

HYDROGEL SCAFFOLDS AND USES THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of priority of Singapore patent application No. 10202104006R, filed 20 April 2021, the contents of it being hereby incorporated by reference in its entirety for all purposes.

FIELD OF THE INVENTION

[0002] The present invention generally relates to the field of biotechnology. In particular, the present invention relates to hydrogel scaffolds and uses thereof.

BACKGROUND OF THE INVENTION

[0003] Scaffolds are used to support cell growth or cell differentiation, or a combination thereof. Presently, it is common to upscale the production of cells using scaffolds for different applications, including the production of artificial foods to achieve sustainable and healthier food sources. Presently, most scaffolds include artificial components such as synthetic polymers, which have low biocompatibility for cell encapsulation and growth, and have therefore limited use in different applications, for example, cell-based research, food production, medical or cosmetic applications. Also, the scaffolds break easily during production, resulting in low production efficiency of the scaffolds.

[0004] In addition, present scaffolds require the use of expensive and complex cell medium that consists of chemical and biological components such as growth factors or differentiation-inducing factors to grow cells. These cell culture methods are very expensive, resulting in low returns of investment for any cell-based application.

[0005] In view of the above problems, there is a need to provide alternative scaffolds, in particular hydrogel scaffolds, that do not break easily during production and can support cell growth and/or differentiation. There is also a need to provide an alternative method of fabricating the scaffolds.

SUMMARY OF THE INVENTION

[0006] In one aspect, there is provided a hydrogel scaffold comprising:

- about 3.0-10.0 w/v% gelatin methacryloyl (GelMA);

- about 0.5-2.0 w/v% alginate;
- about 0.5-2.0 w/v% pectin; and
- one or more cell types.

[0006a] In one aspect, there is provided a hydrogel scaffold comprising:

- 5 - 3.0-10.0 w/v% gelatin methacryloyl (GelMA);
- 0.5-2.0 w/v% alginate;
- 0.5-2.0 w/v% pectin; and
- one or more cell types.

[0007] In another aspect, there is provided a method of myogenic differentiation comprising
10 culturing one or more cell types in the hydrogel scaffold as disclosed herein in cell culture
media, wherein the cell culture media comprises a basal medium and a serum.

[0008] In another aspect, there is provided a method of fabricating a hydrogel scaffold, the
method comprising:

- 15 a) preparing a solution comprising alginate and pectin;
- b) treating the solution from step a) to a temperature of about 4-120°C;
- c) adding gelatin methacryloyl (GelMA) to the heat-treated solution from step b);
- d) adding one or more cell types to solution from step c);
- e) setting an injection rate of about 0.1-2.0 ml/min;
- f) wet-spinning a hydrogel scaffold.

20 [0008a] In another aspect, there is provided a method of fabricating a hydrogel scaffold, the
method comprising:

- g) preparing a solution comprising alginate and pectin;
- h) treating the solution from step a) to a temperature of 4-120°C;
- i) adding gelatin methacryloyl (GelMA) to the heat-treated solution from step b);
- 25 j) adding one or more cell types to solution from step c);
- k) setting an injection rate of 0.1-2.0 ml/min;
- l) wet-spinning a hydrogel scaffold.

BRIEF DESCRIPTION OF THE DRAWINGS

30 [0009] The invention will be better understood with reference to the detailed description
when considered in conjunction with the non-limiting examples and the accompanying
drawings, in which:

[0010] **Figure 1** shows photos of the morphology of pADSC from porcine adipose tissue. pADSC adhered and expanded after **(A)** 3 days, **(B)** 6 days and **(C)** 8 days seeding on a 75 cm² culture flask with a seeding density of 6,000 cells/cm². Scalebar = 200 µm. Figure 1 shows that pADSCs have a fibroblast-like morphology.

5 [0011] **Figure 2** is a graph that shows the growth kinetics of pADSC harvested from porcine adipose tissue. Figure 2 shows that pADSCs have a higher doubling time in the later passages (P6-P7).

[0012] **Figure 3** are column graphs to show the measurement of viscosities of polymer solutions. **(A)** viscosities of different polymers solutions (P1, P2 and P3) measured at different
10 temperatures (20°C and 37°C) respectively. **(B)** viscosities of different polymers solutions (P1, P2 and P3) were measured at 37°C before and after heat treatments (No Treatment; 80°C for 2 hours; 120°C for 20 mins). P1: 1% Alginate A+1% Pectin +3% GelMA; P2: 1% Alginate