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(54) Title: IMPROVED EDIBLE COMPOSITIONS COMPRISING AN IMPROVED *CHLAMYDOMONAS REINHARDTII* COMPONENT

(57) Abstract: The subject invention pertains to a composition for humans or animals that provides effective amounts of algal protein for nutrition or functionality, or algal pigment for functionality, without concurrently adding algal starch that leads to increasing the composition's glycemic index or unwanted calories. The invention provides for a foodstuff comprising wholemeal biomass of *Chlamydomonas reinhardtii* that is higher in protein and substantially starchless. This provides for flexibility in food compositions, ingredient proportions, and algal inclusion rates to attain a flavor, texture, shape, viscosity, rheology, color, ingredient substitutions, enhanced palatability, or other desirable attribute in uncooked or cooked products. The invention provides a process for producing an edible product comprising the *C. reinhardtii* component.



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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC - INV. A21D 13/06, A21D 13/064, A23L 33/195 (2024.01)
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CPC - INV. A21D 13/06, A21D 13/064, A23L 33/195

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
 See Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y --- A	US 2021/0386088 A1 (Triton Algae Innovations Inc) 16 December 2021 (16.12.2021) Abstract, claims, figures, para [0006]-[0028], para [00101], para [0071], para [00102], para [0082] and entire document	1-5,7,11-27,33,34 ----- 6,8,10 ----- 9,28-32
Y ---- A	US 2021/0198680 A1 (Kuehnle Agrosystems Inc) 1 July 2021 (01.07.2021) Abstract, claims, figures, para [0051], para [00153], para [0031], para [0084]	6,8,10 ----- 28-32
A	US 2021/0401008 A1 (Triton Algae Innovations Inc) 30 December 2021 (30.12.2021) Abstract, claims, figures, para [0006]-[0104]	28-32
A	US 2011/0124034 A1 (Kuehnle et al.) 26 May 2011 (26.05.2011) Abstract, claims, para [0008]-[0031]	28-32
A	US 2018/0002711 A1 (Kuehnle Agrosystems Inc) 4 January 2018 (4.01.2018) Abstract, claims, figures, para [0029]-[0045]	28-32

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"D" document cited by the applicant in the international application	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P/Y	WO 2024/160737 A1 (Coriopco Inc) 8 August 2024 (08.08.2024) Abstract, claims, full document	1-34
A	Morrell et al.; "Control of starch biosynthesis in vascular plants and algae" in Control of primary metabolism in plants (2006): 258-290. Full document	1-34

INTERNATIONAL SEARCH REPORT

International application No.

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

-----continued in supplemental box-----

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

-----continued from Box III-----

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I: Claims 1-27 are directed to a composition comprising a *Chlamydomonas reinhardtii* biomass and at least one additional edible component, wherein the *C. reinhardtii* biomass is present in a concentration of about 0.1 to about 99 percent by weight, wherein the *C. reinhardtii* biomass has a protein content exceeding about 50 percent by weight and a starch content less than about 2.25 percent by weight, and wherein the *C. reinhardtii* biomass is produced in a heterotrophic, mixotrophic, or autotrophic production process, or any combination of such production processes

Group II: Claims 28-34 are directed to a method of growing a *C. reinhardtii* cell, the method comprising: i) mating a first *C. reinhardtii* strain that has a starch content of at least about 2.25 percent by weight and a second *C. reinhardtii* strain that contains a mutation or epigenetic modification inhibiting the starch biosynthetic pathway; ii) desiccating the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain; iii) removing non-zygotic cells resulting from the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain; and iv) optionally, germinating a zygote resulting from the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

Special Technical Features:

Group I requires a at least one additional edible component, wherein the *C. reinhardtii* biomass is present in a concentration of about 0.1 to about 99 percent by weight, wherein the *C. reinhardtii* biomass has a protein content exceeding about 50 percent by weight and a starch content less than about 2.25 percent by weight, and wherein the *C. reinhardtii* biomass is produced in a heterotrophic, mixotrophic, or autotrophic production process, or any combination of such production processes not required by group II

Group II requires a method comprising: i) mating a first *C. reinhardtii* strain that has a starch content of at least about 2.25 percent by weight and a second *C. reinhardtii* strain that contains a mutation or epigenetic modification inhibiting the starch biosynthetic pathway; ii) desiccating the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain; iii) removing non-zygotic cells resulting from the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain; and iv) optionally, germinating a zygote resulting from the mated first *C. reinhardtii* strain and second *C. reinhardtii* strain, not required by group I.

Shared Technical Features:

Groups I and II share the common feature of a *C. reinhardtii* with a starch content less than about 2.25 percent by weight. However, these shared technical features do not represent a contribution over prior art, as the feature is anticipated by US 2021/0198680 A1 to Kuehnle Agrosystems Inc. (hereinafter Kuehnle). Kuehnle discloses a *C. reinhardtii* (para [0051], *C. reinhardtii* suited for high rate heterotrophic growth) with a starch content less than about 2.25 percent by weight (para [0205], pigment content of 2.3 percent, and para [0048], pigments such as isoprenoid, astaxanthin).

As the shared technical features were known in the art, they cannot be considered special technical features that would otherwise unify the groups. Therefore, Groups I-II lack unity under PCT Rule 13.