Adhesive for Artificial Kidney Saves Lives of Patients with Chronic Kidney Disease

SANYO PRODUCT TOPICS

The kidneys play an important role in sustaining life, for example, by removing toxins as urine.
Therefore, when kidney function declines, measures to purify the blood in place of the kidneys become necessary.
This section introduces adhesives used in the processing of artificial kidneys, which serve as the filter for such products.

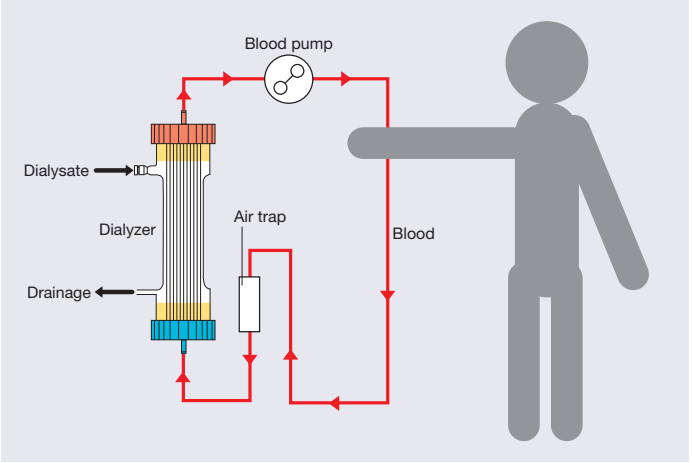
Kidneys perform many functions essential to life

The kidneys play a number of vital roles, such as urinating out toxins, producing blood-related hormones, and producing vitamin D, which promotes calcium absorption.
As kidney function declines, the ability to concentrate urine decreases, resulting in polyuria, frequent urination at night, and other symptoms. As the condition worsens, excess water and toxins accumulate in the body, and the patient is at risk of losing the ability to sustain life. In the early stages of the disease, the patient is treated with medications to maintain the current state of health, but once kidney function deteriorates, it never recovers.
There are several methods of blood purification, but dialysis is currently the most widely used. The number of patients receiving dialysis treatment is increasing every year, and in Japan the number will increase to about 350,000 by the end of 2020 (see the statistical survey by the Japanese Society for Dialysis Therapy). Typical chronic kidney diseases that require such dialysis include diabetic nephropathy and hypertensive kidney disease.

Dialyzer, which acts as a filter of blood

Dialysis is performed while the patient is lying down or sitting in a chair, with an IV-like needle inserted in two places in the arm. Systemic blood is drawn out of the body from one end and filtered in a dialysis machine, and clean blood is returned to the body from the other end. The standard frequency is three times a week, and each session takes about four hours. Since all the blood in the body is purified at a considerable speed, this treatment is very taxing on the body.
The blood filter used in dialysis is a dialyzer (artificial kidney). It consists of a tubular plastic case about four centimeters in diameter and 30 centimeters in length, containing about 10,000 threads called "hollow fibers" that are as thin as a few strands of hair.
The inside of this hollow fiber is straw-like, with microscopic holes on the sides that allow small molecules to pass through but not large ones. When blood flows inside the hollow fiber straw and dialysate flows outside, blood cells, useful proteins, and other large molecules in the blood do not pass through, and only waste products such as urea and uric acid, which are small molecules, and excess water are pumped out through the holes in the sides of the hollow fiber into the dialysate solution. This is how blood is filtered in dialysis.

■Schematic diagram of dialysis



In addition to safety, many other functions are required of adhesives

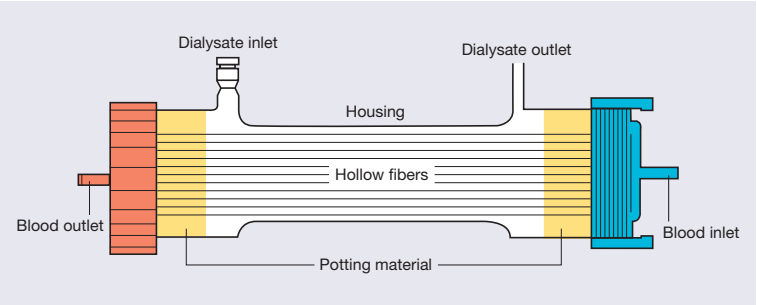
Potting material (adhesive) is used in the dialyzer to bind the hollow fibers and bond them to the case. In the dialyzer manufacturing process, hollow fibers are filled into a tubular plastic case and rotated at high speed. Potting material is then poured into it and centrifugal force is used to pull it to both ends and fix it in place. Finally, unnecessary portions are cut off and a jig is attached to connect it to the dialysis circuit to complete the process.
Potting materials are in contact with blood during dialysis, so a high level of safety is required. In addition, since the hollow fibers are bound together during processing, the material must have the proper viscosity to penetrate the gaps on the outside of the hollow fibers but not the inside where the blood passes

through. In addition, hardenability, which hardens at an optimum rate to increase productivity, is also important. Potting materials for artificial kidneys must meet all of these various requirements.

Proven technology backed by over 30 years of history

Sanyo Chemical developed the "POLYMEDICA" series of potting materials for artificial kidneys, a product with a long history that was launched more than 30 years ago. As the demand for dialyzers has increased, Sanyo Chemical has continued to develop this product in response to customer demand for even shorter curing times for potting materials in order to increase productivity.
The "POLYMEDICA" series is a two-component mixture of polyol and isocyanate urethane adhesives, featuring high safety, low viscosity, and fast curing. Sanyo Chemical's strength is its expertise in freely designing the viscosity and curing speed required for these potting materials. Normally, low viscosity and high speed curing are contradictory, but Sanyo Chemical's polyol design technology has made it possible to achieve both, and to customize the product according to customer requirements, which has greatly contributed to improving the productivity of artificial kidneys.
Another feature of the "POLYMEDICA" series is that it does not use metal catalysts, which are commonly used overseas. Metal-free catalysts that take advantage of Sanyo Chemical's catalyst design technology are used to make the product even safer. In the future, in addition to improved productivity, it is anticipated that further pursuit of safety will be required, such as reducing the amount of eluted substances from potting materials, and development is progressing not only in terms of curing speed, but also in terms of safety.
The POLYMEDICA series is a product that contributes to SDG 3 "Health and Welfare for All" by continuing to provide safe, high-quality products. We will continue to contribute to people's healthy lives by expanding our high-quality products to other countries and regions in Asia as well as Japan.

■Hollow fiber dialyzer (artificial kidney) structure



■The latest "POLYMEDICA" (development product)

Product name		Appearance	Viscosity (mPa·s/ 25°C)	Mixing ratio	Viscosity after mixing*1 (mPa·s)	Time to reach viscosity 50Pa·s*2 (min)	Hardness after curing JIS D instant value*3
Main component	POLYMEDICA MA-6002	Pale yellow transparent liquid	1100	MA/MB 54/46	1000	6.7	53
Curing agent	POLYMEDICA MB-6002	Yellow transparent liquid	750				

*1 Value measured 1 minute after mixing the two liquids at 25°C each for 30 seconds and 1 minute after the start of mixing.
*2 Time required to mix the two liquids at each 25°C for 30 seconds from the start of mixing to reach a viscosity of 50 Pa·s.
*3 Instant value read by pressing a JIS D hardness tester after 48 hours of curing at 50°C

Please contact our sales department when handling our products.
Read the "Safety Data Sheet" (SDS) in advance. It is the responsibility of the user to determine the suitability and safety of the product for their intended use.