THE MOLECULAR DYNAMICS CALCULATION OF CLATHRATE HYDRATE STRUCTURE STABILITY FOR INNOVATIVE ORGAN PRESERVATION METHOD

TADAIHRO KIN
Kyushu University
Fukuoka 812-8581, Japan
kin.tadahiro@jaea.go.jp

KEN-ICHI MAKINO
Research Center of Showa Hospital
Shimonoseki 750-0059, Japan

NOBUO NODA AND KAZUHARU KOIDE
National Center for Geriatrics and Gerontology
36-3, Morioka-Cho, Obu, Aichi 474-8511, Japan

MASAHIRO NAKANO
Information Science
University of Occupational and Environmental Health
Iseigaoka 1-1, Yahata-nishi, Kitakyushu 807-8555, Japan

Received December 2006; revised July 2007

ABSTRACT. It is very important to keep the volume of intracellular throughout organ preservation. We focused on the structure of intracellular water. It is the main unacceptable factor to change volume of cell under low temperature. Because this report is a preliminary study for new organ preservation technology, we considered a simple system that contains only water and hydrogen molecules. We simulated a stability of clathrate hydrate crystal by using a code of molecular dynamics method; MXDTRICL. In this paper, we give a new suggestion to suppress the change of intracellular volume under low temperature.

Keywords: Clathrate hydrate, Organ preservation, Molecular dynamics, MXDORTO, MXDTRICL, Intracellular water

1. Introduction. There are quite a few diseases that can be cured by organ transplant [1]. However, in the case where a recipient needs an organ from brain-dead donors, nobody knows when and where transplantable organ can be obtained. Almost always the distance from transplantable organ to recipient is very far. Therefore, it is inevitable to keep the organ fresh for a long time for transportation. Then, the development of organ preservation technique is very important to save more and more recipients lives.

In these days, there are two ways for organ preservation in clinical practice [2,3]. One is just cooling by ice and keep the temperature around 4 degrees Celsius not to freeze an organ. Another is cooling and perfusion of nutrition into an organ. In the latter method, because some intake of nutrition is provided to an organ, the time of preservation is longer than the former method. However, for example, talking about a case of kidney preservation, although we use the latter method, the organ can be kept in good condition for only one hour. It is very short to cover all recipients of organ transplant.