KTSoftSkills - Soft Skills for Knowledge Transfer - Project n. 2022-1-IT02-KA220-HED-000089663

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CONFIDENTIAL

Invention Disclosure Form

1. Title of Invention

Improved chromatographic method for purification of viruses

2. Inventors (namely the researchers whose intellectual contribution to the design or discovery can be described as inventive, being different from team members whose contributions applied skills but not inventive input. If more than 3 inventors please append additional sheets)[1]

Name (Contact person):	Professor Friederike Loeffler		
Employer:	LIV (Leibniz)		
Research Group:			
Division:		Work address*:	
Work Phone:			
Mobile Phone:			
Work Fax:			
Work E-mail:			
% inventive contribution:	45%		

Name:	Professor Paulina Frosch		
Employer:	IoV (Berlin)		
Research Group:			
Division:		Work address*:	
Work Phone:			
Mobile Phone:			
Work Fax:			
Work E-mail:			
% inventive contribution:	45%		

3. Other Contributors

These are people with whom you may like to share any acknowledgement or returns in the event of successful valorisation of the invention. They are people whose work contributed to the success of the research but who were not responsible for the inventive spark or design of the research. They can include PhD students, technicians, postdocs or other colleagues whom you believe made a material, non-inventive contribution.

Name (Contact person):	Martina Beijerinck		
Employer:	NIAID USA		
Research Group:			
Division:		Work address*:	
Work Phone:			
Mobile Phone:			
Work Fax:			
Work E-mail:			
% contribution:	10%		

4. Description of invention

Please try to answer the following questions.

4.1. What problem does the invention solve?

The invention is a new method for purification of viruses. This is important as the purification of viruses can be a significant bottleneck in large-scale viral vector production for gene therapy and vaccine development. This is because traditional methods used for protein purification are not always suitable for viruses due to their larger size and different properties, requiring specialized techniques.

4.2. Do you know of any similar inventions that exist and if so, how does your invention differ?

Methods for purifying viruses are known in the prior art, see for example U.S. Pat. No. 4,664,912 which discloses in particular a method for purifying rabies virus by zone centrifugation in a sucrose gradient. However, such a method has the drawback of being difficult to automate; in addition, a prior inactivation step is necessary, which may lead to interactions between the virus and the cellular DNA which then make the step for removal of this DNA more difficult.
The disclosed invention is a novel method for purifying viruses in very high yield which is easy to automate.

4.3. Abstract or summary of the invention. Please explain the invention in general terms (max. = 100 words)

A method for purifying viruses from a cell line culture by chromatography, comprising an anion exchange chromatography step followed by a cation exchange chromatography step and optionally a metal-binding affinity chromatography step. The method is particularly suitable for producing viruses for use in vaccines.

4.4. Keywords (for an overview, see the Annex) maximum of five

Virus; Purification; Chromatographic

4.5. Technology Information. Technical description including background, what is new with respect to the state of art, what is the stage of development and further needed improvements (max. = 150 words)

The invention relates to the field of purification of viruses, and in particular the purification of viruses obtained by culturing on cell lines.
Harvests of viruses obtained from culturing on cell lines such as Vero cells contain not only the desired viruses but also proteins and DNA originating from the culture cells. However, when the viruses are intended for certain uses, such as the manufacture of vaccines, it is essential for them to be as pure as possible. This is because standards exist which limit, to 100·10-12 g/vaccinal dose, the maximum authorized amount of cellular DNA in vaccines comprising products obtained from continuous and heteroploid cell lines.

The new method consists of in separating by ion-exchange chromatography the viruses from the cell proteins and DNA originating from the culture, characterized in that it comprises at least one step of anion-exchange chromatography and one step of cation-exchange chromatography.
The major difference compared to existing methods is the inversion of the order of cation-exchange chromatography and anion-exchange chromatography.

The invention is currently at TRL3 (PoC) having been demonstrated in the lab.
It is now important to carry our further R&D to optimise the purification yields by reducing the amounts of residual DNA to a minimum and optimising the pH of the chromatography steps.

4.6. Additional Information, please attach all available information, for example a summary of the invention being disclosed (Include photographs, drawings, sketches, or any other descriptive material)

4.7. What products and/or processes do you think could be protected by a patent?

We believe that the process may be patentable.

4.8. What are disadvantages to the invention or limitations that needs to be overcome?

The process itself does not appear to have any inherently disadvantages, but it will require a technology adopter to make significant changes to their existing processes e.g. their production lines. This may require significant investment in new equipment that is not currently commercially available because it is not the present established approach.

5. Information on the intellectual property

MATERIALS	Yes	No	Don't Know
• Have you supplied any material relating to the invention to anyone outside your research group? Please include names of researchers or others outside of your institution.		X	
• If yes, was the material transferred under a Material Transfer Agreement (MTA)? If appropriate, please supply a copy of the MTA or a contact person.			
• Did you use any materials supplied by other researchers or companies to make your invention? • If yes, were the materials supplied under an MTA? If appropriate, please supply a copy of the MTA or a contact person. We have made use of continuous and heteroploid cell lines. These were supplied under an MTA from the NIH USA.	X		

When did the idea for the invention first arise? Please indicate who was/were the employer(s)[2] at the time of the invention

Date: January 2023
The idea came from a discussion between Professor Friederike Loeffler LIV (Leibniz) and Professor Paulina Frosch IoV (Berlin) when the latter was attending a symposium at LIV.

Place: LIV (Leibniz)
Employer(s): LIV and IoV.

[2] Please indicate if the employer is different from the employer as indicated on page 1.

6. Funding sources

Please list all sources of funding that have contributed to the invention

Time Period	**Source** First money stream (University), Second money stream (national funding agencies), Companies, Other sources including EU (please specify)	**What was the relation to the inventive step** (idea, people, materials, etc.)
06.2023-12.2023	IoV investigator grant	Initial test of the invention effect (Loeffler and Frosch)
03.2024-03.2025	LIV Collaborative research grant	Systematic investigation of effect of parameters on yield (Loeffler and Frosch with discussions involving Beijerinck).

7. Public disclosures and confidentiality

	Yes	**No**
• Has the invention or any part of it been disclosed in a publication, an abstract or any other written materials? If yes, please attach a copy and write the date of the disclosure on the material. • Will the invention or any part of it be disclosed in a publication, an abstract or any other written materials? If yes, what is the intended date of disclosure?(please be aware that any disclosure may jeopardize the ability to obtain a patent; we advise you to contact the KTO as soon as possible) The idea for the invention was partially disclosed in the research proposal for funding for the IoV investigator grant (2023) and LIV Collaborative research grant (2024). See above. The abstracts for both projects have been subsequently published. Intended disclosure date:		X
• Is there a draft manuscript detailing the invention? If yes, please attach a copy.	X	
• Has this draft manuscript been submitted to a journal or publisher? Please provide details of the publishers, dates of submission and whether or not the publication has been accepted. Journal name: **Viruses** Submission date: 6 weeks ago Outcome/Status: Pending.		
• Has there been a (poster) presentation or lecture during a public meeting? There was a discussion about the idea at the symposium at LIV in 2023 but this was not considered to be a public event. • Will there be a (poster) presentation or lecture during a public meeting? Not planned Intended disclosure date:	X	

• Has a third person (outside the institution) been approached about the invention? If yes, who was this person and was the information shared in confidence? Professor Beijerinck (NIAID USA) was approached for discussion and collaboration and she has subsequently discussed the idea with her Patenting unit.	X	

8. Commercial interest

	Yes	No
• Are you aware of any companies or other users that might be interested in this invention? Do you know of companies or other research groups that could possibly have developed inventions in the same area? If yes, please list names. Pasteur Merieux Serum et Vaccines SA hold patent rights in this field. Key players in this market include established pharmaceutical companies, specialized viral vector manufacturers, and contract development and manufacturing organizations (CDMOs). We have not yet approached them but the following may be interested: Merk, Lonza, Thermo Fisher Sceintific, Catalent and Oxford Biomedica.		
• Is the invention related to previous sponsored research projects within your department? If yes, please provide details. • Do you know of any other past or ongoing collaborations and/or agreements with third parties that may be relevant to this invention? If yes, please provide details.		X

9. Signature of inventors

_____	_____	_____
Print Name	**Signature**	**Date**
_____	_____	_____
Print Name	**Signature**	**Date**