incorporated in small amounts in smoothies or juice drinks (usually less than 0.5% w/w). Other microalgae, including some species of *Chlorella* are popular in Asian countries as a nutritional supplement.

[0007] In addition to these products, algal oil with high docosahexanoic acid (DHA) content is used as an ingredient in infant formulas. DHA is a highly polyunsaturated oil. DHA has anti-inflammatory properties and is a well known supplement as well as an additive used in the preparation of foodstuffs. However, DHA is not suitable for cooked foods because it oxidizes with heat treatment. Also, DHA is unstable when exposed to oxygen even at room temperature in the presence of antioxidants. The oxidation of DHA results in a fishy tasteand unpleasant aroma.

[0008] There remains a need for methods to produce foodstuffs from algae cheaply and efficiently, at large scale, particularly foodstuffs that are tasty and nutritious. The present invention meets these and other needs.

SUMMARY OF THE INVENTION

[0009] In one aspect, the present invention refers to a food composition comprising at least 0.1% w/w microalgal biomass and one or more other ingredient, wherein the microalgal biomass (i) comprises microalgal cells of *Chlorella protothecoides* cultured under heterotrophic conditions, (ii) is reduced in green pigmentation and (iii) comprises at least 10% algal oil that is less than 5% by weight or less than 1% by weight, or is substantially free of docosahexanoic acid (DHA) (22:6). In another aspect, the present invention refers to a method of making a food composition of the present invention, comprising combining heterotrophically cultivated microalgal biomass containing at least 10% by weight algal oil with at least one other edible ingredient. In still another aspect, the present invention refers to a microalgal powder that (i) comprises microalgal cells of *Chlorella protothecoides* cultured under heterotrophic conditions, (ii) is reduced in green pigmentation, and (iii) comprises at least 10% algal oil that is less than 5% by weight, less than 1% by weight, or is substantially free of docosahexanoic acid (DHA)(C22:6), wherein the microalgal powder has been pasteurized. In one example, the present disclosure provides methods for preparing microalgal biomass suitable for use as a foodstuff. In these methods, the microalgae are fermented under heterotrophic conditions and so lack or have a significantly reduced amount of green pigment that characterizes other microalgal derived foodstuffs. In one example, the microalgae lack or have significantly reduced amounts of any pigment. In one example, the disclosure refers to a microalgae of the species *Chlorella protothecoides,* strain 33-55

(*Chlorella* protothecoides 33-55) deposited in accordance with the Budapest Treaty on October 13, 2009 at the American Type Culture Collection at 10801 University Boulevard, Manassas, VA 20110-2209 with a Patent Deposit Designation of PTA-XXXX. In another example, the disclosure refers to a microalgae of the species *Chlorella protothecoides,* strain 25-32 (*Chlorella protothecoides 25-32)* deposited October 13, 2009 at the American Type Culture Collection at 10801 University Boulevard, Manassas, VA 20110-2209 with a Patent Deposit Designation of PTA-XXXX. In one example, the fermentation conditions are manipulated to provide a biomass rich in lipid. In another example, the fermentation conditions are manipulated to provide a biomass rich in protein. In all examples, the methods can be carried out cheaply and efficiently at large scale (biomass produced in 4500 L or larger fermentors).

[0010] In another example, the present disclosure provides microalgal biomass suitable for incorporation into human foodstuffs. In one example, this microalgal biomass is the concentrated biomass resulting directly from the biomass preparation methods of the present invention. In another example, this biomass is in the form of dried flakes resulting from

drying, *e.g.*, drum drying, such biomass preparations. In this latter example, an antioxidant can be added to the biomass prior to the drying step to extend the shelf-life of the microalgal biomass and any food product containing such biomass.

[0011] In one example, the present disclosure provides methods for further processing the microalgal biomass of the microalgal flakes into a microalgal homogenate. In one example, the dried microalgal flakes are rehydrated in deionized water to create a suspension. This suspension is then micronized with a high pressure homogenizer so that the average particle size is less than 10 μm in size, creating a microalgal homogenate.

[0012] In another example, the present disclosure provides methods for processing the microalgal biomass into a food ingredient that is multifunctional in that it provides healthy oils to foods and provides structural benefits to foods such as baked goods. In one example, the processing involves pneumatic drying (*e.g.*, spray drying or flash drying) the biomass preparation to form an algal powder that contains a large percentage of intact microalgal cells. In another example, the biomass is first micronized to disrupt the cells before pneumatic drying to form an algal flour that contains only a small percentage (or no) intact algal cells; in some examples a flow or dispersal agent is added prior to the drying step.

[0013] In one example, the present disclosure describes a method of producing an oil or oil-containing microbial biomass suitable for human consumption. In some examples, the process involves extracting the lipid (oil) from the biomass to form an algal oil. In one example, the method comprises providing a microorganism, and culturing the microorganism in the presence of a feedstock that is not derived from a food composition suitable for human consumption, in which the microorganism converts at least some portion of the feedstock into triglyceride oil. In some cases, the triglyceride oil comprises at least 50% 18:1 lipid.

[0014] In one example, the present disclosure describes foods that incorporate an algal powder, algal flour, and/or algal oil. In one example, the food is a baked good, dressing, sauce, or mayonnaise in which, relative to the same food produced using conventional recipes, all or a portion of the egg or butter has been replaced by an algal flour rich in algal oil. In another example, the food is a powdered egg product containing an algal flour rich in algal oil. In another example, the food is a liquid egg product containing an algal flour rich in algal oil. In another example, the food is a liquid milk product containing algal protein, fiber, and oil. In another example, the food is a meat product in which, relative

to previously available meat products, a portion or all (a meat substitute) of the meat has been replaced by an algal flour, algal powder, or algal flake rich in protein.

[0015] In one example, the disclosure describes methods of inducing satiety by providing algal foods or food ingredients containing algal fiber and optionally algal protein and/or algal oil.

[0016] Aspects and embodiments of the invention are described in the accompanying drawings, a brief description of which immediately follows, and the detailed description of the invention below, and exemplified in the examples below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 shows the lipid profile of selected strains of microalgae as a percentage of total lipid content. The species/strain corresponding to each strain number is shown in Table 1 of Example 1.

[0018] Figure 2 shows the amino acid profile of *Chlorella protothecoides* biomass compared to the amino acid profile of whole egg protein.

[0019] Figure 3 shows the sensory scores of liquid whole egg with and without algal flour held on a steam table for 60 minutes. The appearance, texture and mouthfeel of the eggs were evaluated every 10 minutes.

DETAILED DESCRIPTION OF THE INVENTION

[0020] This detailed description of the invention is divided into sections and subsections for the convenience of the reader. Section I provides definitions for various terms used herein. Section II, in parts A-E, describes methods for preparing microalgal biomass, including suitable organisms (A), methods of generating a microalgae strain lacking in or has significantly reduced pigmentation (B) culture conditions (C), concentration conditions (D), and chemical composition of the biomass produced in accordance with the invention (E). Section III, in parts A-D, describes methods for processing the microalgal biomass into algal flake (A), algal powder (B), algal flour (C); and algal oil (D) of the invention. Section IV describes various foods of the invention and methods of combining microalgal biomass with other food ingredients.

[0021] All of the processes described herein can be performed in accordance with GMP or equivalent regulations. In the United States, GMP regulations for manufacturing, packing, or holding human food are codified at 21 C.F.R. 110. These provisions, as well as ancillary provisions referenced therein, are hereby incorporated by reference in their entirety for all purposes. GMP conditions in the Unites States, and equivalent conditions in other jurisdictions, apply in determining whether a food is adulterated (the food has been