Probl Cryobiol Cryomed 2023; 33(4):286
https://doi.org/10.15407/cryo33.04.286

Розробка чисельної імітаційної моделі для кріоконсервування еритроцитарного концентрату методом безперервного спливання

Л. Кампхаус[1], Д. Хайят[1,2], Р. Кахлфельд[3], Я. Хагедорн[1], С. Кабелак[3], Б. Гласмахер[1,2]

[1]Інститут багатофазних процесів, Ганноверський університет імені Лейбніца, м. Гарбсен, Німеччина

[2]Нижньосаксонський центр біомедичної інженерії, досліджень і розробки імплантатів, м. Ганновер, Німеччина

[3]Інститут термодинаміки Ганноверського університету ім. Лейбніца, м. Гарбсен, Німеччина

Development of a Numerical Simulation Model for Continuous Floating Cryopreservation of Red Blood Cell Concentrate

L. Kamphaus[1], D. Khayyat[1,2], R. Kahlfeld[3], J. Hagedorn[1], S. Kabelac[3], B. Glasmacher[1,2]

[1]Institute for Multiphase Processes of the Leibniz University Hannover, Garbsen, Germany

[2]Lower Saxony Centre for Biomedical Engineering, Implant Research and Development, Hannover, Germany

[3]Institute of Thermodynamics of the Leibniz University Hannover, Garbsen, Germany

Currently, cryopreservation of red blood cell concentrate is often performed in blood bags, which lead to a harmful cooling rate due to their geometry. The novel float freezing process allows the cryopreservation of blood without the utilization of blood bags during freezing. The method has been developed at the Institute for Multiphase Processes (IMP) of the Leibniz University Hannover and enables a continuous and reproducible process on a carrier liquid with subsequent removal. The float freezer device is cooled with nitrogen vapor from top and via a plate perfused by cooled ethanol from below.

For the investigation of the freezing process within the float freezer, a CFD simulation has been created in this study using ANSYS® Fluent® software R1 2021 for the heat transfer. To determine the cooling rate and phase change, a section of the blood strand is observed in a transient simulation. Convective heat transfer is set as a boundary condition for this model. The first simulation is done under operating conditions of the existing Float Freezer. To achieve higher cooling rates, the flow rate and temperature of the nitrogen were changed and the coolant was replaced by FC-770. The lower pour point allows the setting of lower overall temperatures. Averaged temperature profiles and freezing processes are examined for the model in both operating conditions. From this, the cooling rates and times of complete freezing are derived. Time-dependent temperature and ice distribution in the blood strand are recorded. Subsequently, the simulations for both operating conditions are compared. Mean cooling rates of 3 K/min and 36.3 K/min are determined for the previous and new operating conditions from 2°C to –30°C. The next step is the simulation of the flow processes in the entire float freezer. An optimization of the cooling rate in the blood strand shall be done by a change of the cross-sectional area while keeping the mass flow constant. This is to become wider and shallower.

Probl Cryobiol Cryomed 2023; 33(4):286
https://doi.org/10.15407/cryo33.04.286a

Вплив екологічних чинників на стан мохових банок на Аргентинських островах (Західна Антарктика): міжрічний моніторинг

А. Пуговкін[1,2,3], Г. Євчун[3], М. Бартак[2], Й. Гаєк[2], Ю. Шепета[3], Н. Мірюта[3], І. Парнікоза[3,4]

[1]Інститут проблем кріобіології і кріомедицини НАН України, м. Харків, Україна

[2] Університет Масарика, м. Брно, Чеська Республіка

[3] Державна установа Національний антарктичний науковий центр МОН України, м. Київ, Україна

[4] Інститут молекулярної біології і генетики НАН України, м. Київ, Україна

Impact of Environmental Factors on the Moss Banks' State in Argentine Islands (West Antarctica): Interannual Monitoring

A. Puhovkin[1,2,3], H. Yevchun[3], M. Bartak[2], J. Hajek[2], Y. Shepeta[3], N. Miryuta[3], I. Parnikoza[3,4]

[1]Institute for Problems of Cryobiology and Cryomedicine of the National Academy of Sciences of Ukraine, Kharkiv, Ukraine

[2]Masaryk University, Brno, Czech Republic

[3]State Institution National Antarctic Scientific Center, Ministry of Education and Science of Ukraine, Kyiv, Ukraine

[4]Institute of Molecular Biology and Genetics of the National Academy of Sciences of Ukraine, Kyiv, Ukraine

Understanding the natural cold resistance of living systems, particularly vegetation, in Antarctica is of great importance because of specific environmental conditions and increasing climate change in this region. In order to study the response of moss banks of the Argentine islands to environmental influences we focused on monitoring the state of four developed tall moss turf subformation. Monitoring was based on remote sensing of each moss bank surface for its regular mapping as well as field and lab investigation to study spectral/vitality parameters of mosses.

Remote sensing: drone with the standard and multispectral camera equipped with four monochrome sensors was used for aerial photography. Relative chlorophyll concentration measurement: the optical density of the moss ethanol extracts was measured in the range of 350–750 nm using the Hach Lange DR 3900 spectrophotometer. Spectral reflectance and photosynthetic characteristics of mosses: a PolyPen RP 400 spectral reflectometer was used to measure the reflectance within a wavelength range from 320 to 800 nm, the measurements of fast chlorophyll fluorescence transients (OJIPs) were taken by a FluorPen fluorimeter.

Determination of the relative area occupied by moss of different colour categories and inlay estimated by normalized difference vegetation index (NDVI) analysis (remote sensing) can be used as an indicator of changes in the state of moss groups for their longterm monitoring. We identified classes based on the NDVI spectra that corresponded to a particular state of moss in each colour class and can be considered as a moss health state.

A ground and laboratory investigation to estimate moss vitality parameters confirmed that monitoring reflected the dynamics of the moss bank health state due to the influence of environmental factors especially temperature, snow cover duration, etc. Our data generally indicate a positive impact of environment factors (increasing of the temperature) on the health of the moss during the study period.