MICROBIAL OILS WITH HIGH LEVELS OF OMEGA-3 FATTY ACIDS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. 63/005,054, filed April 3, 2020, which is incorporated by reference herein in its entirety.

BACKGROUND

Oil from microorganisms is produced as a result of two parallel fatty acid synthesis pathways: the classical fatty acid synthesis (FAS) pathway and the polyunsaturated fatty acid (PUFA) synthase pathway. Medium chain fatty acids like myristic (C14:0) and palmitic acid (C16:0) are generally produced from the FAS pathway and long chain polyunsaturated fatty acids (LC-PUFA) like docosahexaenoic acid (DHA, C22:6 n-3) and docosapentaenoic acid (DPA, C22:5 n-6) are generally produced from the PUFA synthase pathway. The resultant fatty acid profile, however, varies greatly across microorganisms, depending on the relative activity of these parallel pathways.

BRIEF SUMMARY

In one aspect of the present disclosure, there is provided a microbial oil comprising at least 85% total fatty acids by weight, wherein the total fatty acids comprise at least 50% docosahexaenoic acid by weight, between 6% to 18% docosapentaenoic acid n-6 by weight, between 10% to 30% by weight of palmitic acid, between 0.01% to 2.0% arachidonic acid by weight, less than 1% stearic acid by weight, and 0.1% to 0.5% heptadecanoic acid by weight.

In another aspect of the present disclosure, there is provided a microbial oil comprising at least 85% total fatty acids by weight, wherein the total fatty acids comprise at least 60% docosahexaenoic acid by weight.

Provided herein are microbial oils and methods of making and using microbial oils with high levels of omega-3 fatty acids. Specifically, provided is a microbial oil comprising at least 85% total fatty acids by weight, wherein the total fatty acids comprise at least 50% DHA by weight. Also provided is a method of making a biomass comprising culturing an oil-producing microorganism (e.g., *Aurantiochytrium*) in a culture medium comprising a fatty acid synthesis inhibitor, wherein the biomass comprises at least 500 mg/g oil.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a graph showing fatty acid profiles of *Aurantiochytrium* sp. (G3) utilizing different initial fatty acid synthesis inhibitor dosing timepoints at 20°C.

Figure 2 is a graph showing fatty acid profiles of *Aurantiochytrium* sp. (G3) in varying concentrations of fatty acid synthesis inhibitor at 20°C.

Figure 3 is a graph showing fatty acid profiles of *Aurantiochytrium* sp. (G3) in various fatty acid synthesis inhibitor dosing strategies at 20°C. Treatments indicating 3x and 6x are multiple additions of fatty acid synthesis inhibitor at equally-spaced time intervals

WHAT IS CLAIMED IS:

1. A microbial oil comprising at least 85% total fatty acids by weight, wherein the total fatty acids comprise at least 50% docosahexaenoic acid by weight, between 6% to 18% docosapentaenoic acid n-6 by weight, between 10% to 30% by weight of palmitic acid, between 0.01% to 2.0% arachidonic acid by weight, less than 1% stearic acid by weight, and 0.1% to 0.5% heptadecanoic acid by weight.

2. A microbial oil comprising at least 85% total fatty acids by weight, wherein the total fatty acids comprise at least 60% docosahexaenoic acid by weight.

3. The microbial oil of claim 1 or 2, wherein the total fatty acids comprise 0.01% to 1% stearic acid by weight.

4. The microbial oil of any one of claims 1-3, wherein the total fatty acids comprise between 10% to 18% docosapentaenoic acid n-6 by weight.

5. The microbial oil of any one of claims 1-4, wherein the microbial oil comprises 85% to 95% total fatty acids by weight.

6. The microbial oil of any one of claims 1-4, wherein the microbial oil comprises at least 90% total fatty acids by weight.

7. The microbial oil of any one of claims 1-6, wherein the total fatty acids comprise less than 1% eicosapentaenoic acid by weight.

8. The microbial oil of any one of claims 1-7, wherein the total fatty acids comprise less than 3% pentadecanoic acid by weight.

9. The microbial oil of any one of claims 1-8, wherein the total fatty acids comprise less than 40% saturated fatty acids.

10. The microbial oil of claim 9, wherein the total fatty acids comprise between 10% and 40% saturated fatty acids.

11. The microbial oil of claim 9, wherein the total fatty acids comprise between 10% and 30% saturated fatty acids.

12. The microbial oil of any one of claims 1-11, wherein the total fatty acids comprise 60% to 70% docosahexaenoic acid by weight.

13. The microbial oil of any one of claims 1-12, wherein the total fatty acids comprise 0.01% to 1% eicosatetraenoic acid by weight.

14. The microbial oil of any one of claims 1-13, wherein the microbial oil comprises at least 90% triglycerides.

15. The microbial oil of claim 14, wherein the microbial oil comprises at least 95% triglycerides.

16. The microbial oil of any one of claims 1-15, wherein the ratio of docosahexaenoic acid to docosapentaenoic acid n-6 is less than or equal to 7:1.

17. The microbial oil of any one of claims 1-16, wherein the total fatty acids comprise less than 4% myristic acid by weight.

18. The microbial oil of any one of claims 1-17, wherein the total fatty acids comprise at least 60% docosahexaenoic acid by weight and between 10% by weight to 18% docosapentaenoic acid n-6 by weight.

19. The microbial oil of any one of claims 1-18, wherein the oil is produced by culturing an *Aurantiochytrium* microorganism in a culture medium at a temperature from 22° to 28°C.

20. The microbial oil of any one of claims 1-18, wherein the oil is produced by culturing an *Aurantiochytrium* microorganism in a culture medium at a temperature from 25° to 28°C.