UNIVERSITY OF GDANSK

TECHNOLOGY TRANSFER OFFICE

TECHNOLOGICAL OFFER
No. 011/1/2018

PROTEIN PVII WITH BACTERIOPHAG M13 AND ITS APPLICATION IN BINDING OF NANOMATERIALS

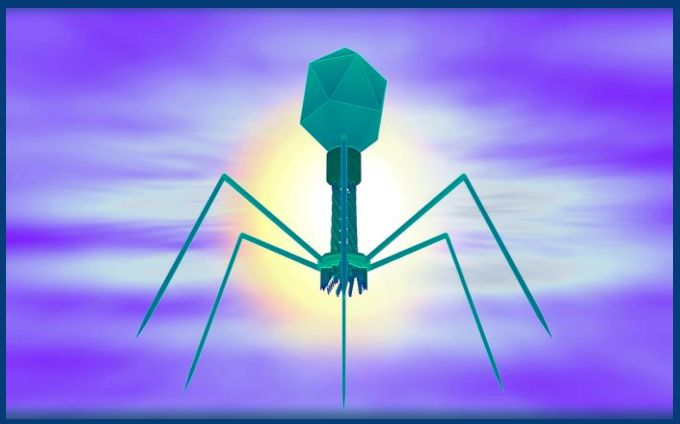
Market

The nanotechnology market in accordance with "Accuray Research LLP Global Nanotechnology Market - Analysis, Technologies and Forecasts Report 2016-2025) makes a market with significant dynamic of growth, and includes in its area two main sectors - chemical (52%) and electronic (40%) (including semiconductor). Remaining sectors of the market are: military, air, medical, automotive and food industries. The target market for the invention is the nanocomposite market, which comprises 5% of the nanotechnology market. In years 2018-2023, the nanotechnology market value is expected to increase more than double from USD 53765 million in 2018 to USD 123523 million in 2023, while the nanocomposite market is expected to grow almost three times in revenue from USD 2482 million in 2018 to USD 7299 million in 2023.

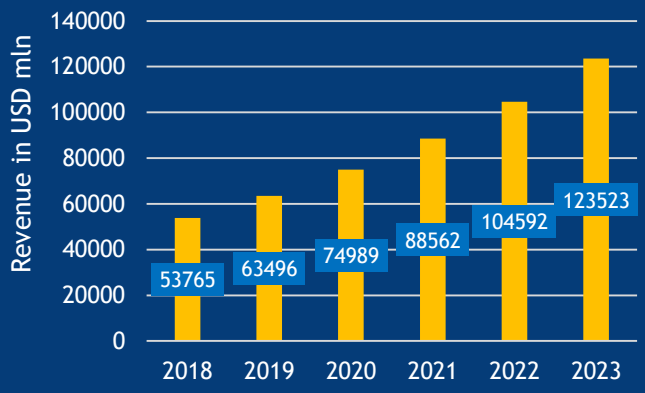
Technology

The proposed technology is pVII protein with M13 filamentous bacteriophage mutation being a part of filamentous phage with a diameter of about 6.5 nm and a modifiable length of about 880 nm, depending on the length of the single-stranded DNA packed in the capsule. The M13 phage capsid consists of approximately 2700 copies of helically organized major coat protein pVIII and 5-7 copies of smaller coat proteins pIII, pVI, pIX and pVII located at the opposite ends of the phage, wherein natural protein motifs / amino acid sequences are exhibited on the capsid surface, and they are able to bind specifically a given material, or they are inducted into the appropriate protein as a result of genetic engineering activities at the DNA level. The invention also relates to the use of pVII protein in carbon nanomaterials (carbon nanofibers).

Opportunity Analysis and Forecasts to 2023

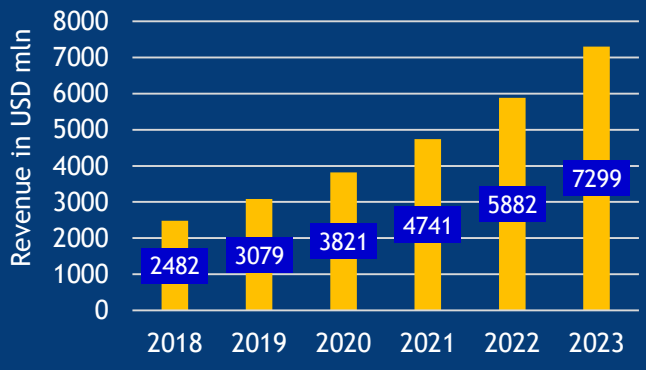


Nanotechnology market
size and forecast for years 2018-2023



source: Accuray Research LLPGlobal Nanotechnology Market - Analysis, Technologies and Forecasts Report 2016-2025, 2016

Nanocomposits market
size and forecast for years 2018-2023



source: Accuray Research LLPGlobal Nanotechnology Market - Analysis, Technologies and Forecasts Report 2016-2025, 2016; Elena Inshakova and Oleg Inshakov - World market for nanomaterials: structure and trends, 2018

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Technology highlights

1. Bacteriophages are used in hybrid materials (bionanomaterials) production and may be applied in biology, medicine, optics and electronics.
2. Carbon nanofibers find a wide range of applications in many industrial sectors, with the largest share in chemical (52%) and electronic (40%), including semiconductors industries.
3. The use of carbon nanofibers in industry is economically efficient due to the low costs and simplicity of production.
4. The improvement of the electrical properties of carbon nanofibers gives the possibility of extending the areas of their use in various branches of industry.

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Commercialization opportunities

- Licensing relationship
- Partnership for further studies and commercialisation
- Transfer of ownership

IP Status

The invention was submitted for patenting according to Polish P.415779 procedures.

Implementation progress

TRL 4
Technology validated in laboratory conditions

Summary

The subject of the invention is a modified protein, named PVII, with a filamentous bacteriophage M13 point mutation and its application for specific binding of carbon nanomaterials, and in particular carbon nanofibres (abb. CNF). Carbon nanofibers with diameter between 10-500 nm, possess a number of unique qualities, such as excellent electrical conductivity, high porosity and well-developed active surface. Due to aforementioned features, carbon nanofibres are widely applied in electrochemical industry as a material for electrodes modification. Electrodes modified by nanofibers may be applied in the manufacturing processes of supercapacitors, fuel cells, lithium-ion batteries and electrochemical sensors. They may be also used as substrates for immobilizing biomolecules, e.g. DNA. Carbon nanofibers themselves can be applied as a hydrogen storage material or as biomaterial for the creation of specialized medical devices such as implants. In case of industrial applications, the improvement of the electrical properties of nanofibres by developing their active surface is being indicated. For achievement of the above mentioned goal, viruses, particularly bacteriophages are increasingly being used. The developed pVII protein with the M13 filamentous bacteriophage point mutation may be used for specific binding of carbon nanomaterials enabling creation of the hybrid materials (bionanomaterials) with more developed surface, and with increased efficiency comparing to the existing industrial solutions based on bacteriophages. The use of carbon nanofibers in industry is economically efficient due to low costs and simplicity of production, and improving the electrical qualities of carbon nanofibers gives the opportunity to expand their use in various industries.

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