minutes. However, typical binding capacities at 10% breakthrough of target for monoliths and membranes under dynamic flow are lower than porous beads. The inferior binding capacity of monolith and membrane materials (compared to porous bead-based materials) can be offset to some extent by utilising higher flowrates. In (membrane) adsorption chromatography, in contrast to gel-permeation chromatography, there is binding of components of a fluid, for example individual molecules, associates or particles, to the surface of a solid in contact with the fluid without the need for transport in pores by diffusion and the active surface of the solid phase is accessible for molecules by convective transport. The advantage of membrane adsorbers over packed chromatography columns is their suitability for being run with much higher flow rates.

This is also called convection-based chromatography. A convection-based chromatography matrix includes any matrix in which application of a hydraulic pressure difference between the inflow and outflow of the matrix forces perfusion of the matrix, achieving substantially convective transport of the substance(s) into the matrix or out of the matrix, which is effected very rapidly at a high flow rate.

Convection-based chromatography and membrane adsorbers are described in for example US20140296464A1, US20160288089A1, US2019308169A1 and US2019234914A1, hereby incorporated by reference in their entireties.

There exists a need for chromatography materials that can separate mRNA from an *in vitro* transcribed (IVT) reaction to enable a therapeutic product to be recovered at industrial scale. The chromatography materials should also share the high binding capacity that porous bead-based materials have desired molecules and the higher flowrates that are achievable with monolith/membrane materials. The chromatography materials must also be sufficiently porous so the binding area is accessible to the large mRNA and so that suitably high flowrates may be achieved.

Summary

The inventors have found that convection-based chromatography material can be functionalized with oligo d(T) ligands and used to separate polyA-tagged products, such as mRNA, from undesired material. They have found that such materials have high capacities for mRNA at residence times down to 10 seconds. The materials used in the disclosure provide an optimal pore size distribution giving a high binding capacity for the polyA-tagged product. The porosity is large enough that diffusion is not relevant to obtain maximum binding capacity. It is the interaction between oligo dT and the poly A-tagged product that is decisive for residence time.

In one example, the disclosure relates to processes for synthetic mRNA purification from an *in vitro* transcribed (IVT) reaction. The process involves contacting the sample with a functionalized chromatography material according to the invention.

In an aspect, there is provided a process for recovering a poly A-tagged product from a composition comprising said product, which process comprises contacting the composition with a chromatography material comprising convection-based chromatography material functionalised with oligo(dT)-ligands, wherein the oligo(dT)-ligand is a (d)T_{10-50} ligand, preferably a (d)T_{12-30} ligand.

In another aspect, there is provided a chromatography material comprising a convection-based chromatography material functionalized with oligo d(T)-ligands, wherein the material comprises polymer nanofibers and is in the form of one or more membrane(s) or sheet(s), wherein the oligo(dT)-ligand is a (d)T_{10-50} ligand, preferably a (d)T_{12-30} ligand

In an example, the disclosure relates to a process for recovering a poly A-tagged product from a composition comprising said product, which process comprises contacting the composition with a chromatography material comprising convection-based chromatography material functionalised with oligo(dT)-ligands.

The oligo(dT)-ligand is preferably a (d)T_{10-50} ligand, more preferably a (d)T_{12-30} ligand.

According to the disclosure the oligo(dT)-ligand density on the chromatography material is 10-20 μmole/g. Preferably the oligo(dT)-ligand is coupled to the chromatography material via a C3-C12 linker, such as a C6 or C12 linker.

The chromatography material may comprise one or more non-woven polymer nanofibers, preferably cellulose nanofibers. Alternatively, the chromatography material comprises 3D printed material. Further examples may be found in the detailed section of the disclosure below.

Preferably the chromatography material is in the form of one or more membrane(s) or sheet(s) and the composition is passed through a holder comprising one or more said membranes or sheets and optionally one or more frits or other spacer materials.

Optionally a heat able metal structure is placed between the membranes or sheets which facilitates the elution of the poly A-tagged product when the device is heated.

According to the disclosure the composition is contacted with the functionalised chromatography medium for a period of 10-15 seconds.

A process for using the device comprises the steps of:
(i) contacting the composition with the functionalised chromatography medium;
(ii) optionally washing the functionalised chromatography medium with a liquid phase of low ionic concentration; and
(iii) selectively eluting the poly A-tagged product and the product-related impurities by contacting the functionalised chromatography medium with a liquid phase of low/very low ionic strength.

In one example the process comprises the steps of:
(i) contacting a solution comprising the composition with the functionalised chromatography material; and
(ii) collecting the solution that has contacted the functionalised chromatography material in step (i), which solution comprises the poly A-tagged product.

The process may be repeated at least 10 times without cleaning in place (CIP).

In an example, the disclosure relates to a chromatography material comprising a convection-based chromatography material functionalized with oligo d(T)-ligands.

The chromatography material comprises for example polymer nanofibers or a 3D