Summary

The present disclosure provides~~According to a first aspect, there is provided~~ a porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material.

In a first aspect, there is provided a porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.

The pores may be formed along the length of the fiber. Advantageously, the pores may allow the encapsulated biological material to be exposed to an external environment. The pores of the fiber may be dimensioned such that they do not allow the escape of the biological material from the fiber and at the same time, increase the contact between the biological material and the external environment.

In a conventional (non-porous) fiber, only the exposed ends of the fiber allow interaction of the encapsulated biological material with the external environment. However, in the disclosed porous fiber, the encapsulated biological material may interact with the external environment not only though the exposed ends, but also along the length of the fiber via the pores. Accordingly, the disclosed porous fiber increases the contact surface area between the encapsulated biological material and the environment. This increased contact area may aid in decreasing the reaction time when the encapsulated biological material acts on a target substrate in the external environment.

The present disclosure provides~~According to a second aspect, there is provided~~ a method of forming a porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material, comprising the steps of:

providing a core solution of the biological material;

providing a mixture comprising a fiber material and a pore-forming material as the shell solution, wherein the

fiber material and the pore forming material are miscible with each other;

forming a core-shell fiber from said core solution and shell solution, said fiber encapsulating and retaining said biological material in the core; and

removing said pore-forming material from said formed core-shell fiber to create pores therein.

In a second aspect, there is provided a method of forming a porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material, comprising the steps of:

a. providing a core solution of the biological material;

b. providing a mixture comprising a fiber material comprised of the non-biodegradable polymer and a pore-forming material as the shell solution, wherein the fiber material and the pore forming material are miscible with each other;

c. forming a core-shell fiber from said core solution and shell solution, said fiber encapsulating and retaining said biological material in the core; and

d. removing said pore-forming material from said formed core-shell fiber to create pores therein.

The present disclosure provides ~~According to a third aspect, there is provided~~ use of a porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material, in the removal of contaminants from an environmental sample.

In a third aspect, there is provided the use of a porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein, for the removal of contaminants from an environmental sample.

The present disclosure provides~~According to a fourth aspect, there is provided~~ use of a porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material, as a biosensor.

In a fourth aspect, there is provided the use of a porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein, as a biosensor.

The present disclosure provides~~According to a fifth aspect, there is provided~~ a filtration membrane comprising a plurality of porous fibers, each porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material.

In a fifth aspect, there is provided a filtration membrane comprising a plurality of porous fibers, each porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.

The present disclosure provides~~According to a sixth aspect, there is provided~~ a bioreactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material.

In a sixth aspect, there is provided a bioreactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.

The present disclosure provides~~According to a seventh aspect, there is provided~~ a membrane contactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, wherein the pores on the fiber are

configured to encapsulate and thereby retain a biological material.

In a seventh aspect, there is provided a membrane contactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.

Definitions

The following words and terms used herein shall have the meaning indicated:

The term 'biological material' is to be interpreted broadly to include any substance derived or obtained from a living organism. Examples of such biological material include, but are not limited to, bacteria, viruses, enzymes, algae, cells, yeast, proteins and nucleic acids.

The term "nano-sized", when referring to a nanofiber, is to be interpreted broadly to relate to an average diameter of the nanofiber as being less than about 1000nm, less than about 500 nm, or less than about 100 nm. After encapsulating a biological material therein, the diameter of the nanofiber may be more than about 200 nm. When the term "nano-sized" is used in relation to a particle size, this term relates to an average particle size of the particle of being less than about 1,000 nm. The particle size may refer to the diameter of the particles where they are substantially spherical. The particles may be non-spherical and the particle size range may refer to the equivalent diameter of the particles relative to spherical particles.

The term "micro-sized", when referring to a microfiber, is to be interpreted broadly to relate to an average diameter of the microofiber as being more than about 1 μm, until about 10 μm. When the term "micro-sized" is used in relation to a particle size, this term relates to an average particle size of the particle of being between about 1 μm to about 10 μm. The particle size may refer to the diameter of the particles where they are substantially spherical. The particles may be non-

configured to encapsulate and thereby retain a biological material therein.

29. A bioreactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.

3033. A membrane contactor comprising a membrane module, wherein said membrane module comprises a plurality of porous fibers, each porous fiber having a core-shell configuration, said fiber comprised of a non-biodegradable polymer, wherein the pores on the fiber are configured to encapsulate and thereby retain a biological material therein.