



- (51) **International Patent Classification:**
C11B 1/10 (2006.01) *C12P 7/64* (2006.01)
- (21) **International Application Number:**
PCT/US2012/027537
- (22) **International Filing Date:**
2 March 2012 (02.03.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
13/081,221 6 April 2011 (06.04.2011) US
13/149,595 31 May 2011 (31.05.2011) US
13/274,201 14 October 2011 (14.10.2011) US
- (71) **Applicant (for all designated States except US):** **HELIAE DEVELOPMENT, LLC** [US/US]; 614 E. Germann Road, Gilbert, AZ 85297 (US).
- (72) **Inventor; and**
- (75) **Inventor/Applicant (for US only):** **KALE, Aniket** [IN/US]; 4909 W. Joshua Blvd., #1097, Chandler, AZ 85226 (US).
- (74) **Agents:** **SUPERKO, Colleen et al.**; Wilmer Cutler Pickering Hale and Dorr LLP, 60 State Street, Boston, MA 02109 (US).

(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.

(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).

Published:

- with international search report (Art. 21(3))
- with information concerning one or more priority claims considered void (Rule 26bis.2(d))

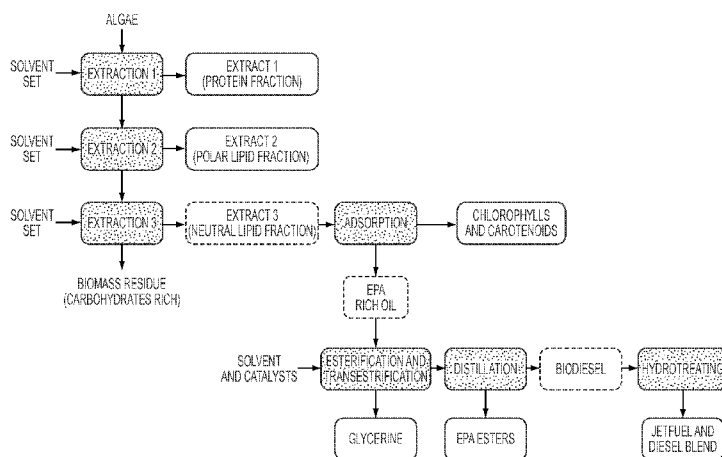
(54) **Title:** METHODS OF PRODUCING BIOFUELS, CHLOROPHYLLS AND CAROTENOIDS

FIG. 22A

(57) **Abstract:** A method for producing biofuels along with valuable food and nutraceutical products is provided. A method of making biofuels includes dewatering substantially intact algal cells to make an algal biomass, extracting neutral lipids along with carotenoids and chlorophylls from the algal biomass, and separation of the carotenoids and chlorophylls using adsorption or membrane diafiltration or other methods. The remaining neutral lipids are esterified with a catalyst in the presence of an alcohol. The method also includes separating a water soluble fraction comprising glycerin from a water insoluble fraction comprising fuel esters and distilling the fuel esters under vacuum to obtain a C 16 or shorter fuel esters fraction, a C16 or longer fuel ester fraction, and a residue comprising omega-3 fatty acids esters and remaining carotenoids. The method further includes hydrogenating and deoxygenating at least one of (i) the C16 or shorter fuel esters to obtain a jet fuel blend stock and (ii) the C16 or longer fuel esters to obtain a diesel blend stock.