



# Anticancer natural killer cell therapeutic agent

Technology /Method for mass production of natural killer cell and use thereof in anticancer agent



한국생명공학연구원  
Korea Research Institute of Bioscience and Biotechnology

**Patent title** Method for mass-production of natural killer cells, and use of natural killer cells obtained by method as anticancer agent

**Inventor** Korea Research Institute of Bioscience and Biotechnology /Choi In-pyo

**Patent application No.** KR 10-2016-7036895 (2016.01.15)

**Authority status** Registered

## Technicality

### Technology overview

- It is possible to obtain fresh NK cells with high purity in a shorter period of time than before, and it is possible to produce refrigerated NK cells and cryopreserved NK cells having the same efficacy as fresh NK cells.
- Furthermore, NK cells having the same efficacy as fresh NK cells can be produced from cryopreserved CD3-negative cells. The cells can be utilized excellently for various cancers and leukemias, and various anticancer treatment agents can be produced.

### Development background and problem to be solved

- NK cells have high potential as cancer therapeutics. However, the number of NK cells present in a body is small, and the cells exist in an inactive state. Thus, in order to use the cells for therapeutic purposes, a large amount of NK cells are required to maintain the activated and sufficient efficacy.
- NK cells are not properly mass-proliferated and cultured in vitro, and thus it is necessary to develop a technology for amplifying and culturing NK cells to a practically useful level.

### Excellence and discrimination of technology

#### Excellence of technology

- Self-proliferation is not performed after human injection.
- The technology automatically destroys cancer cells after an attack, and thus there is little concern about side effects compared to existing cell therapy drugs.
- Economic feasibility is secured by enabling mass-production in a shorter period of time than before.
- Allogenic stem cells are utilized.

#### Discrimination of technology

- The world's highest level of NK cell therapy drugs are mass-produced.
- The world's highest level of clinical trials are successfully performed.
- The approval of phase 1 commercial clinical trial and Ministry of Food and Drug Safety clinical trial plans has been completed.
- The technology is applicable to refractory solid cancer.



# Anticancer natural killer cell therapeutic agent

Technology / Method for mass production of natural killer cell and use thereof in anticancer agent

## Implementation method

- Only CD3-positive T cells are removed from monocytes to obtain CD3-negative cells. CD3-negative cells are mixed with IL-15 and IL-21 and then cultured to be differentiated into NK cells. NK cells are frozen in a freezing storage medium including 10% dimethyl sulfoxide (DMSO) under serum-free, protein-free, and animal-free urea conditions, and are cryopreserved for a period of less than two months (freezing is performed by lowering the temperature stepwise from -70°C to -200°C).
- By allowing CD3-positive T cells and red blood cells to cross-link with each other and then separating CD3-negative cells by using a density gradient during centrifugation, no cytokine other than IL-15 and IL-21 is included.

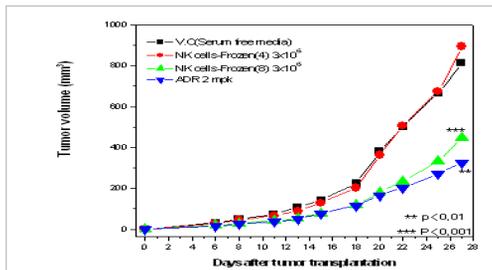


Figure 1 Verification of anticancer effects of NK cells using this technology

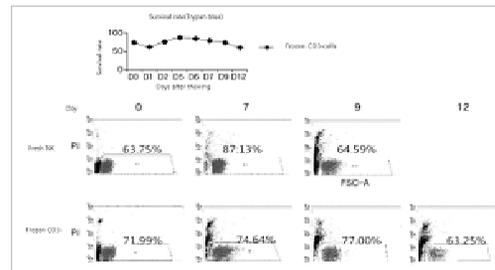


Figure 2 NK cell viability obtained from frozen CD3-negative cells

## Degree of technology completion (TRL)

Degree of technology completion: TRL4 (Lab Scale prototype development stage)

TRL1	TRL2	TRL3	TRL4	TRL5	TRL6	TRL7	TRL8	TRL9
Technical principle presentation	Technology concept setting	Technology concept verification	Lab Scale prototype development	Implementation environment application experiment	Full Scale prototype development	Quasi-commercial product development	Commercial product development	Commercial product implementation

## Utilization

### Utilization field and applied product

#### Utilization field

- Cell medicine
- Cell culture technology
- Toxicology
- Measurement and diagnosis technology



Picture 1 Biotechnology

<Data: BBC>

#### Applied product

- Anti-cancer treatment agent
- Virus treatment agent



Picture 2 Various cancer treatment agents

<Data: Medipharms today >



# Anticancer natural killer cell therapeutic agent

Technology / Method for mass production of natural killer cell and use thereof in anticancer agent

## Technology trend

- Natural killer cells (NK cells) are used in various blood cell transplantations such as a method of treating diseases by increasing NK cell activities or inducing an NK cell-mediated immune response, and a direct administration method of NK cells in a hematopoietic stem cell transplantation such as a bone marrow transplantation for blood cancer.
- In addition, the effect of NK cell treatment, which was almost limited to blood cancer, is being expanded to various carcinomas.
- NK cells are poorly cultured cells, and in the past, culturing methods using simple cytokine treatment or K562 itself were mainly used. However, recently, a CAR NK mass cell culture method using genetically modified support cells has been developed. Thus, production costs have been greatly reduced, and it is a trend to develop an off-the-shelf concept treatment agent which can be provided at any time if a patient wants.

## Family patent status

Application nation	Application No. (Application date) / Registration No.	Title of the invention
KOR	KR 10-2016-7036895 (2016.01.15)/ 10-1957384	Method for mass-production of natural killer cells, and use of natural killer cells obtained by method as anticancer agent
US, JP, EU, PCT	US 16-811063 (2020.03.06)/ - one more JP 2019-178623 (2019.09.30)/ - one more EP 2016-743625 (2016.01.15)/ - KR 2015-000854 (2015.01.27)/ - one more	METHOD FOR MASS PRODUCING NATURAL KILLER CELL AND USE OF NATURAL KILLER CELL OBTAINED BY THE METHOD AS ANTI-CANCER AGENT

## Market prospect

### Target market size and prospect

- The global immuno-oncology market size is expected to reach USD 103.4 billion in 2024, growing at a CAGR of 17.4% from USD 33.7 billion in 2017. The global NK cell therapy agent market is expected to grow at a CAGR of 17.4% from USD 1.4 billion in 2018 to about 5.1 billion in 2026.



**Table Global immuno-oncology market forecast** <Data: GBI Research / Nice D&B reconfigured> **Table Global NK cell therapy agent market forecast** <Data: Allied Market Research / Nice D&B reconfigured>

## Technology transfer query

두호특허법인 / (주)두호기술경영  
DooHo IP Law Firm / DooHo Tech. & Mgt. Inc.

**Person in charge** KyuhyeongLIM

**Contact** 070-4333-8021

**Email** khlim@doohopat.co.kr

## Technology transfer process

