Probl Cryobiol Cryomed 2022; 32(4):303
https://doi.org/10.15407/cryo32.04.303

Удосконалення кріоконсервування скаффолдів за допомогою магнітних наночасток

С. Ліл-Марін[1,2], К. Холтьє[1,2], А. Лопера[3,4], К. Гарсіа[3], Б. Гласмахер[1,2], О. Гришков[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] Група кераміки та склоподібного тіла, Інститут фізики, Національний університет Колумбії, м. Меделъін, Колумбія

[4] Група наноструктур і прикладної фізики (NANOUPAR), Національний університет Колумбії, м. Ла-Пас, Колумбія

Improvement of Scaffold Cryopreservation By Use of Magnetic Nanoparticles

S. Leal-Marin[1,2], K. Höltje[1,2], A. Lopera[3,4], C. Garcia[3], B. Glasmacher[1,2], O. Gryshkov[1,2]

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

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

[3] Grupo de Cerámicos y Vítreos, Escuela de Física, Universidad Nacional de Colombia, Medellín, Colombia

[4] Grupo de Nanoestructuras y Física Aplicada (NANOUPAR), Universidad Nacional de Colombia, La Paz, Colombia

Thawing is one of the main challenges during cryopreservation of tissue-engineered constructs, and adequate heat transfer guarantees better preservation of the seeded cells and viability. To improve the heat transfer, magnetic nanoparticles (NPs) have been incorporated into cryoprotective solutions in the called nanowarming approach. This study incorporates magnetic NPs in polymeric scaffolds to improve them for cryopreservation of tissue-engineered constructs with mesenchymal stem cells.

The electrospinning process was employed to obtain polymeric polycaprolactone scaffolds (14% (w/v) solved in TFE) with different concentrations (2.5%, 5% (w/v)) of magnetic NPs (magnetite or cobalt ferrite). The round scaffolds of 16 mm diameter were seeded with human mesenchymal stem cells and cultivated for 14 days before cryopreservation. Prior to slow freezing, samples were loaded with 10% Me_2SO/20% FBS supplemented with sucrose. The morphology of the cells was assessed by scanning electron microscopy, and the metabolic activity was evaluated using a resazurin reduction assay for 7 days after thawing.

The cells seeded on the scaffolds keep their normal morphology with cell-cell and cell-scaffold interactions. Scaffolds without magnetic nanoparticles exhibit higher metabolic activity, followed by magnetite and cobalt ferrite. The proposed scaffold model with magnetic NPs is promissory for improving cryopreservation, and future work should be done under magnetic stimulation.

Probl Cryobiol Cryomed 2022; 32(4):303
https://doi.org/10.15407/cryo32.04.303a

Врожайність буряка столового (*Beta vulgaris* var, *conditiva*) після передпосівної обробки насіння озонуванням та заморожуванням

Т. Мірошніченко[1], Н. Баштан[1], Г. Мозговська[1], Т. Івченко[1], О. Куц[1], Г. Коваленко[2], Н. Шевченко[2]

[1] Інститут овочівництва і баштанництва НААН України, с. Селекційне, Харківська область, Україна

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

Yield of Table Beets (*Beta vulgaris* var*, conditiva*) After Pre-Sowing Treatment of Seeds by Ozonation and Freezing

T. Miroshnichenko[1], N. Bashtan[1], H. Mozgovska[1], T. Ivchenko[1], O. Kuts[1], G. Kovalenko[2], N. Shevchenko[2]

[1] Institute of Vegetable and Melon of the National Academy of Agrarian Sciences of Ukraine, Selektsiyne village, Kharkiv region, Ukraine

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

Various methods of pre-sowing seed treatment have been developed to improve the seeds germination, plants growth and their resistance to stressors. Various minerals, organic compounds, hormones and antioxidants are used to stimulate physiological, biochemical, physical agents and molecular mechanisms involved in the early stages of germination. Physical factors include magnetic field, ultraviolet and gamma radiation, X-rays, ozonation, microwave and heat treatment (low or high temperatures).

The aim of this study was to establish the effect of pre-sowing treatment of beet seeds with ozone-air mixture, freezing to the liquid nitrogen temperature and the combined effect of these factors on the yield.

The research was conducted in 2021. Beet seeds of the "Diy" variety of 2018 reproduction were frozen to the liquid nitrogen temperature (for 24 hours); treated with the ozone-air mixture (1 mg / l ozone) for 20 min and ozonation followed by freezing. Untreated seeds served as controls. The seeds were sown in open ground 4 days after treatment. We determined the leaves number, the haulm length, the leaves width, the petioles diameter; length, diameter, weight and biochemical analysis of the obtained root crops.

It has been shown that ozonation, freezing to the liquid nitrogen temperature and the combined action of these factors do not significantly change the number of leaves, stem length, leaf width, petiole diameter, root length and diameter. The weight of root crops obtained from the frozen seeds was significantly higher compared to the control. Biochemical analysis showed a decrease in the content of total sugars, vitamin C, dry matter and betanin in root crops obtained from the treated seeds. An increase in nitrate levels was observed in roots obtained from frozen and ozonated-frozen seeds.

In order to determine whether the method of pre-sowing treatment affects the yield of plants, studies should be carried out over several years in different weather conditions. We could not determine the positive effect of the studied seed treatment techniques on the yield, since 2021 under the experiment conditions (eastern part of the Left Bank of the Forest-Steppe of Ukraine) was favorable for growing table beets.