



(51) International Patent Classification:

A23B 4/20 (2006.01) C11B 1/10 (2006.01)
C11B 13/00 (2006.01)

(21) International Application Number:

PCT/GB2016/050704

(22) International Filing Date:

16 March 2016 (16.03.2016)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1510540.6 16 June 2015 (16.06.2015) GB

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(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, BN, 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, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: ROE SACK PRESERVATION FOR CAVIAR PRODUCTION

(57) Abstract: Preservation of newly-extracted roe sacks of sturgeons for subsequent harvesting of roe and caviar production, wherein said preservation employs an oil derived from roe sack membrane normally discarded in conventional caviar production. Such preservation enables roe sacks with retained roe derived from farmed or wild sturgeon to be stored and transported whereby export can be considered. The same oil, or fatty acid-containing fractions thereof, may also find use in dietary compositions, e.g. pet foods.



WO 2016/203187 A1

Roe Sack Preservation For Caviar Production

Field of the invention

5 The present invention relates to a method of preserving isolated roe-sacks (ovaries) from sturgeons for subsequent harvesting of roe for caviar production. The method employs an oil composition derived from emptied roe sacks as normally discarded in conventional caviar production. The same oil composition, and fatty acid-containing fractions thereof, may find use as dietary components, e.g. by incorporation in food products such as pet food, or by
10 provision as dietary supplements. Such an oil composition may be combined with harvested sturgeon roe following washing as a flavour supplement in caviar production.

Background to the invention

15 Caviar as referred to herein corresponds with traditional use of the term solely in relation to salt-treated, unfertilized eggs or roe from ovaries of female sturgeons, a luxury food owing to its difficulty of production and perishable nature. Sturgeon is the common name for a large number of fish species of the family Acipenseridae, including the genera Acipenser, Huso, Scaphirhynchus and Pseudoscaphirhynchus (for more information see: www.sturgeonweb.co.uk). Often it is used more exclusively to refer to two species commonly
20 connected with caviar production, Acipenser and Huso. For example Beluga caviar derived from wild Beluga sturgeon (*Huso huso*) has traditionally been much prized, but other sturgeon species are also well-known for caviar production and are increasingly farmed. These include for example Siberian sturgeon (*Acipenser baerii*), now being farmed for the
25 first time for caviar production in the UK by Exmoor Caviar, and other Acipenser species. One of the problems for caviar production is the many years female sturgeons take to reach reproductive maturity. Female Siberian sturgeons commonly take 8-10 years to become mature and produce eggs; females of some species, e.g. Beluga sturgeon, take far longer, e.g. around 20 years or more. To reduce this time, some hybrid crosses have been
30 achieved, e. g. male *Huso huso* sturgeon have been crossed with faster maturing species such as *Acipenser sterlet* or *baerii* to provide hybrid species for farming. The present invention is applicable to caviar production whenever ovaries are extracted from any species or hybrid species of sturgeon for this purpose; this remains the most common and preferred initial step for caviar production.

35 Whilst farming of sturgeons addresses the ecological problem of relying on wild sturgeon for caviar production and enables caviar production more widely, there remains for

caviar producers the problem of the need for careful timing of harvesting of the roe, preferably very shortly before spawning, coupled with need for roe sacks to be quickly processed once extracted to avoid deterioration of the roe. This is still a delicate task usually done by hand. The roe sacks are normally gently rubbed across a sieve, either a
5 nylon mesh or stainless steel sieve, whereby the roe eggs are separated from the membrane of the roe sack and pass through the sieve to be collected. Running cold water may be employed to aid the roe release and separation. Salt will be added to the separated roe according to requirement for taste and to aid preservation. A stabilizer may be additionally added such as E285 stabilizer. The roe, which is now caviar, is packed into
10 containers with airtight sealing, normally under vacuum, for refrigerated storage. The caviar may be subsequently re-packaged in smaller quantities, e.g. into tins at 10-125g per tin.

Summary of the invention

15 The present invention enables extraction of sturgeon roe sacks to be advantageously divorced from roe harvesting for a substantial period of time whereby extracted ovaries may be processed at a far later date. The present invention for the first time makes it feasible to transport extracted sturgeon roe sacks containing roe substantial distances, and even export such roe sacks for caviar production, while avoiding unacceptable deterioration of the roe
20 and enabling production of caviar with desirable taste. As indicated above, this has been achieved using an oil composition derived from discarded remains of roe sacks after roe harvesting and referred to as Biobengeon™ oil. Roe sacks with unharvested roe can be immersed in this oil and vacuum-packed in air-tight containers for storage and /or transport with refrigeration.

25 While others have previously looked at extracting oil from dried sturgeon muscle by various methods (see Hao et al. (2015) Food Chem., 173, 274-282: "The effects of different extraction methods on composition and storage stability of sturgeon oil"), it has not previously been appreciated that any useful oil composition might be extracted from normally
30 discarded membrane remains of sturgeon roe sacks following harvesting of the roe. Nor has any sturgeon-derived oil been proposed for use in preserving extracted sturgeon roe sacks ahead of roe harvesting.

In one aspect, as indicated above, the present invention now provides a method of obtaining
35 a sturgeon-derived oil wherein the oil is extracted from membrane of sturgeon roe sacks following separation of the roe from the roe sacks.

In a preferred embodiment, such a method for obtaining an oil composition suitable for use in storing extracted sturgeon roe sacks still containing roe, comprises

- (1) processing membrane of sturgeon roe sacks following roe extraction to obtain a liquid mixture;
- (2) heating said mixture whereby proteins are denatured and an oil composition accumulates (visible as a golden-coloured fluid) and
- (3) separating said oil composition.

Such separation may conveniently be carried out using a sieve to separate the oil from visible clumps of matter. Alternatively, such separation may be achieved by centrifugation.

The separated fluid will generally be refrigerated for storage and subsequent use.

The oil composition thus obtained (Biobengeon oil) can be employed in the preservation of newly-extracted sturgeon roe sacks containing roe as further detailed below. It is envisaged that other sturgeon-derived oils may be similarly employed, either derived from roe sack membrane by different methods or derived from sturgeon muscle. However, Biobengeon oil prepared as discussed above is preferred since the method can be carried out very conveniently without any complex equipment or need for additional reagents.

Detailed description of the invention

Processing of sturgeon ovary membrane for obtaining therefrom the desired oil composition may be achieved using simply a food blender, although a larger blender may be employed for larger scale production. Heating may be at any temperature whereby proteins are denatured and clump and the required oil accumulates. Generally a temperature of at least about 70° C will be employed, e.g. at least about 80-85°C or at least about 90°C-95 °C or at least about 100°C. A temperature of about 120°C has, for example, been found suitable by the inventors.

Once separated from the mixture, e.g. for convenience using a sieve, the resulting fluid (Biobengeon oil) may be employed in a protocol for preserving extracted sturgeon roe sacks with retained roe comprising:

- (1) submerging one or more roe sacks in said fluid, preferably at refrigerated temperature, e. g. about 2-4° C, in a container suitable for vacuum packing such that they are completely covered by said fluid;
- (2) sealing the container
- (3) and applying a vacuum whereby the roe sacks are vacuum-packed.

The container will normally be refrigerated for storage, preferably at around 2° C.

As indicated above, it is envisaged that other sturgeon-derived oils might be similarly, although less conveniently applied, including known oils derived from sturgeon muscle. In particular, it is envisaged that other methods previously employed to extract sturgeon oil from sturgeon muscle and fish oils from other fish parts might also be applied to extract oil from sturgeon roe sack membranes. Such well-known extraction methods include enzymatic extraction employing a protease, extraction using ammonia and ammonium sulphate or a supercritical fluid extraction (SFE) method, e.g. with carbon dioxide as a solvent. For further details of such methods reference may be made to Hao et al. (2015) *ibid.* and references therein re fish oil extraction, e.g. Hao et al. (2013) *Adv. Materials Res.* 657, 1975-1981: "Extraction of fish oil from the muscle of sturgeon using supercritical fluids."

Extracted sturgeon roe sacks with retained roe and packaged for storage and /or transport by a method as described above constitute a further aspect of the invention.

For subsequent harvesting of roe, roe sacks thus stored will simply be removed from the container and harvesting of the roe and caviar production may then be carried out in known manner. Cold water rinsing of the roe during and/or after harvesting may be preferred.

Caviar can thus be prepared from such stored roe sacks with no significant deterioration in quality as regards appearance and good taste. Furthermore, as indicated above, oil prepared from roe sack membrane in accordance with the invention, or a fatty – acid containing fraction thereof, may optionally be included in a caviar preparation prior to packaging to influence taste. The caviar thus obtained may be initially packed, e.g. under vacuum, and then subsequently re-packed in smaller quantities in conventional manner.

In this way a use is provided for roe sack membranes which would otherwise be simply discarded and which greatly aids more cost-effective caviar production and enables export of full sturgeon roe sacks from farmed or wild sturgeon.

As indicated above, furthermore oil derived from sturgeon roe sack membranes in accordance with the invention, or fatty acid-containing fractions thereof, may have use more widely as dietary supplements. A method of the invention for obtaining such an oil may thus further comprise incorporating the oil, or a fatty acid-containing fraction thereof, into a dietary composition suitable for either human or non-human animal consumption, e. g. a pet food, for example a canine or cat pet food. Such a pet food may include additionally other sturgeon-derived product, e.g. sturgeon muscle.

In a further embodiment, the present invention provides a dietary composition, e.g. a pet food such as a canine or cat pet food, including an oil composition of the invention. As indicated above, such a pet food may include additionally, for example, sturgeon muscle and/ or other sturgeon – derived product, e.g. fragments of sturgeon roe sac. It may be formulated as a pet food treat, e.g. in the form of pellets or balls.

The following non-limiting example is provided to illustrate the invention.

10 Example

Oil was extracted from sturgeon roe sack membranes of farmed *Acipenser baerii* by:

- 1) taking sturgeon roe sack membrane derived from roe sacks following roe harvesting and placing it in a food blender;
- 2) macerating the membrane in the blender until thick and smooth;
- 3) transferring the macerated roe sack membrane into a container and heating to 120°C;
- 4) permitting oil to accumulate as a golden–coloured fluid and protein to clump;
- 5) separating the oil using a sieve and
- 6) refrigerating the oil.

The oil thus obtained (referred to as Biobengeon™ oil) was analysed for its fatty acid content by Eurofins Food Testing UK and found to have the following composition consistent with its oil definition:

Analysis of Biobengeon oil	
Analyte	Result
Moisture	0.281 g/100g
Crude Protein (Nx6.25) (Dumas)	<0.1 g/100g
Ash	<0.1 g/100g
Carbohydrates (available)	< 0.1 g/100g
Total fat	100.1 g/100
Total dietary fibre (AOAC)	<0.5 g/100g
Energy value (kcal)	901 kcal/100g
Energy value (kJ)	3700 kJ/100 g
Sodium	<0.01 g/100g
Enterobacteriaceae	< 10 cfu/g
Escherichia coli	< 10 cfu/g
Fructose	<0.1 g/100g
Galactose	<0.1 g/100g
Glucose	<0.1 g/100g
Lactose	<0.1 g/100g
Maltose	<0.1 g/100g
Monounsaturated fatty acids (MUFA)	50.54 g/100g
Polyunsaturated fatty acids (PUFA)	22.92 g/100 g
presumptive Lactic Acid Bacteria	610 cfu/g
Salt (via sodium x 2.5)	< 0.025 g/100g
Saturated fatty acids (SFA)	18.99 g/100g
Sucrose	<0.1 g/100g
Total sugars	<0.1 g/100g
Trans Fatty Acids	0.95 g/100g

Claims:

1. A method of obtaining a sturgeon-derived oil wherein the oil is extracted from membrane of sturgeon roe sacks following separation of the roe from the roe sacks.
2. A method of obtaining an oil as claimed in claim 1, which comprises
 - (i) processing membrane of sturgeon roe sacks following roe extraction to obtain a liquid mixture;
 - (ii) heating said mixture whereby proteins are denatured and an oil accumulates and
 - (iii) separating said oil.
3. A method as claimed in claim 1 wherein said heating is at at least about 100° C, e.g. about 120° C.
4. An oil composition obtainable by the method of any one of claims 1 to 3.
5. A method for preserving extracted sturgeon roe sacks with retained roe comprising:
 - (i) submerging one or more roe sacks in oil derived from sturgeon roe sack membrane in accordance with any of claims 1 to 3 or derived from sturgeon muscle, preferably at refrigerated temperature, in a container suitable for vacuum packing such that the roe sacks are completely covered by said oil;
 - (ii) sealing the container and
 - (iii) vacuum-packing the roe sack(s) in the container.
6. A method as claimed in claim 5 wherein said oil is derived from sturgeon roe sack membrane.
7. A method as claimed in claim 5 or claim 6 which further comprises refrigerating the container for storage.
8. Extracted sturgeon roe sacks with retained roe and packaged for storage and /or transport by a method according to any one of claims 5 to 7.
9. A method of caviar production wherein sturgeon roe sacks according to claim 8 are used for harvesting roe following removal from the container.

10. A method as claimed in claim 9 wherein the harvested roe is combined with an oil composition according to claim 4, or a fatty- acid containing fraction thereof, to influence taste.
11. A method as claimed in claim 9 or claim 10 which further comprises packing the caviar in a sealed container, preferably under vacuum.
12. A method as claimed in claim 11 which further comprises re-packaging the caviar in smaller quantities per container.
13. A method as claimed in any one of claims 1 to 3 which further comprises incorporating said oil, or a fatty-acid containing fraction thereof, into a dietary composition for human or non-human animal consumption.
14. A method as claimed in claim 13 wherein said dietary composition is a pet food, for example, a canine or cat pet food.
15. A dietary composition comprising an oil composition according to claim 4.
16. A dietary composition according to claim 15 which is a pet food, for example a canine or cat pet food, optionally additionally including other sturgeon-derived product.
17. A caviar preparation incorporating an oil composition according to claim 4, or a fatty acid containing fraction thereof, so as to influence taste.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/050704

A. CLASSIFICATION OF SUBJECT MATTER

INV. A23B4/20

ADD. C11B13/00 C11B1/10

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)

A23B A23D A23L A61K C11B

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

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

EPO-Internal, WPI Data, COMPENDEX, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	G.E. BLEDSOE ET AL: "Caviars and Fish Roe Products", CRITICAL REVIEWS IN FOOD SCIENCE AND NUTRITION, vol. 43, no. 3, 1 May 2003 (2003-05-01), pages 317-356, XP055273360, USA ISSN: 1040-8398, DOI: 10.1080/10408690390826545 the whole document ----- -/--	1-17



Further documents are listed in the continuation of Box C.



See patent family annex.

* 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

19 May 2016

Date of mailing of the international search report

12/08/2016

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2016/050704

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HAO SHUXIAN ET AL: "The effects of different extraction methods on composition and storage stability of sturgeon oil", FOOD CHEMISTRY, ELSEVIER LTD, NL, vol. 173, 7 October 2014 (2014-10-07), pages 274-282, XP029102108, ISSN: 0308-8146, DOI: 10.1016/J.FOODCHEM.2014.09.154 the whole document	1-17
A	----- OLSEN RAGNAR L ET AL: "Challenges and realistic opportunities in the use of by-products from processing of fish and shellfish", TRENDS IN FOOD SCIENCE AND TECHNOLOGY, vol. 36, no. 2, 1 April 2014 (2014-04-01), pages 144-151, XP028836827, ISSN: 0924-2244, DOI: 10.1016/J.TIFS.2014.01.007 the whole document	1-17
X	----- EP 2 868 207 A1 (KORYAZOVA IRINA LVOVNA [RU]; KOPILENKO LILIYA RAFALIEVNA [RU]) 6 May 2015 (2015-05-06)	17
A	the whole document -----	1-16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2016/050704

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:

see additional sheet

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 an 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.:

1-4, 13-17(completely); 5-12(partially)

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4, 13-17(completely); 5-12(partially)

Method of preserving caviar by submersion in oil extracted from the membranes of sturgeon roe sacks; subsequent applications thereof.

2. claims: 5-12(partially)

Method of preserving caviar by submersion in oil derived from sturgeon muscle; subsequent applications thereof.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2016/050704

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2868207 A1	06-05-2015	EP 2868207 A1	06-05-2015
		WO 2014171846 A1	23-10-2014
