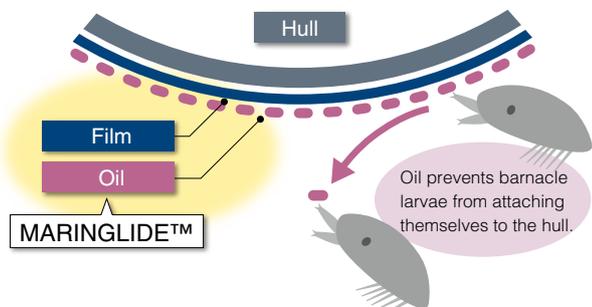
Nitto Denko has therefore developed MARINGLIDE™, the industry's first adhesive film that repels barnacles. The main characteristics of this film are shown below.

1. Easy Maintenance

When MARINGLIDE™ is applied to the hull of a vessel, a very small amount of oil is released from the surface of the film, which makes it difficult for barnacle larvae to attach themselves to the hull.

Even if the film becomes fouled, it can be easily cleaned by water blasting and remains effective for about three years, after which it can be easily peeled off and replaced. It is easy to work with, does not damage the hulls of vessels and reduces vessel maintenance costs.

MARINGLIDE™'s barnacle-repelling mechanism



A very small amount of oil is released from the surface of the film to prevent biofouling.

2. Reduced Water Resistance

As the surface of MARINGLIDE™ is smooth and does not have the rough finish of paint, frictional resistance is extremely low. This, combined with the fact that barnacles cannot attach themselves to the hull, means that water resistance can be reduced by about 10% or more. It is generally said that if frictional resistance can be reduced by 10%, then this will result in an improvement in fuel efficiency of 7% to 8% and also potentially result in an increase in speed.

There was a great deal of interest regarding MARINGLIDE™ among boat owners at the Japan International Boat Show held in March 2013. The product is expected to go in sale in 2014 after further testing and improvement.



A boat hull showing barnacle growth



MARINGLIDE™ is a transparent adhesive film that can be easily applied to the hull.



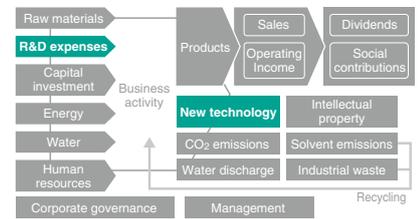
MARINGLIDE™ is almost unnoticeable after application.

Using Molecular Targeting DDS in the Development of Therapeutic Agents for Organ Fibrosis

Initiates Clinical Trials for Liver Cirrhosis Therapy Drug

Nitto Denko has worked with Professor Yoshiro Niitsu at Sapporo Medical University since 2008 on the development of antifibrotic drugs for conditions such as cirrhosis of the liver. Basic patents were acquired regarding this





revolutionary treatment for fibrosis in Japan, the US, China and Australia, and clinical trials are scheduled to start in 2013.

Liver cirrhosis, which is one form of organ fibrosis, is said to be incurable and 6 million people throughout the world are suffering from this intractable disease. This disease is caused by chronic inflammation of the liver whereby excess amounts of collagen, which play a role in repairing areas of inflammation site, are synthesized from hepatic stellate cells and then deposited. Professor Niitsu thought of a way of delivering drugs directly to the hepatic stellate cells in order to prevent the excessive synthesis of collagen, however there were two issues.

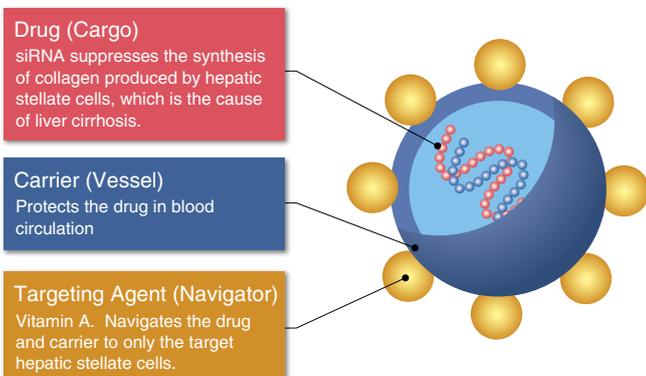
The first was the development of a drug that could suppress the synthesis of collagen. Nucleic acid medicine was used to provide a solution, whereby siRNA was used to suppress a specific RNA function. By suppressing this important factor in the synthesis of collagen it is possible to suppress the synthesis of collagen itself.

The second issue was how to deliver it exclusively to the target hepatic stellate cells without degrading the siRNA. Professor Niitsu saw the potential of vitamin A because hepatic stellate cells will specifically take up vitamin A.

Using this idea coupled with Nitto Denko's patented drug delivery system (DDS), siRNA (cargo) was inserted into a special carrier (vessel) and vitamin A (navigator) applied to the outside to create a revolutionary new therapeutic agent.

Basic patents regarding this new drug were granted firstly in Japan, China and Australia, followed in May 2012 by the US.

An overview of the new drug
<The vessel and navigator deliver the drug.>



The carrier (vessel) delivers the siRNA drug (cargo) exclusively to the hepatic stellate cells by means of the vitamin A targeting agent (navigator).

In March 2013, an Investigational New Drug (IND) application was filed with the US Food and Drug Administration to use this therapeutic agent as a treatment for liver cirrhosis and clinical trials will commence during this fiscal year. Currently there is no drug that will cure liver cirrhosis and if this therapeutic agent can be commercialized it will be the first of its kind in the world.

Nitto Denko is carrying out further research to apply this therapeutic agent not only with regard to liver cirrhosis, but also to other forms of organ fibrosis to help people suffering from this intractable disease.

Nitto Denko Participates in National R&D Project to Develop Flexible OLED Lighting

In fiscal 2012, the Nitto Denko Group participated in the New Energy and Industrial Technology Development Organization's (NEDO) R&D project regarding the development of a reel-type vacuum deposition method for the efficient production of flexible organic light-emitting diode (OLED) lighting. OLED lighting is gaining much attention as the next generation of energy-efficient lighting that will follow the rapidly expanding use of LEDs. It is hoped that the practical application of this process will contribute to the popularization of OLED lighting and the realization of an energy-efficient society, and that the flexible nature of the technology will enable the development of unique lighting products that up until now have not been possible.

R&D Center Established in Switzerland for Materials related to the Environment and Life Sciences

In July 2012, Nitto Denko established Nitto Denko Europe Technical Centre Sàrl (NET) in the Innovation Square of the École Polytechnique Fédérale de Lausanne (EPFL) in western Switzerland. The new facility, which started R&D operations in October of the same year, is part of the company's global corporate R&D setup, together with three other facilities in Japan, the US and Asia (Singapore).

EPFL is one of the top universities in Europe, with a rich pool of talented personnel from throughout the world, and it is hoped that NET will be able to utilize the university's network to develop new research themes – especially in environmental and life science-related fields, and conduct collaborative research and development with the university's researchers in biosciences and chemistry and outside research institution.



NET has mid-term goals (milestones) to help see the transition of R&D themes into product development in the following three to six years. The main R&D themes at present are the development of medical device-related products, such as surgical tape utilizing bio-based materials, which are being jointly developed by teams of researchers specializing in biosciences and chemistry.

As of May 2013 the center had a staff of eight, but this is expected to increase to 20 within the next five years in order to strengthen R&D activities. We are also keen to source interns from EPFL and other research institutions and train them, along with other R&D personnel from within NET and the wider Nitto Denko Group, to branch out into many other new themes.



The exterior of the Nitto Denko Europe Technical Centre Sàrl (NET)

Expansion into the Fitness and Wellness Market

Since R&D activities commenced in 2008, the Nitto Denko Asia Technical Centre (NAT) has been developing new products in the life science sector based on the proprietary optical sensing technologies developed. Recently, they succeeded in developing a unique lifestyle product for the mobile fitness and wellness market.

There has been an increased awareness regarding health evident around the world, and a visible indicator is the major growth of fitness and wellness related markets together with the variant of related products brought to market.

Mobile devices that are able to monitor the state of one's lifestyle at any time in any place are helpful in maintaining day-to-day fitness and wellness and improving overall awareness.

Known as tinké™ mobile lifestyle sensor developed by NAT works by connecting it into the dock connector of iOS device and resting your thumb over the sensing platform to monitor your heart rate, respiratory rate, blood oxygen level and heart rate variability* in real time.

Each measurement can be saved as history where you can

observe the trend or shared with family and friends using social media.

Whereas in the past most mobile health devices were mainly used for monitoring people's physical activities, such as pedometers, tinké™ can monitor information from your body that provides a direct indication of one's fitness and wellness. This information is processed by the proprietary software developed to provide indexes that can be easily understood by the general consumer.

In December 2011, NAT established a business operation entity, Zensorium, to introduce tinké™ into the consumer markets. tinké™ has been displayed at various trade shows and been featured in the media as a unique optical sensing device.

As a member of the Nitto Denko Group, NAT is committed to creating new businesses focused around our "Green, Clean and Fine" theme in order to develop products that can contribute to people's health and make their lives more comfortable.

More information regarding this device can be found at the following website:

<http://www.zensorium.com/tinke>

* Heart Rate Variability

Used as an index to show fluctuations in heart rate, this varies in accordance with changes in autonomic nerve activity. By monitoring heart rate information it is possible to ascertain psychological conditions, such as stress.



tinké™ in action

