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31 March 2016



WO 2015/195969 A3

(54) Title: METHOD FOR REDUCING LOW MOLECULAR WEIGHT SPECIES IN CARAMEL

(57) Abstract: The present invention provides a method for forming caramels having reduced low molecular weight species such as 4-MeI. The low-4-MeI caramels produced by this method have improved stability and taste relative to those known in the art. The invention also extends to the caramels produced by the disclosed methods and the use of such caramels in food and beverages.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/36512

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - A23G 3/32; A23L 1/27, 1/272; C12C 5/04 (2015.01) CPC - A23G 3/32; A23L 1/27, 1/272; C12C 5/04 According to International Patent Classification (IPC) or to both national classification and IPC</p>											
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) IPC (8) - A23G 3/20, 3/32; A23L 1/27, 1/272, 2/58; C12C 5/04 (2015.01); CPC - A23G 3/32; A23L 1/27, 1/272, 1/2751, 1/2758; C12C 5/04; USPC - 127/34; 426/262, 536</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatSeer (US, EP, WO, JP, DE, GB, CN, FR, KR, ES, AU, IN, CA, Other Countries (INPADOC), RU, AT, CH, TH, BR, PH), ProQuest, Google/Google Scholar, IP.com; caramel, Class IV, 4-methyl-imidazole, 4-Mel, low-4-Mel class IV caramel, caramelization, ammonium, sulfite, temperature, heating, preheated, pH, stability, food, beverage, ppm,</p>											
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:10%;">Category*</th> <th style="width:60%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width:30%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="vertical-align: top;">X</td> <td style="vertical-align: top;">US 2010/0003383 A1 (PARKER, O et al.) January 7, 2010; table 1; paragraphs [0004], [0006]-[0019]</td> <td style="vertical-align: top;">1-2, 11/2-7, 12/2-7, 13/12/2-7, 14/13/12/2-7, 15/1-7, 16-18, 22/1-7, 23-25, 26/24-25, 31/1-7, 32/1-7, 53/1-7, 54/53/1-7, 55/53/1-7, 56/53/1-7, 57/53/1-7, 58/53/1-7, 59/53/1-7, 60/53/1-7, 61/1-7, 62/61/1-7, 63/61/1-7, 64/61/1-7, 65/61/1-7, 66/61/1-7, 67/61/1-7, 68/61/1-7, 69/68/61/1-7</td> </tr> <tr> <td style="vertical-align: top;">-- Y</td> <td></td> <td style="vertical-align: top;">3-7, 8/1-7, 9/5-7, 10/9/5-7, 19, 20/1-7, 21/20/1-7, 27-30, 33-43, 44/33-43, 45/44/33-43, 46/33-43, 47/46/33-43, 48/33-43, 49/33-43, 50/49/33-43, 51-52, 53/33-43, 54/53/33-43, 55/53/33-43, 56/53/33-43, 57/53/33-43, 58/53/33-43, 59/53/33-43, 60/53/33-43, 61/33-43, 62/61/33-43, ---continued below---</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 2010/0003383 A1 (PARKER, O et al.) January 7, 2010; table 1; paragraphs [0004], [0006]-[0019]	1-2, 11/2-7, 12/2-7, 13/12/2-7, 14/13/12/2-7, 15/1-7, 16-18, 22/1-7, 23-25, 26/24-25, 31/1-7, 32/1-7, 53/1-7, 54/53/1-7, 55/53/1-7, 56/53/1-7, 57/53/1-7, 58/53/1-7, 59/53/1-7, 60/53/1-7, 61/1-7, 62/61/1-7, 63/61/1-7, 64/61/1-7, 65/61/1-7, 66/61/1-7, 67/61/1-7, 68/61/1-7, 69/68/61/1-7	-- Y		3-7, 8/1-7, 9/5-7, 10/9/5-7, 19, 20/1-7, 21/20/1-7, 27-30, 33-43, 44/33-43, 45/44/33-43, 46/33-43, 47/46/33-43, 48/33-43, 49/33-43, 50/49/33-43, 51-52, 53/33-43, 54/53/33-43, 55/53/33-43, 56/53/33-43, 57/53/33-43, 58/53/33-43, 59/53/33-43, 60/53/33-43, 61/33-43, 62/61/33-43, ---continued below---
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.									
X	US 2010/0003383 A1 (PARKER, O et al.) January 7, 2010; table 1; paragraphs [0004], [0006]-[0019]	1-2, 11/2-7, 12/2-7, 13/12/2-7, 14/13/12/2-7, 15/1-7, 16-18, 22/1-7, 23-25, 26/24-25, 31/1-7, 32/1-7, 53/1-7, 54/53/1-7, 55/53/1-7, 56/53/1-7, 57/53/1-7, 58/53/1-7, 59/53/1-7, 60/53/1-7, 61/1-7, 62/61/1-7, 63/61/1-7, 64/61/1-7, 65/61/1-7, 66/61/1-7, 67/61/1-7, 68/61/1-7, 69/68/61/1-7									
-- Y		3-7, 8/1-7, 9/5-7, 10/9/5-7, 19, 20/1-7, 21/20/1-7, 27-30, 33-43, 44/33-43, 45/44/33-43, 46/33-43, 47/46/33-43, 48/33-43, 49/33-43, 50/49/33-43, 51-52, 53/33-43, 54/53/33-43, 55/53/33-43, 56/53/33-43, 57/53/33-43, 58/53/33-43, 59/53/33-43, 60/53/33-43, 61/33-43, 62/61/33-43, ---continued below---									
<p><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p>											
<p>* Special categories of cited documents:</p> <table style="width:100%;"> <tr> <td style="width:50%;"> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“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)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width:50%;"> <p>“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</p> <p>“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</p> <p>“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</p> <p>“&” document member of the same patent family</p> </td> </tr> </table>			<p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“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)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p>	<p>“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</p> <p>“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</p> <p>“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</p> <p>“&” document member of the same patent family</p>							
<p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“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)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p>	<p>“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</p> <p>“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</p> <p>“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</p> <p>“&” document member of the same patent family</p>										
<p>Date of the actual completion of the international search</p> <p>13 October 2015 (13.10.2015)</p>		<p>Date of mailing of the international search report</p> <p align="center">28 JAN 2016</p>									
<p>Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-8300</p>		<p>Authorized officer</p> <p align="center">Shane Thomas</p> <p>PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774</p>									

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/36512

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y		---continued from above--- 63/61/33-43, 64/61/33-43, 65/61/33-43, 66/61/33-43, 67/61/33-43, 68/61/33-43, 69/68/61/33-43, 70/61/1-7, 70/61/1-7, 73/61/1-7, 73/61/33-43, 74/73/61/1-7, 74/73/61/33-43, 75/73/61/1-7, 75/73/61/33-43, 76/1-7, 76/33-43, 77/76/1-7, 77/76/33-43, 78/76/1-7, 78/76/33-43, 79/78/76/1-7, 79/78/76/33-43, 80/78/76/1-7, 80/78/76/33-43, 81/80/78/76/1-7, 81/80/78/76/33-43, 82/81/80/76/1-7, 82/81/80/76/33-43, 83/78/76/1-7, 83/78/76/33-43, 84/83/78/76/1-7, 84/83/78/76/33-43, 85/83/78/76/1-7, 85/83/78/76/33-43
Y	CN 103,740,129 A (ZHAO, B et al.) April 23, 2014; see translation; paragraph [0027]	3-4, 6-7, 19, 20/1-7, 21/20/1-7, 46/33-43, 47/46/33-43
Y	US 2012/0090602 A1 (ZHANG, H et al.) April 19, 2012; claims 1, 3	5-7, 9/5-7, 10/9/5-7, 27-30
Y	US 3214294 A (MEISEL, H) October 26, 1965; column 2, lines 19-45, 61-64; column 4, lines 31-35; claim 2	8/1-7, 40-41, 43
Y	CN 102,642,862 B (QIANHE WEIYE FOOD CO) May 28, 2014; see translation; paragraphs [0001], [0003], [0007], [0015]-[0016], [0026]-[0027], [0040]	9/5-7, 10/9/5-7, 33-43, 44/33-43, 45/44/33-43, 46/33-43, 47/46/33-43, 48/33-43, 49/33-43, 50/49/33-43, 51-52, 53/33-43, 54/53/33-43, 55/53/33-43, 56/53/33-43, 57/53/33-43, 58/53/33-43, 59/53/33-43, 60/53/33-43, 61/33-43, 62/61/33-43, 63/61/33-43, 64/61/33-43, 65/61/33-43, 66/61/33-43, 67/61/33-43, 68/61/33-43, 69/68/61/33-43, 70/61/33-43, 73/61/33-43, 74/73/61/33-43, 75/73/61/33-43, 76/33-43, 77/76/33-43, 78/76/33-43, 79/78/76/33-43, ---continued below---

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/36512

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2008/047347 A2 (YISSUM RESEARCH DEVELOPMENT COMPANY OF THE HEBREW UNIVERSITY OF JERUSALEM) April 24, 2008; table 2; page 3, lines 4-21; page 10, lines 3-4	---continued from above--- 80/78/76/33-43, 81/80/78/76/33-43, 82/81/80/76/33-43, 83/78/76/33-43, 84/83/78/76/33-43, 85/83/78/76/33-43 70/61/1-7, 70/61/33-43, 73/61/1-7, 73/61/33-43, 74/73/61/1-7, 74/73/61/33-43, 75/73/61/1-7, 75/73/61/33-43, 80/78/76/1-7, 80/78/76/33-43, 81/80/78/76/1-7, 81/80/78/76/33-43, 82/81/80/76/1-7, 82/81/80/76/33-43, 83/78/76/1-7, 83/78/76/33-43, 84/83/78/76/1-7, 84/83/78/76/33-43, 85/83/78/76/1-7, 85/83/78/76/33-43
Y	JP 2013523127 A (PEPSICO) June 17, 2013; see translation; abstract; claim 1; page 1, column 2, third paragraph; page 2, column 2, second paragraph; page 4, fourth paragraph	75/73/61/1-7, 75/73/61/33-43, 76/1-7, 76/33-43, 77/76/1-7, 77/76/33-43, 78/76/1-7, 78/76/33-43, 79/78/76/1-7, 79/78/76/33-43, 80/78/76/1-7, 80/78/76/33-43, 81/80/78/76/1-7, 81/80/78/76/33-43, 82/81/80/76/1-7, 82/81/80/76/33-43, 83/78/76/1-7, 83/78/76/33-43, 84/83/78/76/1-7, 84/83/78/76/33-43, 85/83/78/76/1-7, 85/83/78/76/33-43
A	SETHNESS CARAMEL COLOR "Frequently Asked Questions About Caramel Color" 2012 [retrieved on 20 August 2015]. Retrieved from the internet; URL: < http://www.sethness.com/caramel_color_facts/faqs.php >; page 4, resinification	22/1-7, 23/22/1-7, 24-25, 26/24-25, 27-30, 49/33-43, 50/49/33-43, 51-52, 53/1-7, 53/33-43, 54/53/1-7, 54/53/33-43, 55/53/1-7, 55/53/33-43, 56/53/1-7, 56/53/33-43, 57/53/1-7, 57/53/33-43, 58/53/1-7, 58/53/33-43, 59/53/1-7, 59/53/33-43, 60/53/1-7, 60/53/33-43, 66/61/1-7, 66/61/33-43, 67/61/1-7, 67/61/33-43, 69/68/61/1-7, 69/68/61/33-43

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/36512

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.: 71-72
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 Within the Next 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.:
1-70, 73-85

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.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/US15/36512

.-***-Continued from Box III: Observations where unity of invention is lacking-***-

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 examined, the appropriate additional examination fees must be paid.

Group I: Claims 1-70 and 73-85 are directed toward methods of forming a low-4 methyl-imidazole (4-Mei) class IV caramel through a caramelization reaction.

Group II: Claims 86-117 are directed toward a method of reducing the low molecular weight component of a caramel solution with diafiltration and reverse osmosis.

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: the special technical features of Group I include a method of forming a low-4 methyl-imidazole (4-Mei) class IV caramel, comprising (i) providing a solution that comprises a carbohydrate and an acid; (ii) initiating a caramelization reaction in the solution; (iii) after initiation, adding a portion of ammonium and sulfite to solution; and (iv) continuing the caramelization reaction, thereby producing a low-4-Mei class IV caramel; and A method of forming a low-4-Mei class IV caramel, comprising: (i) adding a carbohydrate and an acid to a reaction vessel to provide a first reaction mixture; (ii) closing the reaction vessel; (iii) adding a first portion of ammonium and sulfite to the first reaction mixture to provide a second reaction mixture; (iv) heating the second reaction mixture to a temperature of at least about 80°; (v) adding a second portion of ammonium and sulfite to the second reaction mixture to provide a third reaction mixture; and (vi) maintaining the temperature of step (iv) or heating the third reaction mixture to a suitable temperature, thereby providing a low-4-Mei class IV caramel, which are not present in Group II; and the special technical features of Group II include a method of reducing the low molecular weight component of a caramel solution, comprising: (i) providing a solution comprising a caramel selected from a class III or class IV caramel; (ii) subjecting the solution to diafiltration to provide a retained fraction and a permeated fraction, said retained fraction comprising high molecular weight color bodies and water; (iii) subjecting the permeate fraction to reverse osmosis to provide a recycle water stream and a permeate concentrate stream; (iv) adding the retained fraction and recycle water stream to the caramelized solution; and (v) repeating steps (ii)-(v) one or more times to provide a concentrated, purified low-4-Mei class III or class IV caramel, which are not present in Group I.

The common technical features of Groups I-II are a caramelized solution, and providing a concentrated, purified low-4-Mei class IV caramel.

These common technical features are disclosed by US 2010/0003383 A1 to Parker, et al. (hereinafter 'Parker'). Parker discloses a caramelized solution (caramelization reaction is initiated; paragraph [0009]-[0010]), and providing a concentrated, purified low-4-Mei class IV caramel (class IV caramel with low-4-Mei is produced; paragraphs [0006], [0016]).

Since the common technical features are previously disclosed by Parker, these common features are not special and so Groups I-II lack unity.