

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 December 2011 (08.12.2011)

PCT

(10) International Publication Number
WO 2011/150933 A2

(51) International Patent Classification:

A01H 5/10 (2006.01) *C12C 12/00* (2006.01)
C12C 1/18 (2006.01) *C12N 9/10* (2006.01)
C12C 7/00 (2006.01) *C12N 15/82* (2006.01)

(21) International Application Number:

PCT/DK2011/050186

(22) International Filing Date:

31 May 2011 (31.05.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

PA 2010 70243 3 June 2010 (03.06.2010) DK

(71) Applicants (for all designated States except US):

CARLSBERG BREWERIES A/S [DK/DK]; Ny Carlsberg Vej 100, DK-1799 Copenhagen V (DK).
HEINEKEN SUPPLY CHAIN B.V. [NL/NL]; 2de We-
teringsplantsoen 21, NL-1017 ZD Amsterdam (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KNUDSEN, Søren** [DK/DK]; Bakkesvinget 18, DK-2760 Måløv (DK). **RIIS, Preben** [DK/DK]; Birkegården 65, DK-3500 Værløse (DK). **SKADHAUGE, Birgitte** [DK/DK]; Lindehøjvej 31 B, DK-3460 Birkerød (DK). **BECH, Lene, Mølskov** [DK/DK]; Liljehaven 83, DK-2765 Smørum (DK). **OLSEN, Ole** [DK/DK]; Holmbladsgade 102, 2.tv., DK-2300 Copenhagen S (DK).

(74) Agent: **HØIBERG A/S**; St. Kongensgade 59 A, DK-1264 Copenhagen K (DK).

(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, RO, RS, RU, 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, 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).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

— with (an) indication(s) in relation to deposited biological material furnished under Rule 13bis separately from the description (Rules 13bis.4(d)(i) and 48.2(a)(viii))

— with sequence listing part of description (Rule 5.2(a))

(54) Title: ENERGY SAVING BREWING METHOD

(57) Abstract: Barley based beverages are produced in large quantities, employing highly energy consuming methods, for example in the malting and brewhouse facilities for kiln drying and wort boiling operations, respectively. The present invention relates to energy saving methods for preparing barley based beverages, as well as to barley plants useful in such methods. In particular, the invention describes barley plants with combined traits of null-lipoxygenase-1 (null-LOX-1), null-lipoxygenase-2 (null-LOX-2) and null-S-adenosylmethionine:methionine S-methyltransferase in one plant, which is particularly useful for energy saving methods to prepare barley based beverages, such as beer.



WO 2011/150933 A2