



(51) International Patent Classification:
A23L 1/22 (2006.01) A23L 3/44 (2006.01)

[US/US]; 2103 Doubletree Lane, Champaign, IL 61822 (US). **WANG, Yi** [CN/US]; 1304 W. Pennsylvania Ave., RM 382G, Urbana, IL 61801 (US).

(21) International Application Number:
PCT/US2012/033068

(74) Agent: **CAHOON, Colin P.**; Carstens & Cahoon, LLP, P.O. Box 802334, Dallas, TX 75380 (US).

(22) International Filing Date:
11 April 2012 (11.04.2012)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/085,088 12 April 2011 (12.04.2011) US

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(71) Applicants (for all designated States except US): **FRITOLAY NORTH AMERICA, INC.** [US/US]; 7701 Legacy Drive, Plano, TX 75024-4099 (US). **THE BOARD OF TRUSTEES OF THE UNIVERSITY OF ILLINOIS** [US/US]; 352 Henry Administration Building, 506 South Wright Street, Urbana, IL 61801 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GEORGE, Eapen** [US/US]; 4613 Shadow Ridge Drive, Frisco, TX 75034 (US). **GIVEN, Peter S.** [US/US]; 16 O'Neill Court, Ridgefield, CT 06877 (US). **GROVER, Julie Anne** [US/US]; 4824 Rockcreek Lane, Plano, TX 75024 (US). **GUARDIOLA, Lia** [HN/US]; 902 S. Lincoln Ave., Apt. 107, Urbana, IL 61801 (US). **PADUA, Graciela Wild**

[Continued on next page]

(54) Title: METHODS OF FLAVOR ENCAPSULATION AND MATRIX-ASSISTED CONCENTRATION OF AQUEOUS FOODS AND PRODUCTS PRODUCED THEREFROM

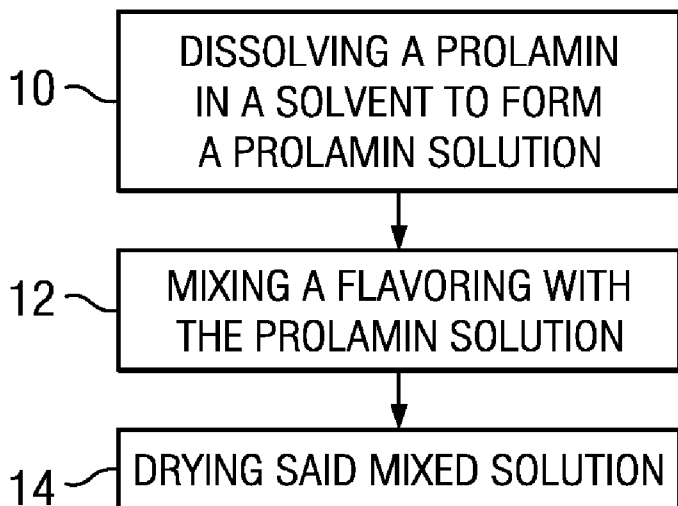


FIG. 1

(57) Abstract: Flavor encapsulation is generally performed by mixing flavor with a prolamin solution and drying the mixture into powdered forms of encapsulated flavor. In one embodiment, flavor and zein are separately dispersed in an alcohol-water mixture of appropriate ratio prior to mixing. In another embodiment, an aqueous food comprising bioactive components is mixed with the prolamin solution, thereby initiating precipitation of the prolamin and concentration of the bioactive components in said aqueous food. Resulting powdered forms of encapsulated flavor comprise the bioactive components from the aqueous food. In another embodiment, a two-phase drying process may be employed comprising removal of alcohol for evaporation-induced-self-assembly of zein microstructures, followed by removal of remaining water to produce said powdered form.



Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*
- *of inventorship (Rule 4.17(iv))*

Published:

- *with international search report (Art. 21(3))*

(88) Date of publication of the international search report:
1 May 2014

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/33068

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A23L 1/22, 3/44 (2012.01) USPC - 426/96; 426/238 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) IPC(8)- A23L 1/22, 3/44 (2012.01); USPC- 426/96; 426/238 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC- 426/650; Patents and NPL (classification, keyword; search terms below) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PubWest (US Pat, PgPub, EPO, JPO), GoogleScholar (PL, NPL), FreePatentsOnline (US Pat, PgPub, EPO, JPO, WIPO, NPL); search terms: prolaime, zein, encapsulate, microencapsulate, flavor, flavour, dissolve, solution, flavor, flavour, dry, powder, particle, particulate, dual, second, two, roil, phase, freeze, vacuum, sonciate		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2010/9845 A1 (GROVER et al.) 29 July 2010 (29.07.2010), para [0010]-[0017], [0020]-[0025]	1, 3, 9, 10 ----- 2, 4-8, 11-29
Y	US 2010/0197568 A1 (HEITTIARACHCHY et al.) 05 August 2010 (05.08.2010), para [0026], [0034], [0081], [0085], [0087], [0134], [0153]	2, 4-8, 11-29
Y	US 2010/0158984 A1 (QVYJT) 24 June 2010 (24.06.2010), para [0022]-[0184]	1-29
Y	US 2008/0063747 A1 (BOGHANI et al.) 13 March 2008 (13.03.2008), para [0006]-[0442]	1-29
Y	US 5,629,035 A (MISKEWITZ) 13 May 1997 (13.05.1997), col 3-7	1-29
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/>		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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 "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 "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 "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 "&" document member of the same patent family		
Date of the actual completion of the international search 27 June 2012 (27.06.2012)		Date of mailing of the international search report 11 JUL 2012
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201		Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774