

## **1. Project Name**

1.5.1 Development of Evaluation Methods Aiming Standardization, in addition to Development of Measurement Technology of Pore Size on Separation Membrane

## **2. Objectives**

This project aims for the development and research of the standardization of the RO membrane and the NF membrane evaluation methods done by the establishment of the technology able to calculate the RO and NF membranes for the comparative evaluation of the pore and the separation membrane abilities, calculated by the positron annihilation method.

## **3. Contents**

This project is done in collaboration with the National Institute of Advanced Industrial Science and Technology (AIST), as the AIST is in charge of the research and development for the positron annihilation method. WRPC is in charge of gauging the separation abilities of the RO and NF membranes in order to research the correlation between the pores within the membranes and its separation abilities. The below research was done for the evaluation of the separation abilities of both membranes, in order to standardize the evaluation methods.

(1) The correlation between separation abilities and the pore within a separation membrane

Low pressure RO, NF, and seawater desalination purpose RO membranes were selected out of the separation membranes sold in the market as well as membranes donated by manufacturers. The evaluation of the amount of pure water permeation was done using the flat membrane testing device, in addition to the facilitation of the solution permeation ability testing of 20 types of membranes. As a result, the NaCl prevention rate of each low pressure RO and NF membranes were identical to the numbers declared by the manufacturers.

The membrane permeation ability testing was done with 15 types of solution characteristics, as well as the measurement of pure water permeate amount using the flat membrane testing device with 3 types of seawater desalination purpose RO membranes. The NaCl prevention rate was mostly identical to the catalog print. As for the isopropyl alcohol prevention rate, a number somewhat lower than the NaCl prevention rate was observed, similar to the low pressure RO and NF membranes stated above. Salts other than alcohol and the neutral solute substances were observed to change according to the molecular amount

As a result of conducting a measurement of each of the membranes under the standard pressure stated on the catalog, there were membranes which the pure water permeate amount stabilized in 24 hours to ones that took up to three weeks. The numbers also varied to those that stabilized at levels very similar to the measured amounts after 1 hour of operation, and those that decreased to 1/10 of the original. A partial load of the evaluations of the RO and NF membranes were re-outsourced to The Kumamoto Prefectural Industrial Technology Center.

(2) Experimental research for the standardization of the RO and NF membrane ability evaluation methods

As a result of investigating the Japanese Industrial Standards (JIS) section K3805 (The evaluative methods for the reverse osmosis membrane elements and modules), in addition to the American Society for Testing and Materials (ASTM sections D4191-82 and D4194-03), only salts such as the NaCl and MgSO<sub>4</sub>, and isopropyl alcohol was declared as testing solution, as neutral material were excluded. The results for the evaluation with each of the membrane ability showed contrasting results with neutral material and alcohol. From this, it was

made clear that substances other than salts and isopropyl alcohol were needed to be selected as an evaluator, when in consideration of the widening situation with separation membranes in the future.

In addition, the investigation of literature, patents, and manufacturer hearings were done on the topic of the cleansing methods with the polyamide membrane and salt resistant experimentation methods for the selection of future issues to be covered.

#### **4. Results**

#### **5. Reference**

In 2008, the Ministry of Economy, Trade and Industry (METI), and New Energy And Industrial Technology Development Organization (NEDO) from 2009 to 2013