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Tallow enhancement process investigation

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Abstract

Like most other animal fats, beef tallow is a highly saturated fat with approximately 70% of its component fatty acids being saturated. Tallow also contains significant amounts of free cholesterol. Tallow was once a popular frying medium because of its superior thermal stability and the pleasant flavour characteristics it imparted to foods fried in it. However, due to concerns about adverse health effects of saturated fat and cholesterol on cardiovascular health, tallow has rapidly lost its place in the food service industry, and to a large extent, has been replaced by healthier vegetable oils.

An extensive literature and patent review was conducted to investigate value-adding opportunities for beef and sheep tallow by identifying feasible processes for converting tallow to healthier oil and for extracting significant flavour compounds from crude or fractions of tallow. The feasibility of fractionation technologies and transesterification processes are discussed, as well as potential food applications for highly monounsaturated tallow-based products. The potential for producing and imparting desirable tallow flavour to foods cooked in tallow-based products is also discussed.

Executive Summary

Extensive searching of scientific and patent literature, as well as information from current industrial processes, has shown that technologies and processes exist to convert beef tallow to a food ingredient with significantly reduced saturation. This can be achieved by either fractionation or transesterification.

Fractionation technology exists that can separate beef tallow into saturated and unsaturated fractions. Fractionation can be achieved either by solvent or dry fractionation processes. Solvent fractionation is reported to yield a major liquid fraction, accounting for approximately 60% by weight of the starting tallow which is completely liquid at refrigeration temperature. This fraction contains only 24% total saturated fat, and a large part of the saturated fatty acids in the liquid fraction is composed of stearic acid which is considered to have a neutral effect on cardiovascular health. No by-products or *trans* fats are formed during the fractionation process.

Transesterification is a process whereby tallow is chemically or enzymatically reacted with one or more unsaturated vegetable oils. The saturated fatty acids in the tallow triglycerides are exchanged with unsaturated fatty acids of the vegetable oils to obtain products of reduced saturation. The process allows flexibility of manipulating the end product to desired specifications by the choice of vegetable oil(s) used. This process however, results in the formation of by-products (free fatty acids, mono- and di-glycerides) which need to be removed before the product can be used. No *trans* fats are generated in this process.

Consumer preference for the flavour of foods fried in tallow over the flavour of foods fried in other oils suggests that tallow contains unique flavour precursors which produce characteristic “tallow-fried” flavour after frying. This is analogous to meat flavour which is generated when meat is cooked, probably through a complex series of reactions involving various meat constituents. The key precursor compounds required to generate tallow flavour on heating are unknown, so more research, particularly involving the liquid fraction of tallow, is required before considering processes for extracting flavour from tallow.

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1 Background

For many years beef tallow was popularly used in food applications such as deep-frying because of its desirable flavour characteristics and high stability. However, as most animal fats do, both beef (70%) and mutton (60%) tallow contain high levels of saturated fat compared to most vegetable oils (e.g. canola 6%). Current international dietary guidelines recommend that saturated fats contribute no more than 10–15% to the total energy intake. For example, the Australian Heart Foundation advises that "instead of cutting out all of the fat you eat, try to choose the healthier polyunsaturated and monounsaturated fats and limit the amount of the less healthy saturated and trans fats that you eat". Tallow also contains relatively high levels of cholesterol. However, cholesterol in food has only a small effect on LDL cholesterol, especially when compared with the much greater increase caused by saturated fat in food. So, the main deficiency of tallow from a health and nutrition viewpoint is the presence of relatively high levels of saturated fatty acids.

Tallow is a low value, high volume component (52 kg/head). However, overall production and market value is significant, with 460 Kt produced annually at $175 million equating to approximately $20/hd gross sales. The main determinant of tallow quality and price is free fatty acids (FFA) being a measure of breakdown of the main component of tallow, triglyceride. Therefore, higher FFA content results in lower price with approximately a 15% difference between 1% FFA tallow and 4% FFA tallow.

A number of different studies have shown that it is possible to convert tallow to a highly monounsaturated oil for use in food applications (e.g. frying) to produce low saturated food products with significantly reduced cholesterol or LDL (bad) cholesterol causing oils. This could increase the current value of tallow and therefore return a greater price per head to processors through this co-product. Therefore, it is necessary to evaluate the most feasible process and market (if any) to pursue this opportunity.

Additionally, crude tallow contains significant flavour compounds associated with meat flavour characteristics and is also a value-adding opportunity if these compounds can be isolated and extracted from crude or fractions of tallow.

2 Project Objectives

To identify and elucidate what techniques have been developed for isolation and extraction of flavour compounds from tallow and also conversion of beef and sheep tallow (highly saturated fat) to a healthier fat for identified applications in the food industry. The project will deliver a report outlining the following.

- A critical evaluation of the current processes available both in journals and patents that can convert tallow to lower LDL cholesterol oil with significantly reduced saturation
- A critical evaluation of the current processes available both in journals and patents that enable isolation and extraction of flavour compounds from tallow
- Determination of what technologies/processes exist that may be adapted to carry out tallow conversion and comments on their technical and financial feasibility
- Determination of what technologies/processes exist that may be adapted to carry out isolation and extraction of flavour compounds from tallow and comments on their technical and financial feasibility
- Assessment of commercial uptake of opportunities identified in the project

The information provided in this report will be used as a basis for evaluating a viable process to add value to tallow and what uses and markets would be most suitable for highly monounsaturated tallow-based products and extracted flavours from tallow.

3 Methodology

Information gathered from literature and patent searches on tallow conversion and flavour isolation was sourced via detailed and thorough strategic electronic searches of scientific and technical literature.

Scientific Literature Searches
The scientific literature searches were carried out using the following databases:

FSTA – Food Science and Technology Abstracts – FSTA is the internationally recognised world's leading Food Science and Technology Abstracts database. Covers material published since the late 1960s.

CABI – contains over 3.8 million records from over 10,000 journals, books, conferences, reports, and other kinds of literature published internationally. Subjects covered include animal and crop husbandry, animal and plant breeding, plant protection, genetics, forestry, economics, veterinary medicine, human nutrition, and rural development. This database indexes all significant worldwide publications in meat science.

These two databases were selected because of their complete coverage of the literature of both the food and meat industries. It was felt that a combination of these two would be most likely to supply not only the scientific material but also any significant achievements announced in the trade literature.

Additional searches of the world-wide-web were carried out by a team member with considerable industry experience to identify material on the current uses of tallow in food processing.

Search Strategy
Searches were carried out in mid January, 2011 on FSTA and CABI using combinations of index terms (descriptors) and in the case of CABI, some CABICODES.

Food Science and Technology Abstracts (FSTA)
Tallow searched as a key word – i.e. to identify records with high relevance. The resulting 362 records were all hand-searched to identify relevant items - 66 records were retained as relevant.

Beef with and without fat and tallow as a free text search (i.e. not restricted to keywords) was then combined with Flavour* or Flavor* or volatile* to locate additional items – an additional 8 papers were identified.

CABI Abstracts
Tallow (as descriptor) 1662 records; these were combined with
Health or structured or special* (83 records)
Alcoholysis or transesterif* or esterif* or fraction* (161 records)
Polyunsaturat* or monounsaturat* or olein or oleic (319 records)
Modification or modified or fried or frying (70 records)
Volatile* or flavour* or flavour* (101 records)

These combined sets were hand-combed for relevance and then extracted from the complete tallow set and the remainder combined with a set of CABI Codes that indicated broad food processing applications, to double check that no relevant papers had been missed, namely:

QQ500 Food Composition and Quality
QQ030 Meat Produce
QQ100 Food Processing (General) (Combined 224 records)
QQ600 Food in general (18 records)
The set was also combined with long chain fatty acids (12 records)

27 records were selected

Derwent Innovations Index (DII) – Patent Searches
Intellectual property searches were carried out on Derwent Innovations Index, a respected patent database with worldwide coverage. Derwent covers material back to 1963 although this coverage varies with the country of origin (Table 1). This variable country coverage means that material that has been registered in a single jurisdiction prior to that jurisdiction being covered by Derwent will not appear in these results. The advantage of Derwent, apart from its breadth of coverage, is that it collates patents into their families. This means that the user does not have to bring single applications in different countries for the same patent together in order to follow their registration and status in different patent jurisdictions. If a patent was registered later in a covered zone, the patent family approach sometimes mitigates the country coverage variability issue.

Due to copyright restrictions, abstracts and papers from patents cannot be republished. Therefore, this information has been provided in 2 forms in this Final Report – one section contains only references for patents which can be used for general publication; the other form contains abstracts from the patent searches as an appendix.

Table 1 : Country Coverage by Derwent Innovation Index

Country/Abbreviation	Initial Year of Coverage
Argentina (AR)	1974-1976 only
Australia (AU)	1983 (also 1963-1969)
Austria (AT)	1975
Belgium (BE)	1963
Brazil (BR)	1976
Canada (CA)	1963
China (CN)	1987
Czech Republic (CZ)	1994
Czechoslovakia (CS)	1975-1994
Denmark (DK)	1974
European Patents (EP)	1978
Finland (FI)	1974
France (FR)	1963
Germany (East) (DD)	1963
Germany (DE)	1963
Hungary (HU)	1975
India (IN)	2004
International Technology Disclosures (TP)	1984-1993
Ireland (IE)	1963-1969; 1995
Israel (IL)	1975
Italy (IT)	1966-1969 (section A subjects only); 1978
Japan (JP)	1963
Korea (KR) (South)	1986
Luxembourg (LU)	1984
Mexico (MX)	1997
Netherlands (NL)	1963
New Zealand (NZ)	1993
Norway (NO)	1974
Patent Cooperation Treaty (WO)	1978
Philippines (PH)	1995
Portugal (PT)	1974
Research Disclosure (RD)	1978
Romania (RO)	1975
Russian Federation (RU)	1994 (Russia)
Singapore (SG)	1995

Country/Abbreviation	Initial Year of Coverage
Slovakia (SK)	1994
South Africa (ZA)	1963
Soviet Union (SU)	1963-1994
Spain (ES)	1983
Sweden (SE)	1974
Switzerland (CH)	1963
Taiwan (TW)	1993
United Kingdom (GB)	1963
United States (US)	1963

Search Strategy
Searches were carried out on DII during the third week of December 2010 and some sample sets supplied to the major researcher. As a result of feedback from him, more complex searches were carried out in the first two weeks of January, 2011.

The following synonym sets were used for free-text searches:

Tallow or Beef fat or Suet

To accommodate the unsaturated fatty acids that might be mixed with tallow to produce a healthier oil, the following were also combined with the tallow set:

Canola or Sunflower or sunola or soybean or soyabean

Other health aspects were searched using:

Low saturat* or Unsaturat* or Mono-unsaturat* or Monounsaturat* or reduced cholesterol or Low cholesterol or Glycerol ester or Olein or Stearin or Oleic or Satd or Unsatd or Saturate* or Unsaturated* or Specialty fats

Technologies and applications were searched using the following synonym sets:

Fraction* or Interesterif* or Transesterif* or Alcoholysis or Acidolysis
Sepn or Extn or Extract* or Separat*

Flavour aspects were searched using:

Flavour* or Flavor* or Volatile*

Because tallow is used in a wide variety of industrial applications and also often appears in long lists of fats and oils where claims are made for generic oil technologies, these first sets were restricted to food applications by combining these free text terms with either International Patent Classification (IPC) codes or Derwent

Class Codes – two types of classification systems used on the database to identify broad but specific application areas. The codes used are shown below in their classification hierarchies.

Bolded codes were searched. The asterisk (*) after the code indicates truncation meaning that all possible forms of that code were searched. These variants are not shown.

IPC Code Hierarchy

SECTION A - HUMAN NECESSITIES
A23 - FOODS OR FOODSTUFFS; THEIR TREATMENT, NOT COVERED BY OTHER CLASSES
A23D* - EDIBLE OILS OR FATS, e.g. MARGARINES, SHORTENINGS, COOKING OILS
A23D-009/00 - Other edible oils or fats, e.g. shortenings, cooking oil A23D-009/02 - characterised by the production or working-up

A23L - FOODS, FOODSTUFFS, OR NON-ALCOHOLIC BEVERAGES, NOT COVERED BY SUBCLASSES - see cross reference IPC A23B TO - see cross reference IPC A23J; THEIR PREPARATION OR TREATMENT, e.g. COOKING, MODIFICATION OF NUTRITIVE QUALITIES, PHYSICAL TREATMENT; PRESERVATION OF FOODS OR FOODSTUFFS, IN GENERAL
A23L-001/00 - Foods or foodstuffs; Their preparation or treatment
A23L-001/22 - Spices; Flavouring agents or condiments; Artificial sweetening agents; Table salts; Dietetic salt substitutes
A23L-001/221 - Natural spices, flavouring agents, or condiments; Extracts thereof
A23L-001/312 - from offal, e.g. rinds, skins, marrow, tripes, feet, ears or snouts A23L-001/31 - Meat products; Meat meal
A23L-001/313 - Meat extracts

SECTION C - CHEMISTRY; METALLURGY
C11 - ANIMAL OR VEGETABLE OILS, FATS, FATTY SUBSTANCES OR WAXES; FATTY ACIDS THEREFROM; DETERGENTS; CANDLES
C11B* - PRODUCING (pressing, extraction), REFINING OR PRESERVING FATS, FATTY SUBSTANCES (e.g. lanolin), FATTY OILS OR WAXES, INCLUDING EXTRACTION FROM WASTE MATERIALS; ESSENTIAL OILS; PERFUMES

C11C* - FATTY ACIDS FROM FATS, OILS OR WAXES; CANDLES; FATS, OILS OR FATTY ACIDS BY CHEMICAL MODIFICATION OF FATS, OILS, OR FATTY ACIDS OBTAINED THEREFROM

Derwent Class Code Hierarchy

Chemical Sections
D - Food, Detergents, Water Treatment and Biotechnology
D1 - Food and Fermentation
D11 - Baking - including bakery products, flour, doughs, bakery ovens, dough transporting and/or handling equipment, pies and pasta, but not flour milling. (A21).
D12 - Butchering, meat treatment, processing poultry or fish. (A22).
D13 - Other foodstuffs and treatment - including preservation of food, milk, milk products, butter substitutes, edible oils and fats, non-alcoholic beverages, artificial

sweeteners, food additives and animal feed . (A23B A23C A23D A23E A23F A23G A23H A23I A23J A23K A23L).

D2 - Cosmetics, Disinfectants and Detergents
D23 - Oils, fats and waxes - including fatty acids, essential oils, but excluding butter (substitutes) and montan wax. (C11B C11C).

Results
Seven sets of documents were supplied to the major researcher after the results of searches combining the above concept sets were combed manually for relevance.

Set 1 27 records
Set 2 51 records
Set 3 8 records
Set 4 18 records
Set 5 11 records
Set 6 28 records
Set 7 104 records

Sets 1–6 were all restricted using codes shown in the list above that effectively restricted the results to a food application being indexed or claimed.

Set 7 was an attempt to identify more generic processes such as transesterification etc. of oils (including tallow) without the restriction of food applications to try and identify processes that might not claim food processing but could be suitable for this area of applications. This was probably the set of results with the least guarantee of completeness in the searching process because of the sheer numbers of patents taken out on oil processing.

Some individual searches were also carried out on individual inventors and assignees that appeared to have an intellectual property interest in the area to ensure that all relevant patents in their portfolios had been captured. It is envisaged that more of this sort of double checking will also be carried out again after the final selection of relevant patents has been made.

4 Results

4.1 Conversion of tallow to a healthier oil

The technologies used for this conversion can be grouped into two main categories:

- Fractionation to remove part of the saturated fats and cholesterol to obtain a tallow fraction with reduced levels of saturated fat and cholesterol.
- Transesterification with more unsaturated (healthier) oil to produce a new oil product containing lower levels of saturated fat and cholesterol compared with tallow. The process could be performed on tallow fractions previously separated by fractionation to achieve similar or better outcomes.

4.1.1 Fractionation

Beef tallow has a poor plastic range and is hard at room temperature, making it difficult to use in certain foods. It contains 18% saturated triacylglycerols (TAGs) that do not melt in the mouth, producing an unpleasant sensation (Grompone, 1989). These deficiencies of tallow can be eliminated by separation into various solid and liquid fractions, some of which satisfy the functional properties required for food applications such as frying and preparation of confectionary products.

Tallow is separated into two or more fractions using multi-step crystallisation processes using solvents and temperature (solvent fractionation) or temperature alone (thermal fractionation). The liquid fractions from fractionation can be used directly as deep-frying oil or further modified by transesterification. The solid fractions can be used for specific applications such as shortening, margarine ingredient, and cocoa butter substitute.

Luddy et al. (1973) separated edible beef tallow by acetone crystallisation into five fractions including two liquid fractions (59% and 7%, respectively, w/w) and a semi-solid fraction (20%, w/w). The larger of the two liquid fractions was reported to be a stable product containing minimal *trans* fatty acid, with its quality and composition compared favourably with refined commercial oils. Approximately 60% of its fatty acids were unsaturated with the monounsaturated oleic acid, which is desirable from the health viewpoint, occurring at a level higher than 50%. It was pointed out that this oil contained a lower amount (24%) of palmitic acid (undesirable) compared with palm olein (>40%), which is widely used for cooking and deep-frying. USDA patents based on this solvent fractionation process were filed by Luddy et al. (US3944585, 1976; See Appendix record 17; US4049839, 1977; US4130572, 1978 See Appendix

record 16) claiming “greater usefulness” of the five tallow fractions. It was claimed that one of the liquid fractions was completely liquid at 5°C without winterising, and that the melting point could be further lowered by winterisation or fatty acid rearrangement (randomisation) using sodium methoxide to reduce the amount of disaturated glycerides. This liquid fraction, either alone or in combination with other oils, was claimed as suitable base oil for salad dressings, mayonnaise, fluid shortening, margarine, as well as for cooking and frying. Various applications such as cocoa butter substitute, margarine hard stock, confectionary fat etc were proposed for the remaining fractions with higher melting characteristics.

Each stage of the four-step batch fractionation process described by Luddy, Hampson, Herb, Rothbart (US3944585) required 16-20 hours. A USDA patent, filed in 1977 (Craig, Kozempel and Elias, See Appendix record 15) described a two-step, continuous, solvent (acetone) fractionation process to separate tallow into hard solid, plastic solid and liquid oil. Nominal residence time of the crystallising solution in the system at steady state crystallising temperature was claimed to be only 10 minutes. The plastic solid which melted sharply at body temperature (37°C), displayed thermal properties analogous to cocoa butter, and was claimed to be suitable for use as cocoa butter substitute. The liquid fraction accounted for approximately 65% (w/w) of the starting material, and was liquid at room temperature (21°C). A subsequent cost evaluation by Kozempel and co-workers (1981), of the above mentioned two-step continuous fractionation process concluded that this continuous tallow fractionation may be commercially feasible depending upon the price and market of the solid fractions. In their process, tallow was separated into a liquid fraction suitable for cooking and frying (69%, w/w), and two solid fractions amounting to 14 and 11.6% (w/w), respectively. It must be pointed out that the primary aim of tallow fractionation around this period of time was to obtain cheaper confectionary fats, particularly to replace expensive cocoa butter in chocolate.

The semi-solid fraction from the tallow fractionation (Luddy et al., 1973) had a bland flavour. It was suitable for use as bakery fat, and as a cocoa butter substitute in wide proportions (5-50% by weight of cocoa butter). An economic evaluation performed in the mid 1970s (Taylor et al., 1976) found that the products that result from beef tallow fractionation can compete favourably with cocoa butter and other vegetable oils in food and confectionary industries.

Subsequent investigations by Holsinger et al. (1978) showed that the liquid oil fraction obtained by fractionation of tallow could be used to replace soybean oil in a formulation designed to yield a spray-dried powder for reconstitution into a nutritional beverage. No significant difference in flavour scores was observed, and the product formulated with the tallow liquid fraction was more stable to oxidation than that formulated with soybean oil.

Free cholesterol occurring in tallow remained in the tallow liquid fractions obtained by acetone crystallisation according to the procedure of Luddy et al. (US3944585, 1976; Appendix record 17 and US4049839, 1977; US4130572, 1978 Appendix record 16). A Japanese patent lodged by Snow Brand Milk Co, in 1993 (JP5168434-A)and again in 2001 (JP3135964-B2 – see Appendix record 8) described a procedure for reducing cholesterol content tallow and other animal fats. The method involved dissolving the fat in a mixture of solvents comprising hexane, acetone, ethanol, and water and treating the solution by pseudo-moving bed type chromatography. It was claimed that a large amount of fat can be treated continuously on an industrial scale.

No patents based on dry (solventless) fractionation were found for fractionating tallow. However, a family of Unilever patent applications (Keuning et al., 1981-1984 See Appendix record 13) describing a process for dry fractionation for oils, which was based on achieving a reduction of dilatation values, used tallow as an aid for the fractionation. The process was claimed to be suitable for large-scale industrial use. The process gave fractions that could be used in margarines, bakery fats and cooking fats.

4.1.2 Transesterification

Transesterification or interesterification, i.e. the interchange of glyceride-bound fatty acid chains among two or more oils, can be used to modify the chemical and physical properties of tallow or its fractions. Forssell et al. (1992) interesterified tallow with rapeseed oil using a solvent-free enzymatic process to obtain a product with lower melting properties. They concluded that enzyme-catalysed interesterification, using either fatty acid-selective or triglyceride position-selective enzymes, is a viable alternative to physical blending or chemical interesterification. Beef tallow randomised by treatment with *Candida antarctica* lipase gave a product that was a satisfactory replacement for cocoa butter in dark chocolate manufacture (Osborn and Akoh, 2002). The modified tallow did not soften the chocolate, and reduced the bloom rates.

Interesterification of beef tallow with canola oil by chemical catalysis led to a reduction in the trisaturated and triunsaturated content (Liu et al., 2010, Meng et al., 2010). The oxidative stability of the modified tallow was reduced compared with the starting oil blend but can be improved by the use of antioxidants (0.02% w/w, TBHQ). Two shortenings obtained from tallow/canola oil blends containing 85% and 65% tallow, respectively, performed satisfactorily when used for bread-making, producing breads with sensory attributes similar to those of breads prepared with commercial shortenings.

Kowalski and co-workers (2004 and 2005) performed chemical as well as enzymatic interesterifications on tallow/rapeseed blends of 50/50 and 75/25. Fatty acid positional distribution was random when chemical interesterification was used and near-random when Novozyme 435 enzyme was used. The fatty acid composition at *sn*-2 remained practically unchanged when Lipozyme M enzyme was used. A similar outcome was obtained when tallow stearin was interesterified with sunflower oil (Kowalska et al., 2005a), soybean oil (Kowalska et al., 2005b), or rapeseed oil (Kowalska et al., 2007).

Bhattacharyya and co-workers (2000) performed both chemical and enzymatic interesterifications on fractionated tallow and vegetable oils such as sunflower, soybean, and rice bran. The products were suitable for various food applications. Lee and co-workers (2002) reacted the liquid fraction separated from beef tallow with medium chain fatty acids using enzyme catalysis. The product predominantly contained medium-chain triglycerides, which have applications as nutraceutical and pharmaceutical products.

A Japanese patent (Yamazaki, et al., JP2006160906-A see Appendix record 6) lodged by Asahi in 2004 described the preparation of a margarine/shortening ingredient with excellent flavour and mouthfeel. It was obtained by transesterification of tallow with fully hardened tallow, and blending the product so obtained with soybean oil and a further amount of tallow. A *trans* fat-free product was claimed. A Unilever patent, applied for in the Netherlands (NL8104823-A See Appendix record 11) in 1983 claimed the technology for the production of a fat ingredient from tallow which imparted butter-like properties to margarine. The ingredient was produced by transesterification of tallow or a fraction thereof (especially tallow olein) with an unsaturated vegetable oil such as sunflower, soya, safflower, and/or groundnut, followed by blending the product with a further amount of tallow or its fraction. It was

claimed that the margarine produced using this tallow-based ingredient had hardness and plasticity properties very similar to natural butter. In a slightly modified version (Stratmann and Legge, See Appendix record 12 for details of this family of patents), lodged in 1982, Unilever claimed the production of a relatively cheap ingredient that was useful in the manufacture of spreads for which elasticity, plasticity, and melting behaviour similar to natural butter was claimed. The modification introduced was the inclusion of hydrogenated oil among the transesterification reactants.

Another patent lodged in the Soviet Union in 1978 by the Fats Research Institute, (Vasilev, Melamud and Meleshin, SU603366-A See Appendix record 14)) also claimed a process for the manufacture of margarine with butter-like flavour, in which tallow was transesterified with sunflower oil and the product blended with cream and milk. An USDA patent (Luddy et al, US4049839-A and US4130572-A Appendix record 16) claimed a process for fractionating tallow to obtain a tallow fraction that could be used as a *trans* fat replacer in margarines and shortenings.

Novozymes patent applications (Nielsen et al, WO2009124844-A2 and 2009124844-A3 See Appendix record 2) described a fully enzyme-based process for producing oils enriched in monounsaturated fatty acids (healthier product) from various fats including tallow. The fat was first hydrolysed using lipolytic enzymes selective for saturated fatty acids and/or lipolytic enzymes selective for the *sn*-1 and/or *sn*-3 position of the triglyceride. The resulting monoglyceride, containing lower levels of saturated fatty acids than the starting fat (tallow), was re-esterified with monounsaturated fatty acids in the free or esterified form. An enzymatic process was used. Applications as fried oil or an ingredient for the manufacture of margarine, shortening, for example, were claimed.

A Japanese patent application in 1992 by Ajinomoto (JP4065493-A.-see Appendix record 9) described a single-step conversion (without the initial hydrolysis step in the Novozymes patent (Nielsen et al – see Appendix record 2) of saturated fat to a less saturated fat using enzyme immobilised on an anion exchange resin. A *trans* fat replacer with good flavour was claimed.

A family of 3 patent applications (USA and world coverage) in 2010 by Bunge Oils (Dayton et al. WO2010024924-A2, US2010055234-A1 and WO2010024924-A3 See Appendix Record 1) achieved a similar outcome to the process described above by using a polypeptide to cause hydrolysis. The polypeptide lipase allowed selective removal of fatty acids from the *sn*-2 or *sn*-1/sn-3 positions of the triglycerides. The

synthesised structured lipid had lower saturated fat content than the original triglyceride. A family of 5 patent applications by Archer Daniels Midland (Binder et al., 2006 US2006257982-A1 and others See Appendix record 5) described a method to purify the triglyceride prior to modification by transesterification. It was claimed that the purification step using vegetable protein helped to extend the useful life of the enzymes used for transesterification.

4.2 Tallow and beef flavour

We observed that while a significant body of scientific literature existed on the subject of cooked meat flavour there was little published on flavour compounds in tallow. A large number of volatile and non-volatile flavour compounds occur in cooked meat and actual compounds responsible for the characteristic flavour of cooked beef and mutton is not well understood. It has been suggested that the basic meaty flavour is the same for beef, pork and lamb, and it is derived from the water-soluble fraction of muscle, whilst the species-specific differences in the aroma of cooked meats are mainly due to concentration and composition differences in lipid-derived flavour substances (Pearson et al., 1973).

Gasser and Grosch (1988) reported 2-methyl-3-furanethiol, 2-acetyl-1-pyrroline, methional, *trans*-2-nonenal, *trans,trans*,2,4-decadienal, β-ionone, and bis(2-methyl-3-furyl) disulfide as the compounds making the greatest contribution to the intensity of cooked beef flavour. Two of these strong odorants, i.e. *trans*-2-nonenal and *trans,trans*,2,4-decadienal, are derived from fatty acid (linoleic acid) oxidation. However, it should be emphasised that, contrary to a recent claim by Song et al (2011), these are not necessarily character-impact compounds of beef flavour, but simply compounds that strongly contribute to the overall flavour intensity of beef.

A method to generate beef flavour from tallow was applied for by the Shanghai Institute of Applied Technology in 2007 (Gong et al., CN101214042-A See Appendix record 3). It involved heating tallow in an oil bath to produce “tallow oxide” which was subsequently reacted with L-cysteine in a Maillard-type reaction to generate beef flavour. The product can be used in frying oils to produce “fried-food” flavour. Another Chinese patent application by the Huabao Food Flavour & Fragrance Shanghai Company in 2009 (Gao, Yu and Hou, WO2009124844-A2 and WO124844-A3 See Appendix record 4) hydrolysed the tallow using an enzyme prior to heating in the presence of oxygen to obtain natural “meat flavour”.

In 2 patents, one granted in the USA, Massie et al., 2002 (US6344225-B1 See Appendix record 7b) and the other applied for in Canada in 1999 (Massie et al. CA2252312-A1 See Appendix record 7a) by Source Food Technologies, a stearin fraction of beef tallow (2-7.5%, w/w) combined with an effective amount of beef tallow volatiles (50-400 ppm), upon heating, has been claimed to impart desirable flavour to frying oils. The flavour is formed by heating the stearin and the volatiles in the presence of air at a temperature exceeding 150°C. Claimed uses included preparation of fried foods such as French fries and onion rings.

Proctor & Gamble Company filed a patent process (Yang, US5104678-A; US5169670-A and others, See Appendix record 10) for producing a frying oil which is healthier (less saturated) than tallow yet retained the ability to impart beef/tallow flavour to fried food. It was produced by fractionating tallow fatty acids to obtain a more unsaturated fatty acid fraction which was subsequently esterified with glycerol. It was claimed that the product had little or no cholesterol (less than 5 mg/100g oil), and imparted tallow or cooked meat (beefy) flavour to foods fried in it. It was further claimed that the minor fatty acids concentrated in this more unsaturated fraction of tallow produced this desirable flavour on heating. The product contains no more than 15% saturated fatty acids. The same company filed a patent in 1978 (Kravis, US4169901, See Appendix record 18) for the process of producing a meaty-flavoured deep-frying composition which was useful for imparting meaty flavour to foodstuffs deep-fried therein. It was further claimed that the frying oil medium stabilised the volatile, artificial meat-like flavouring so as to extend the effective delivery of the flavourant to the fried foodstuff materials over an extended period through repeated cycles of deep-fat frying. However, it must be pointed out, that the vegetable oil base selected as the medium for the flavourant and deep-frying were saturated oils such as coconut, palm-kernel and babassu oil, and therefore was not suitable from a health point of view.

4.3 Tallow commercial processing considerations

4.3.1 Raw materials

According to the Codex Standard For Named Animal Fats (Codex Stan 211-1999) the definition of edible tallow is: “Edible tallow (dripping) is the product obtained by rendering the clean, sound, fatty tissues (including trimming and cutting fats), attendant muscles and bones of bovine animals and/or sheep (*Ovis aries*) in good health at the time of slaughter and fit for human consumption”. However, crude tallow produced in accordance with the Codex guidelines can still have free fatty acid (FFA) levels up to 1.25%w/w, a peroxide value of up to 10 milliequivalents active oxygen/kg fat and a strong characteristic tallow odour and flavour. In practice, relatively small volumes of edible tallow, according to the Codex definition, is produced and the applications for this material are limited to applications where the odour and flavour of this material is acceptable; for example, some deep frying applications, but generally the frying life of this material is less than other commercially produced frying fats.

Accurate data on the quantity of tallow currently produced in Australia is not readily available. Most estimates are based on a survey conducted in 2000-01 by the Australian Renderers’ Association (ARA). That survey indicated the following total production and major uses (Table 2):

Table 2: Total production and major uses of tallow in Australia in 2000-01 (ARA)

	Tonnes
Total production	567,200
Exports	390,000
Domestic – edible usage	66,000
Domestic – intensive animal production	5,000
Domestic – soap and oleo chemical	50,000
Domestic – pet food	30,000
Other	26,200

An Australian Bureau of Statistics (ABS) Trade Report from 2003-04 reported total inedible tallow exports of 368,700 tonnes. When edible tallow exports of 24,371 tonnes are included, the total is very close to the ARA export figures above. These quantities include tallow derived from all raw material except poultry.

Although the ARA lists 66,000 tonnes for edible usage, it is probably not produced in an AQIS-certified edible tallow plant, but from edible materials. There are very few AQIS-certified edible tallow plants in Australia and it is likely that the entire annual production is represented by the ABS export figure of 24,000 tonnes.

If it is considered that tallow from edible material is required to be the source for the production of a reduced cholesterol frying oil, then an alternative source of raw material is the fatty trim from slaughtering and boning operations. This trim is approximately 80% fat and at most plants is presently mixed with other inedible raw materials prior to rendering. It has been estimated that from 15 export plants in south-east Queensland and northern NSW, approximately 380 tonnes of this material is available per day. These plants represent approximately 40% of the total Australian beef kill.

If a process was developed to collect and process this trim material separately, approximately 73,000 tonnes of tallow could be produced from these plants annually. When the remaining larger Australian plants are included, the total edible tallow production could be about 140,000 tonnes per annum from this fatty trim.

The majority of crude tallow produced requires additional processing to make it suitable for its final application and subsequent consumption. These processes are carried out by edible oil processors and depending on the application, can include processes that change physical characteristics of the tallow as well as improving the organoleptic properties.

The following sections of this report will provide an outline of these processes and highlight opportunities of these processes to provide added value to tallow products.

4.3.2 Tallow processing

4.3.2.1 Alkali refining

Normally the first stage of processing crude tallow is alkali refining. This process is used to remove FFAs from the crude tallow. In this process, an aqueous solution of sodium hydroxide is added to the tallow to saponify the FFAs that are present in the crude tallow. The saponified FFAs are water soluble and can be separated from the tallow either by gravity, in a batch refining process, or by disc bowl separators in the case of a continuous refining process.

Following the separation of the saponified FFAs, the tallow is normally washed with water to further reduce the soap levels in the tallow. Again this can be done batch-

wise or continuously, depending on the plant set up. This process may be repeated until the appropriate soap level in the tallow is obtained.

After the washing step(s), the tallow is normally dried under vacuum to reduce the water content of the tallow so that it is suitable for further processing.

4.3.2.2 Bleaching

In this step of processing, 1 to 20% of absorbent clay is added to the tallow to remove trace metals, oxidation products and reduce colour. This process is done under vacuum and the tallow is subsequently filtered to remove the used clay.

4.3.2.3 Fractionation

Like most edible oils and fats, tallow is not a pure compound - it is a mixture of a variety of triacylglycerols (TAGs). These have a range of melting points and using fractionation processes, it is possible to separate the low and high melting point TAGs within tallow. It is possible to obtain fractions that are liquid at room temperature to those that have melting points over 50°C. This allows fractions to be tailored to the intended application so that the required functionality is obtained.
There are a number of commercial methods currently used to fractionate edible fats and oils. However, these all use the basic process of controlled cooling of the product so that the product consists of a mixture of solid and liquid TAGs and then separation of solid and liquid components.

Tirtiaux were one of the first to commercialise a dry fractionation process where the semi-solid product is passed over a Florentine filter which consists of a perforated belt where a vacuum is used to draw the liquid fraction (olein) through the belt. The high melting fraction (stearin) is scraped from the belt as it is rotated back to collect more product for fractionation. One of the advantages of this fractionation technique is that no processing aids are added during the fractionation process so no additional processing of the final fractions is required. This is typically the process used for fractionation of butter where retention of flavour components is critical. Several other manufacturers now produce fractionation plants based on this concept e.g. the Desmet Ballestra “Flexifrac” process.

Dry fractionation can also be carried out using a purpose-built filter press to separate the olein and stearin components. Early examples of this process were not used as throughput was quite slow due to the high viscosity of the mixture. However, developments in membrane technology for pressure filtration made a dramatic impact on fractionation of edible fats. This technology allows for improved separation

between olein and stearin fractions allowing control of the fractionation process to better suit the end use. Separation efficiencies comparable to solvent extraction can be achieved. Throughputs have also been improved to the extent that this is now a very cost-effective process.

The Lanza fractionation process commercialised by Alfa Laval's "Lipofrac" process is a wet fractionation process where surfactants are added to the semi-solid product. The resultant mixture is then centrifuged in a disc bowl separator and as the surfactant preferentially adheres to the solid fractions in the stearin, it is possible to separate the stearin and olein fractions. The stearin and surfactant mixture is heated so that the stearin is completely melted and it is then centrifuged. This separates the stearin and surfactant which is recycled back to the start of the process. This process normally starts with crude oils as the stearin and olein fractions need to be refined, bleached and deodorised to completely remove the surfactants used in the process. Several Australian commercial edible oil manufacturers currently use this process to fractionate tallow.

Solvent fractionation is also applied to edible oils. It has the advantage that the oil dissolves in solvent which reduces the viscosity of the mixture making the separation process more efficient. However, the high cost of solvent fractionation plants generally limits their use to high-value edible oil applications e.g. in the preparation of cocoa butter substitutes or equivalents.

4.3.2.4 Hydrogenation

Hydrogenation can be used to increase the melting point of edible fats and oils. This process involves adding a metal catalyst to the heated oil and then sparging hydrogen into the mixture. The process converts the unsaturated bonds within the TAGs in the product to saturated bonds. By controlling the degree of conversion, reaction temperature, hydrogen pressure, catalyst addition rate and composition, the melting profile of the hydrogenated product can be tailored to suit the desired application. This process has been widely used in the edible oil processing industry. One negative side effect of the hydrogenation process is that it produces *trans* fatty acids in partially hydrogenated product. Hydrogenation conditions can be optimised to reduce the formation of *trans* fatty acids, but their formation cannot be completely eliminated. Fully hydrogenated (fully saturated) fats do not contain *trans* fatty acids but generally need to be blended with other "softer" fats due to the high melting point of fully hydrogenated oils.

4.3.2.5 Interesterification

Interesterification is a technique used to modify the physical properties of fats and oils or mixtures of fats and oils by the rearrangement of the fatty acids across the glycerol molecule within the TAGs present in the reaction environment. Interesterification requires the addition of a catalyst to the mixture, under vacuum, at a temperature of approximately 100°C. While this process has been used in the edible oil processing industry for many years, the recent focus on producing "*trans*-free" products has resulted in the increased use of this technology as an alternative or adjunct to hydrogenation.

Traditionally, chemical interesterification has been used in the edible oil processing industry. In this process sodium methylate or sodium ethylate, either as a powder or a solution in alcohol, is added to the mixture. At the completion of the reaction the catalyst is washed out of the oil with water. The oil must be bleached and deodorised before it is suitable for use.

Recent developments in enzyme technology has made enzymatic interesterification more cost effective. De Smet have a commercial enzymatic interesterification process (Interzym) based on the enzyme developed by Novozymes marketed as Lipozyme (see http://www.novozymes.com).

4.3.2.6 Deodorisation

The final step of the basic tallow process is deodorisation. In this process the tallow is heated, under vacuum, to temperatures of 180 to 265°C and steam is sparged into the tallow to remove any odour and taste-producing compounds within the tallow. The exact temperature used depends on the equipment design; if it is batch or semi continuous, vacuum etc. It is worth noting that under high temperature deodorisation conditions it is possible to generate small amounts of *trans* fatty acids in the tallow.

Before the tallow is removed from the deodorisation vessel it is cooled and, if specified, antioxidant is added to the tallow.

4.3.2.7 Packaging

Most bakery applications for edible fats and margarines require the product to be smooth and plastic. While the product composition determines the inherent hardness of the product, the packing process can have a significant influence on the plasticity of the product. To maximise this attribute, the products are normally rapidly cooled in a scraped surface heat exchanger to produce a fine crystal structure and a plastic

product. A variation to this process for harder products is the “drum and complector” process. In this process the molten fat or margarine is spread across a chilled, rotating drum and the solidified product is scraped from the drum as flakes. These flakes are then compressed into blocks.

4.4 Potential tallow applications

One of the key parameters in determining if a fat blend is suitable for a particular application is its melting profile. This is normally determined by measuring the percentage of solid fat at a particular temperature (SFC). There are various analytical techniques for this but the most widely adopted technique utilises pulsed nuclear magnetic resonance (NMR). The use of fractionation, hydrogenation and interesterification either individually or in combination can modify the SFC of a fat or blend of fats to achieve the required SFC for a particular application.

4.4.1 Frying applications

Tallow has been widely used as a frying medium as it has good frying stability and flavour characteristics. However, as it has a melting point of around 44°C, its use is limited to products that will be consumed hot due to a fatty mouth feel associated with the amount of solid fat when consumed cold. This problem can be addressed by fractionating tallow and using the lower melting point olein as the frying medium.

4.4.2 Bakery margarines and shortenings

Cake, shortbread and pastry margarines can be made using blends of tallow fractions to achieve the required SFC for that application. This typically requires a blend of differing melting point fats (including different melting point stearin fractions) to achieve a plastic product that suits the working process in the bakery application. Due to the variety of TAGs present in tallow and its fractions, tallow-based bakery margarines and shortenings have excellent performance characteristics. In recent years there has been a move towards vegetable-based bakery margarines and shortenings generally due to the perceived health benefits. While bakery goods can be made using vegetable-based margarines and shortenings they generally require tighter control over processing techniques due to the reduced plastic range of the vegetable-based products compared to the tallow alternative.

4.4.3 Confectionary fats

Examination of the composition of the stearin fraction of tallow indicates it should be possible to produce a confectionary fat by blending it with coconut or palm kernel oils. Fractionation, hydrogenation and interesterification techniques will be needed to achieve the required SFC for this application. These types of products require a steep melting curve so the product has a large percentage of solid fat at room

temperature (for good “snap” characteristics) and a low percentage of solids at 37°C for organoleptic qualities. Typically in this application a range of product is also required to suit the local climatic conditions.

5 Conclusions

Review of the scientific and patent literature showed that technology exists to convert beef tallow to a food ingredient with significantly reduced saturation. Additionally these technologies can be used to enhance the functional attributes of tallow (and tallow blends) to make it suitable for a wide variety of applications. This can be achieved in either of two ways:

1. Separate tallow by dry or solvent fractionation to obtain a liquid fraction (accounting for approximately 60% by weight of the starting tallow).
    - The liquid fraction so obtained typically contains 40% or less saturated fatty acids compared with normal tallow.
    - There is no reduction in the content of cholesterol level with the liquid fraction containing more cholesterol than the original tallow. However, contrary to the popular views of the past, it is now well established that elevation of serum LDL-cholesterol by dietary cholesterol is insignificant compared with the effect of dietary saturated fatty acids.
    - Another major advantage of fractionation is that no by-products are formed during the fractionation process.
    - Also, dry fractionation does not involve the use of chemicals so it can be considered a more environmentally-friendly process compared to the alternative chemical interesterification process which is catalysed by chemicals, and requires disposal of chemical waste.
    - Dry fractionation using Florentine filter presses or membrane filter presses, wet fractionation using surfactants and solvent fractionation have been commercially adopted in various segments of the edible oil industry.

2. Chemical or enzymatic reactions of tallow and one or more unsaturated vegetable oils by the process of interesterification to obtain products of reduced saturation.
    - The process allows flexibility of manipulating the end product to desired specifications by the choice of the vegetable oil(s) used for the reaction.
    - However, the chemical process invariably results in the formation of by-products (free fatty acids, mono- and di-glycerides) which need to be removed before the product can be used.

- And, as mentioned above, chemical interesterification is less environmentally friendly compared with dry fractionation because of the greater need for chemical use.
- No *trans* fats are generated in either process.

It appears that consumers who were accustomed to the flavour of French fries and other food fried in tallow preferred it over the flavour of foods fried in other oils. This suggests tallow contains unique flavour precursors which produce characteristic 'tallow-fried' flavour after frying. This is analogous to meat flavour which is generated when meat is cooked, probably through a complex series of reactions involving various meat constituents. One patent suggests that the minor fatty acids occurring in the more unsaturated fraction of tallow contains the key precursor compounds required to generate tallow flavour on heating. However, more research, particularly involving the liquid fraction of tallow, is required before considering processes for extracting flavour from tallow. It is perceivable that the liquid fraction of tallow, which is suitable as deep-frying oil, would already contain the necessary flavour precursors to generate tallow flavour on frying.

Both fractionation and interesterification processes (in various forms) have been commercially adopted in the edible oil processing industry to produce a wide variety of product, including tallow and tallow based products. The performance of products including pastry margarines, confectionary fats, frying fats, shortenings and bakery fats can (and have already been done commercially) be enhanced by using fractionation and interesterification processes.

The above are only general comments on technical feasibility; a detailed assessment can only be performed on particular processes. Similarly, the financial feasibility will depend on many factors including the process, size of operation, cost of raw materials, market size and price etc., and can only be performed on a selected project or projects.

6 Accreditation of the reviewers

A number of authors of this review (Christine Margetts, Peter Roupas, Anita Sikes) are accredited reviewers for the Joanna Briggs Institute (JBI) and have undertaken "*Comprehensive Systematic Review*" training on "*Evidence Based Health Care and the Systematic Review of Evidence*", including a module on "*Systematic Review of Experimental and Non-Experimental Study*". The JBI is an initiative of the Royal Adelaide Hospital and the University of Adelaide and is an international collaboration involving medical and allied health researchers and academics across 40 countries in every continent.

7 About the authors

Dr Chakra Wijesundera obtained his PhD in Lipid Chemistry from the University of St Andrews, Scotland. He has over 30 years of international experience in fats and oils research having worked in laboratories in Sri Lanka, UK, Canada, and Australia. He has extensive experience in flavour chemistry having worked for many years at the CSIRO on projects related to cheese flavour and food off-flavours and taints. Currently, he is a Principal Research Scientist within CSIRO Food and Nutritional Sciences. Chakra's current research is aimed at increasing the utilisation of healthier oils in food and control of rancidity in food. Chakra has over sixty journal publications and has supervised two PhD students. He is widely consulted by food industry on quality and technical issues related to fat. Chakra is a co-recipient of the 2010 CSIRO award for research achievement.

Mr Rod Smith obtained his B. App. Sci. from RMIT in 1977 and has had 22 years working in Technical Management roles in the edible fats and oils processing industry for Australia's largest edible oil processors covering the following areas:

- Process control and new process development in refining, beaching, fractionation, interesterification, hydrogenation, winterisation and deodorisation of edible fats and oils
- New product development of retail and commercial fats & oils, margarines & spreads, bakery fats & margarines (cake, pastry etc) , food service products etc
- Technical service to commercial, food service, retail and export customers
- Laboratory management for analytical laboratories and in plant quality control laboratories (laboratories in five sites and a staff of 30 operating 24 hours a day 7 days a week)

- Raw material quality assurance including development of crude tallow purchasing specifications and liaison with numerous rendering plants to develop process improvements to improve tallow quality
- New plant design and commissioning for refining, beaching, fractionation, interesterification, hydrogenation, winterisation and deodorisation of edible fats and oils
- Development of analytical methods and capabilities relevant to edible fats & oils processing

Dr Peter Roupas obtained his PhD from the Department of Medicine at Monash University, Melbourne, Australia in 1988 and completed his postdoctoral research at the University of Michigan Medical School, USA. During his 3 years at the University of Michigan, he was awarded fellowships from the American Diabetes Association (Michigan) and the Juvenile Diabetes Foundation International (New York). On his return to Australia, to the Department of Clinical Biochemistry at the Royal Children's Hospital, Melbourne, he was awarded the 1991 Eli Lilly Diabetes Fellowship and a 4-year fellowship from the National Health and Medical Research Council (NHMRC) of Australia. For the past 15 years, Dr Roupas has been a Research Team Leader at CSIRO and is currently a Project Leader of projects for the CSIRO Food Futures Flagship and the Preventative Health Flagship in functional foods relating to the scientific substantiation of health messages for dietary guidelines and health claims for food standards / regulatory applications. He is currently the Team Leader of the Knowledge Management team within the Pre-Clinical and Clinical Health Substantiation group within CSIRO Food and Nutritional Sciences. Dr Roupas has been an editorial reviewer for 8 scientific journals, an author of 44 papers in peer-reviewed scientific journals, 30 conference papers and 7 book chapters. Dr Roupas is also a Scientific Editor for Elsevier Science UK (*International Dairy Journal*), a member of the Editorial Board of the *Journal of Functional Foods*, and a member of the *Society of Editors*.

Ms Christine Margetts has qualifications in librarianship, information management, writing and editing. She has over 25 years experience in providing information services to scientists and researchers working in agriculture, engineering and food sciences. As part of the Knowledge Management team within CSIRO-Food and Nutritional Sciences, she provides intensive information services in food and ingredient innovations to scientific groups. This includes developing in-depth literature searches and reviews, assistance with scoping studies and project reports

and alerting researchers and business staff on scientific, marketing and intellectual property developments in the food industry.

Mr Neil McPhail has been involved in the area of Meat Industry Services at CSIRO Food and Nutritional Sciences for 10 years, providing technical advice to the meat industry in the form of Meat Technology Updates and responding to technical enquiries. Neil has contributed significantly to research projects of an engineering and technical nature and consulting assignments with the meat processing industry, including the effect of shipping practices on quality of manufacturing beef and the facilitation of a network group for meat industry engineers. His main areas of expertise are in the fields of carcase and carton chilling and freezing, slaughtering and boning processes and solid waste handling and disposal. During the provision of these services and completion of projects, Neil has developed many contacts throughout the meat industry and has an extensive knowledge of most meat processing plant operations.

Ms Anita Sikes is a science graduate and project leader in the Food Biochemistry and Chemistry group at Coopers Plains, with 20 years experience in meat science relating to red meats. She has been involved in several red meat research areas funded by Meat and Livestock Australia. She has particular expertise in the role of collagen and connective tissues in muscle texture and processing, as well as expertise in strategic research at the micro-structural and biochemical level.

8 Appendix

Abstracts from patent searches

Record 1
Patent Assignee(s): BUNGE OILS INC (BUNG-Non-standard); DAYTON C L G (DAYT-Individual); HITCHMAN T (HITC-Individual)

Patent Number(s): WO2010024924-A2; US2010055234-A1; WO2010024924-A3

Title: Hydrolyzing an oil or fat e.g. Euglena gracilis oil and olive oil, comprises adding a polypeptide to oil or fat to cause hydrolysis, where the polypeptide has a hydrolase activity e.g. palmitase activity

Inventor Name(s): BARTON N; BUENO A; CUENCA J G; DAYTON C L G; HITCHMAN T; KLINE K A; LYON J; MILLER M L; WALL M A; BARTON N R; KLINE K

Abstract: NOVELTY - Method (M) of hydrolyzing an oil or fat comprises obtaining a composition (C1) comprising an oil or fat, where the oil or fat can be hydrolyzed by a polypeptide (Y1) having a hydrolase activity, and adding the polypeptide to the composition to cause hydrolysis of the oil or fat.

USE - The methods are useful for: hydrolyzing oil or fat in a composition which is a margarine, a shortening, a mayonnaise, a pourable dressing, a spoonable dressing, a sauce, a marinade, a condiment, a spray oil, a cooking oil, a frying oil, a salad oil, a confectionary, a cocoa butter alternative, a cocoa butter substitute, a cocoa butter replacer, a cocoa butter equivalent, a food, a food additive, or their manufacturing intermediates, where the hydrolyzed fat has a lower saturated fat or trans fat content than the oil or fat prior to hydrolysis; biocatalytic synthesis of a structured lipid which is cocoa butter alternative, a synthetic cocoa butter, a natural cocoa butter, 1,3-dipalmitoyl-2-oleoylglycerol, 1,3-distearoyl-2-oleoylglycerol, 1-palmitoyl-2-oleoyl-3-stearoylglycerol or 1-oleoyl-2,3-dimyristoylglycerol; catalyzing an interesterification reaction to produce new triacylglycerides; producing a DAG; and hydrolyzing an fat or oil which is refined oil. The interesterification method is useful for preparing a food, feed or an oil (all claimed). (Y1) is useful for e.g. production of alcohol and waste management.

ADVANTAGE - The polypeptide has lipase activity, including palmitase and stearatase activities, which enable it to selectively eliminate undesirable fatty acids from triglycerides or replace such fatty acids with fatty acids having more desirable chemical, physical or biological properties, hence increasing the value of the produced lipids.

DETAILED DESCRIPTION - Method (M) of hydrolyzing an oil or fat comprises (A1) obtaining a composition (C1) comprising an oil or fat, which is hydrolyzed by a polypeptide (Y1) having a hydrolase activity, where (Y1) is isolated, synthetic or recombinant, and: (a1) is encoded by (Ia) a nucleic acid comprising a nucleotide sequence having at least 50% sequence identity to the fully defined sequence of 684 base pairs of SEQ ID NO: 1, as given in the specification, and having at least one base residue change as given in the tables 3 or 4 of the specification, where the nucleic acid encodes at least one polypeptide having a hydrolase activity, or (IIa) a nucleic acid comprising a nucleotide sequence that hybridizes under stringent conditions to a nucleic acid of SEQ ID NO:1, and having at least one base residue change as given in the tables 3 or 4 of the specification, where the nucleic acid encodes a polypeptide having a hydrolase activity; (b1) has at least 50% sequence identity to the fully defined 227 amino acid sequence of SEQ ID NO: 2 over a region of at least 100 residues, and has at least one amino acid residue change as given in the tables 3 or 4 of the specification; (c1) comprises an amino acid sequence of SEQ ID NO: 2 and at least one amino acid residue modification Asp-61-Ala, Asp-61-Glu, Arg-72-Glu, Arg-72-Lys, Glu-116-Ala, Glu-116-Gln, Glu-116-Arg, Glu-116-Thr, Glu-116-Val, Ser-133-Ala, Ile-151-Gly, Ile-151-Ala, Val-163-Arg and/or Asp-164-Arg; or (d1) comprises an amino acid sequence of SEQ ID NO:2 and at least one of amino acid residue modification Ile-20-Leu, Val-62-Ser, Gly-77-Pro, Val-83-Cys, Asp-88-His, Tyr-113-Gly, Glu-116-Thr, Glu-116-Gly, His-140-Lys, Lys-146-Ser, Ile-167-Ser, Leu-180-Glu, Glu-194-Met, Ala-211-Gln, Ser-212-Tyr, Gly-215-Cys, Gly-215-Val, Gly-215-Trp, Ala-218-His, Ala-218-Ser, Val-223-Ala, Ala-225-Met and/or Ala-225-Gln, and (B1) adding (Y1) to the composition to cause hydrolysis of the oil or fat. INDEPENDENT CLAIMS are included for:

(1) a method for biocatalytic synthesis of a structured lipid;

(2) a method (M1) for biocatalytic synthesis of a structured lipid;

(3) a method of catalyzing an interesterification reaction to produce new triacylglycerides;

(4) an interesterification method for preparing a food, feed or an oil;

(5) a method (M2) of producing a DAG;

(6) a composition comprising an oil or fat hydrolyzed by the method (M); and

(7) a method (M3) of hydrolyzing an oil or fat.

DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of a computer system.

Computer system (100)

Processor (105)

Internal data storage device (110)

Data retrieving device (118)

Display (120)

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - BIOLOGY - Preferred Components: In method (M), the oil or fat is: an algal oil, an animal oil, a vegetable oil, an oil having altered fatty acid composition, a low saturated oil and/or a fish oil; and Neochloris oleoabundans oil, Scenedesmus dimorphus oil, Euglena gracilis oil, Phaeodactylum tricornutum oil, Pleurochrysis carterae oil, Prymnesium parvum oil, Tetraselmis chui oil, Tetraselmis suecica oil, Isochrysis galbana oil, Nannochloropsis salina oil, Botryococcus braunii oil, Dunaliella tertiolecta oil, Nannochloris spp. oil, Spirulina spp. oil, Chlorophycease oil, Bacilliarophy oil, canola oil, castor oil, coconut oil, coriander oil, corn oil, cottonseed oil, hazelnut oil, other nut oils, hempseed oil, linseed oil, meadowfoam oil, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, rice bran oil, safflower oil, sasanqua oil, sesame oil, soybean oil, sunflower seed oil, tall oil, tsubaki oil, tallow, lard, butter fat and/or chicken fat. The low saturated oil is high oleic canola oil, low linolenic soybean oil and/or high stearic sunflower oil. The fish oil is candlefish oil, cod liver oil, orange roughy oil, sardine oil, herring oil and/or menhaden oil. The polypeptide is encoded by a nucleic acid having at least one base residue change as given in the tables 3, 4, 9, 10, 11, 16 or 23 of the specification. The polypeptide has at least one amino acid residue change as given the tables 3, 4, 9, 10, 11, 16 or 23 of the specification. Preferred Composition: (C1) is a milk or vegetable-based dietary composition, where (Y1) can hydrolyze the oil or fat in the composition, hence reducing its fat content.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Method: In method (M), the fats or oils comprise molecules having a triacylglyceride backbone and during the hydrolysis fatty acids are selectively removed from a Sn1-Sn3 position of at least some of the triacylglyceride backbone. The method for biocatalytic synthesis of a structured lipid comprises: providing (Y1); providing a composition comprising a triacylglyceride (TAG); contacting (Y1) with the composition under conditions where (Y1) hydrolyzes an acyl residue at the Sn2 position of the TAG, hence producing a 1,3-diacylglyceride (DAG); providing a R1a ester; providing a R1-specific hydrolase; and contacting the 1,3-DAG with the R1a ester and the R1-specific hydrolase under conditions where the R1-specific hydrolase catalyzes esterification of the Sn2 position, hence producing the structured lipid. The method (M1) for biocatalytic synthesis of a structured lipid comprises (a2) providing (Y1); (b2) providing a composition comprising a TAG; (c2) contacting (Y1) with the composition under conditions where (Y1) hydrolyzes an acyl residue at the Sn1 or Sn3 position of the TAG, hence producing a 1,2-DAG or 2,3-DAG; and (d2) promoting acyl migration in the 1,2-DAG or 2,3-DAG under kinetically controlled conditions, hence producing a 1,3-DAG. The method of catalyzing an interesterification reaction to produce new triacylglycerides comprises: (a3) providing a composition comprising (Y1); (b3) providing a mixture of triacylglycerides and free fatty acids; and (c3) treating the mixture with (Y1) under conditions where (Y1) can catalyze exchange of free fatty acids with the acyl groups of triacylglycerides, hence producing new triacylglycerides enriched in the fatty acids. The interesterification method for preparing a food, feed or an oil comprises providing an interesterification reaction mixture comprising a stearic acid source material which is stearic acid and/or stearic acid monoesters of low molecular weight monohydric alcohols; providing a food, feed or an oil containing a triacylglyceride; providing (Y1); interesterifying the stearic acid source material and the triacylglyceride of the food, feed or oil; and separating free fatty acid components from interesterified glyceride components of the interesterification mixture to provide an interesterified oil product and a fatty acid mixture comprising fatty acids and/or fatty acid monoesters, released from the food, feed or oil. The method (M2) of producing a DAG comprises: providing an oil composition comprising a quantity of TAG; providing (Y1); and contacting the oil composition with (Y1) under conditions sufficient for the polypeptide to hydrolyze an acyl residue on the TAG to form a DAG. The method (M3) of hydrolyzing an oil or fat comprises reacting the oil or fat with a

palmitase enzyme in presence of an emulsifier having hydrophilic-lipophilic balance greater than 12, where the palmitase enzyme is encoded by a nucleic acid sequence having at least 50% sequence identity to SEQ ID NO: 1 and having: a nucleotide change (or its equivalent) encoding the amino acid residue at position 95 (or its equivalent) as given in the table 9 of the specification; nucleotide changes (or their equivalents) encoding the amino acid residues at positions 85 and 172 (or their equivalents) as given in the table 15 of the specification; a nucleotide change (or its equivalent) encoding the amino acid residue at position 83 (or its equivalent) as given in the table 16 of the specification; or the silent mutations 35gct, 102gtt, 108agt, 117ctt, 126agg, 133tct or 188acg. In method (M): the oil or fat is present in a feed or a food, and the hydrolysis is accomplished prior to the consumption of the feed or food by an animal or an individual; and the oil or fat comprises at least one of a triacylglycerol, a diacylglycerol or a monoacylglycerol, and (Y1) is contacted with the oil or fat under conditions where (Y1) hydrolyzes the triacylglycerol, diacylglycerol or monoacylglycerol, where the hydrolysis causes the amount of triacylglycerol, diacylglycerol or monoacylglycerol in the composition to decrease. The method (M) further comprises providing an R1b ester and an R1-specific lipase, and contacting the 1,3-DAG with the R1b ester and the R1-specific lipase under conditions where the R1-specific lipase catalyzes esterification of the Sn2 position, hence producing a structured lipid. The step (d2) further comprises using ion exchange resins, where the kinetically controlled conditions comprise non-equilibrium conditions resulting in production of an end product having greater than a 2:1 ratio of 1,3-DAG to 2,3-DAG. The interesterification reaction is continued until there is substantial equilibration of the ester groups in the 1-, 3- positions of the glyceride component with non-glyceride fatty acid components of the reaction mixture. In method (M3): the reaction is conducted at 20-70 degrees C; the reaction mixture comprises 1-20% water based on the total weight of the reactants; and the reaction yields an oil or fat comprising 1% or 5% palmitate based on the total weight of the oil or fat. The method (M3) further comprises addition of a phospholipid. Preferred Components: The altered fatty acid is high oleic acid and/or low linolenic acid. In method (M), the fatty acid is acetic, butyric, caproic, caprylic, undecanoic, lauric, myristic, pentadecanoic, palmitic, margaric, stearic, arachidic or behenic acid. The oil or fat comprises a glycerol ester of a polyunsaturated fatty acid. The hydrolyzed oil or fat comprises at least one of a low-saturate oil or fat, a no-trans oil or fat, a lipid containing essential fatty acid, a lipid containing monounsaturated fatty acid, a lipid containing phosphocholine, a lipid containing phosphoserine, a lipid containing a phytosterol, a 1,3-diacylglyceride, a 2-monoacylglyceride or a triacylglyceride. The R1-specific hydrolase is an Sn2-specific lipase. The R1a and R1b ester comprise a fatty acid of lower saturation than the hydrolyzed acyl residue. The R1a ester comprises: at least one of an omega -3 fatty acid, an omega -6 fatty acid, an omega -9 fatty acid, a mono-unsaturated fatty acid, a phospho-group, a phytosterol ester or oryzanol; or a moiety which is alpha -linolenic acid, stearidonic acid, eicosapentaenoic acid, docosahexaenoic acid, gamma -linolenic acid, dihomo- gamma -linolenic acid, arachidonic acid, oleic acid, palmoleic acid, choline, serine, beta -sitosterol, coumestrol or diethylstilbestrol. The synthesized structured lipid has a lower saturated fat or trans fat content than the triacylglyceride. The R1-specific lipase is a Sn1- or a Sn3-specific lipase. The R1b ester comprises: at least one of an omega -3 fatty acid, an omega -6 fatty acid, a mono-unsaturated fatty acid, a phospho-group, a phytosterol ester or oryzanol; or a moiety which is alpha -linolenic acid, eicosapentaenoic acid, docosahexaenoic acid, gamma -linolenic acid, dihomo- gamma -linolenic acid, arachidonic acid, oleic acid, palmoleic acid, choline, serine, beta -sitosterol, coumestrol, diethylstilbestrol or oryzanol. The hydrolase activity of (Y1) is 1,3-specific lipase activity. The mixture of step (b3) comprises 1,3-dipalmitoyl-2-monoleine. The new triacylglycerides of step (c3) comprise at least one of 1-palmitoyl-3-stearoyl-2-monoleine or 1,3-distearoyl-2-monoleine. The new triacylglycerides of step (c3) have a lower saturated fat or trans

fat content than the triacylglycerides of step (b3). The interesterified triacylglycerides have a lower saturated fat or trans fat content than the triacylglycerides of the food, feed or oil. In the method (M2): (Y1) is Sn2 specific and the DAG produced is 1,3-DAG; or (Y1) is Sn1 or Sn3 specific and the DAG produced is a 1,2-DAG or a 2,3-DAG; and the acyl residue comprises a saturated or a trans fatty acid and the DAG is a lower saturated or trans fat than the TAG. In the method (M3): the nucleic acid sequence is the sequence of SEQ ID NO: 1; and the emulsifier is sodium oleate, potassium oleate, sodium linoleate, potassium linoleate, sodium linolenate, potassium linolenate, sodium laureate, potassium laureate, sodium stearate, potassium stearate, sodium palmitate, potassium palmitate, sodium palm oleate and/or potassium palm oleate.

Drawing:

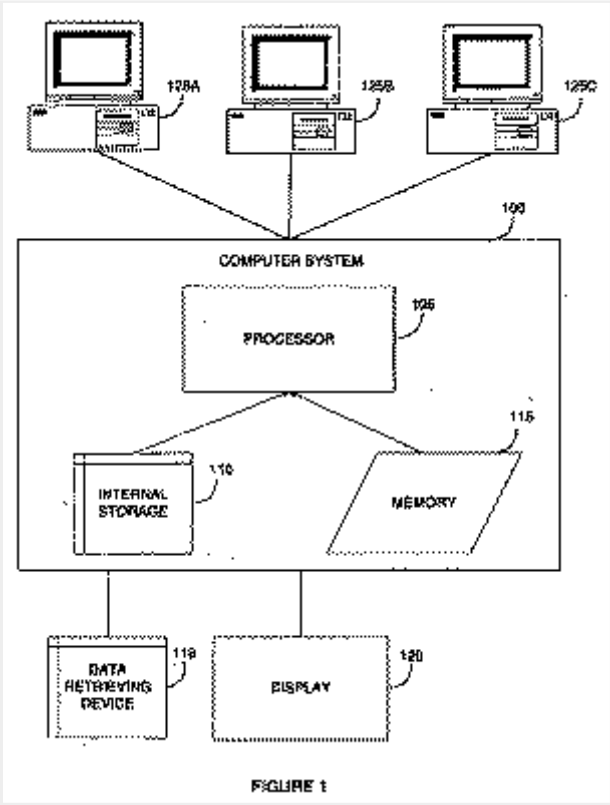


FIGURE 1

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
WO2010024924-A2	04 Mar 2010	C12P-007/64	201020	Pages: 312	English
US2010055234-A1	04 Mar 2010	A23D-009/02	201020		English
WO2010024924-A3	29 Apr 2010	C12N-009/20 C12P-007/64	201029		English

Application Details and Date:

WO2010024924-A2	WOUS004904	28 Aug 2009
US2010055234-A1	US202204	29 Aug 2008
WO2010024924-A3	WOUS004904	28 Aug 2009

Record 2 of 17

Patent Assignee(s): NOVOZYMES AS (NOVO)

Patent Number(s): WO2009124844-A2; WO2009124844-A3

Title: Producing monounsaturated fatty acids enriched glyceride product to prepare e.g. biodiesel involves alcoholysis by lipolytic enzymes selective for saturated fatty acids for 1-position and/or 3-position; and separation of the fractions

Inventor Name(s): BORCH K; COWAN W D; ERNST S; HOLM H C; NIELSEN P M; SENG Y H

Abstract: NOVELTY - A process for producing a glyceride product which is enriched in monounsaturated fatty acids relative to the starting glyceride involves alcoholysis of triglycerides employing lipolytic enzymes selective for saturated fatty acids and/or lipolytic enzymes selective for the 1-position and/or the 3-position in a glyceride; and separation of saturated fatty acid esters (fraction A) from a monounsaturated glycerides (fraction B).

USE - For producing a glyceride product which is enriched in monounsaturated fatty acids relative to the starting glyceride; for producing biodiesel, surfactant, or high purity grade chemicals; and for producing consumer products and/or fried food products (preferably edible oil, consumer oil, margarine, shortenings, frying oil, battered fried products, baked products like bread, cake, cookies, biscuits or snack foods such as e.g. chips and french fries) (all claimed).

ADVANTAGE - The process is a high efficient process and generates high purity products such as fatty acid esters; and provides a high purity chemical grade or high purity food grade.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for a glyceride product comprising monounsaturated fatty acids (at least 70-100 mole%).

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - BIOLOGY - Preferred Components: The lipolytic enzyme selective for saturated fatty acids is selected from Candida antarctica lipase A, Fusarium oxysporum lipase and/or variants. The lipolytic enzyme selective for the 1-position, the 3-position or both positions is selected from Candida antarctica B lipase, Chromobacterium viscosum, dog gastric lipase, dog pancreatic lipase, Fusarium solani cutinase lipase, guinea pig pancreatic lipase, Human gastric lipase, Humicola lanuginosus lipase, human pancreatic lipase, lipoprotein lipase, Mucor miehei lipase, Pseudomonas aeruginosa lipase, Penicillium camemberti lipase, Pseudomonas fluorescens lipase, Pseudomonas glumae lipase, porcine pancreatic lipase, Penicillium simplicissimum lipase, Rhizopus arrhizus lipase, rabbit gastric lipase, Fusarium heterosporum lipase, Candida rugosa lipase and/or variants.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Process: The process further involves alcoholysis or hydrolysis of fraction B and/or a sub fraction employing either lipolytic enzymes selective for saturated fatty acids and/or lipolytic enzymes selective for the 1-position, the 3-position or both positions in a glyceride, or a lipolytic enzyme which is selective for monoglycerides. The process further involves removal of glycerol from the glyceride fractions by methods of centrifugation,

decantation, or membrane separation. The re-esterification further involves a step to remove volatiles such as released alcohols or unreacted esters and fatty acids. The step to remove volatiles is selected from evaporation, distillation, and deodorization. The unreacted esters or fatty acids are reused for re-esterification. Preferred Components: The triglycerides comprise at least 30%, at least 35%, at least 40%, at least 45% or at least 50% monounsaturated fatty acids. The triglycerides are having at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75%, or at least 80% monounsaturated fatty acid residues in the 2-position. The source of triglycerides is palm oil, peanut oil, soybean oil, rapeseed oil, sunflower oil, olive oil, beef tallow, butter fat, cocoa butter, pork lard, poultry fat or their corresponding olein. The alcoholysis is performed by conversion of the triglyceride with a lower alkyl alcohol (preferably 1-3C alcohol, especially ethanol). The conversion in alcoholysis to fatty acid esters is below 5%, below 10%, below 15%, below 20%, below 25%, below 30%, below 35%, below 40%, below 45% or below 50%. The conversion in alcoholysis to fatty acid esters is at least 40%, at least 45%, at least 50%, at least 55%, at least 60%, at least 65%, or at least 70%. The glyceride product comprises long-chain fatty acids (preferably having a carbon number of at least 14, at least 16, and/or at least 18). The fraction A enriched in saturated fatty acid esters is further purified to obtain a sub fraction A1 which relative to fraction A is enriched in saturated fatty acid esters, a sub fraction A2 which relative to fraction A is enriched in monounsaturated fatty acid esters, and optionally a sub fraction A3 which relative to fraction A is enriched in saturated fatty acid esters and which is different from sub fraction A1. The sub fraction A2 is even further purified to obtain a sub fraction A4 (from A2) which is even more enriched in monounsaturated fatty acid esters. The sub fraction A1 is essentially a single molecular species. The sub fraction A1 essentially is ethylpalmitate, sub fraction A2 essentially is ethyloleate and sub fraction A3 essentially is ethylstearate. The sub fraction A1 is at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100% ethyl-palmitate. The fraction B enriched in monounsaturated glycerides and/or any sub fractions derived from it is re-esterified with a composition rich in monounsaturated fatty acid present as esters or free fatty acids, to produce a glyceride product having at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100% monounsaturated fatty acids. The re-esterification is enzymatic. The monounsaturated fatty acid esters for re-esterification are obtained from the sub fraction A2, the sub fraction A4, or a distillate, hydrolysate or alcoholysate of a vegetable oil. The vegetable oil is selected from sunflower oil, peanut oil rapeseed oil, soybean oil, olive oil or alternatively from modified varieties of it enriched in monounsaturates and/or reduced in polyunsaturates. The content of triglycerides in the glyceride product is at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100%. Preferred Product: The product further comprises less than 5%, less than 4%, less than 3%, less than 2%, less than 1% of saturated fatty acids of the total fatty acids in the glycerides.

EXAMPLE - No suitable example given.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
WO2009124844-A2	15 Oct 2009	C12P-007/64	200973	Pages: 25	English
WO2009124844-A3	07 Jan 2010	C12P-007/64	201004		English

Application Details and Date:

WO2009124844-A2	WOEP053513	25 Mar 2009
WO2009124844-A3	WOEP053513	25 Mar 2009

Record 3

Patent Assignee(s): SHANGHAI INST APPLIED TECHNOLOGY (SHAN-Non-standard)

Patent Number(s): CN101214042-A

Title: Preparing beef flavor, involves placing tallow in reaction vessel, heating in oil bath, using Maillard reaction by placing raw material e.g. tallow oxide in vessel, adding preservative and thickening agent or powder medium

Inventor Name(s): GONG G; XIAO Z; RONG S; CAI B; ZHANG W

Abstract: NOVELTY - Preparing beef flavor, involves placing adequate tallow in four opening reaction vessel, fixing air pump, air pipe, thermometer, reflux condenser and stirrer, heating in oil bath, opening air pump to adjust rate of flow, reducing temperature to obtain tallow oxide, making flavor using Maillard reaction by placing raw material e.g. tallow oxide, L-cysteine, vitamin B1 and water in vessel, adjusting pH, reducing temperature, adding preservative and thickening agent to obtain paste of beef flavor or adding powder medium to obtain farinose beef flavor.

USE - The method is useful for preparing beef flavor.

ADVANTAGE - The method reduces the extraction process and provides excellent fragrance, and is inexpensive.

DETAILED DESCRIPTION - A method for making beef flavor involves placing adequate tallow into the four opening reaction vessel, fixing air pump, air pipe, thermometer, reflux condenser and stirrer, heating in oil bath at 120-160 degrees C and stirring slowly, opening air pump to adjust rate of flow to 0.4-0.8 L/minasterisk100g at 120-160 degrees C, stopping heating after 2-4 hours, reducing the temperature to 45-55 degrees C and obtaining tallow oxide used in the second reaction, using Maillard reaction to make beef flavor with raw material such as (in wt. pts) tallow oxide (20-50), L-cysteine (0.8-4.5), glutamic acid (0.5-2.5), alanine (0.5-2.5), glucose (0.8-4.5), xylose (0.5-2), vitamin B1 (0.8-3.5) and water (50-80), where, the alanine can be replaced by aspartate, proline or glycine, placing raw material in vessel, adjusting pH values to 6.5-7.5, placing in pressure reactor for heating upto 110-130 degrees C, reacting for 1-3 hours, taking out to reduce the temperature to 48-60 degrees C, adding preservative and thickening agent, stirring, obtaining paste of beef flavor or adding powder medium and stirring to obtain farinose beef flavor, where the preservative is chosen from fumaric, sodium diacetate, ethyl p-hydroxybenzoate, sodium benzoate, benzoic acid or potassium sorbate, the thickening agent is chosen from arabic gum, modified starch, xanthan gum, sodium tripolyphosphate or sodium alginate, the powder medium is chosen from starch, modified starch, glucose or lactose.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language

CN101214042-A	09 Jul 2008	A23L-001/231	200902	Pages: 7	Chinese

Application Details and Date:

CN101214042-A	CN10173242	27 Dec 2007

Record 4

Patent Assignee(s): HUABAO FOOD FLAVOUR & FRAGRANCE SHANGHAI CO LTD (HUAB-Non-standard)

Patent Number(s): CN101194704-A

Title: Preparation of using animal tallow as raw material to oxidize and thermal-crack into meat flavor spice comprises executing biotransformation, oxidation, thermal cracking

Inventor Name(s): GAO Y; YU Z; HOU X

Abstract: NOVELTY - Preparation of animal tallow comprises adding 0.05-1.0% lipase into mixture of animal tallow and buffer solution, stirring, enzyme digesting in 30-60 degrees C for 3-8 hours; inactivating the obtained zymolyte from step (1) in 75-85 degrees c for 10-30 min; transferring the obtained zymolyte from step (2) into reaction kettle with reflex condenser, increasing temperature, putting into the gas containing oxygen, reacting from 0.5-2 hours, obtaining meat flavor spice.

USE - Animal tallow as raw material to oxidize and thermal-crack into meat flavor spice

ADVANTAGE - The method takes the animal tallow as raw material, executes biotransformation to the animal tallow by preferable lipase so that free fatty acid is hydrolyzed out from part triglyceride in the animal tallow, and executes oxidization and thermal, so as to obtain the natural meat flavor spice. It has real fragrance, simple structure and low cost.

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - BIOLOGY - Preferred Components: Buffer solution is dipotassium hydrogen phosphate, disodium hydrogen phosphate, tripotassium citrate or trisodium citrate solution which their consistency is 0.05-0.1 mol/L. Animal tallow is chicken fatty, cattle fatty, pig fatty or sheep fatty. Gas containing oxygen is oxygen, air, oxygen and nitrogen, and oxygen and carbon dioxide. Preferred Method: Weight proportion (g/g) of animal tallow and buffer solution is 2:3-3:1. Volume proportion (L/g) of the gas aerated containing oxygen and the material is 1:40-1:200 per minute. Reacting temperature is 150-300 degrees C.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
CN101194704-A	11 Jun 2008	A23L-001/221	200854	Pages: 5	Chinese

Application Details and Date:

CN101194704-A	CN10172681	21 Dec 2007

Record 5

Patent Assignee(s): ARCHER-DANIELS MIDLAND CO (ARCH)

Patent Number(s): US2006257982-A1; WO2006124818-A2; EP1879988-A2; CA2608251-A1; BR200609628-A2

Title: Production of fats or oils, i.e. 1,3-diglycerides, involves contacting initial substrate comprising glycerides with types of vegetable protein to generate purified substrate, and contacting purified substrate with lipase

Inventor Name(s): BINDER T P; BLOOMER S; LEE I; SOLHEIM L; WICKLUND L E; WICKLUND L

Abstract: NOVELTY - Fats or oils are produced by contacting an initial substrate comprising one or more glycerides with one or more types of vegetable protein to generate a purified substrate; and contacting the purified substrate with lipase to effect esterification, interesterification or transesterification creating the fats or oils.

USE - The inventive method is used for producing fats or oils, i.e. 1,3-diglycerides.

ADVANTAGE - The inventive method provides improved productivity for producing esterified, transesterified or interesterified fats or oils. It can greatly improve the productivity of enzymatic esterification, transesterification or interesterification by purifying the substrate oil to extend the useful life of the enzyme.

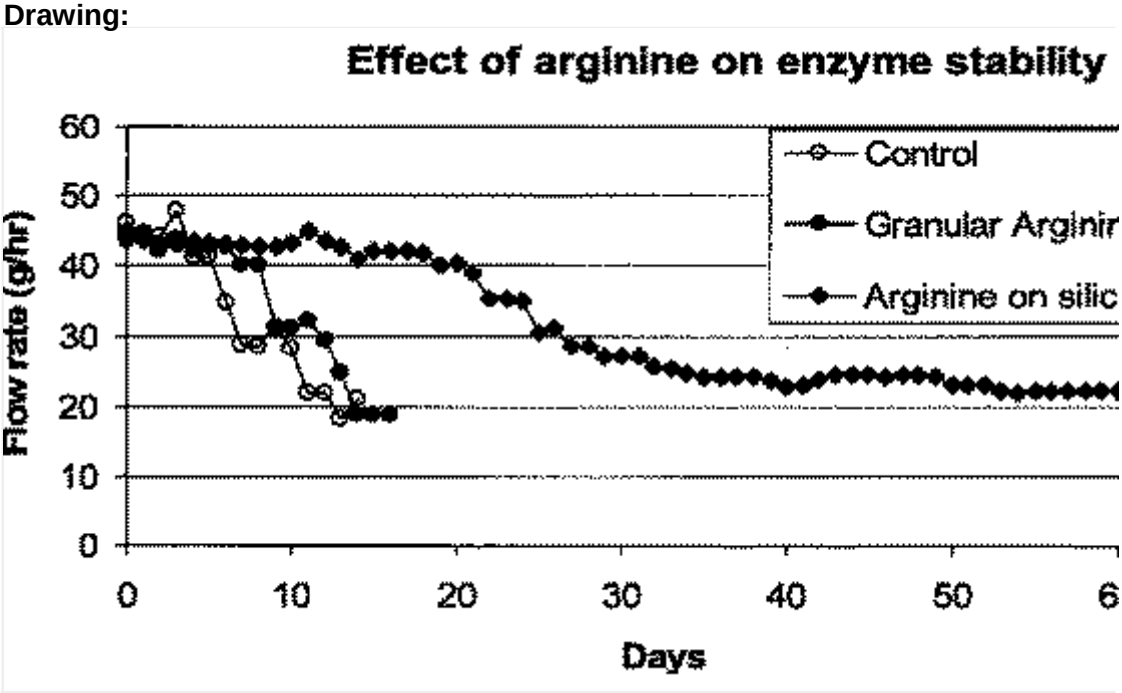
DESCRIPTION OF DRAWING(S) - The figure shows the adjustment of pumping rate as a function of run time for lipase exposed to untreated substrate, substrate treated with granular arginine, or substrate treated with arginine-coated silica.

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - BIOTECHNOLOGY - Preferred Component: The lipase is 1,3-selective lipase, or a non-selective lipase.

TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Component: The vegetable protein is a soy protein; or a textured vegetable protein, i.e. a textured soy protein. The initial substrate further comprises any of free fatty acids, monohydroxyl alcohols, polyhydroxyl alcohols, and/or esters; or primary, secondary or tertiary monohydroxyl or polyhydroxyl alcohols of annular, straight or branched chain compounds; and one or more fatty acids. The glycerides comprise any of butterfat, cocoa butter, cocoa butter substitutes, illipe fat, kokum butter, milk fat, mowrah fat, phulwara butter, sal fat, shea fat, borneo tallow, lard, lanolin, beef tallow, mutton tallow, tallow, animal fat, canola oil, castor oil, coconut oil, coriander oil, corn oil, cottonseed oil, hazelnut oil, hempseed oil, jatropha oil, linseed oil, mango kernel oil, meadowfoam oil, mustard oil, neat's foot oil, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, rice bran oil, safflower oil, sasanqua oil, shea butter, soybean oil, sunflower seed oil, tall oil, tsubaki oil, vegetable oils, marine oils which can be converted into plastic fats, marine oils which can be converted into solid fats, menhaden oil, candlefish oil, cod-liver oil, orange roughy oil, pile herd oil, sardine oil, whale oils, herring oils, 1,3-dipalmitoyl-2-monooleine (POP), 1(3)-palmitoyl-3(1)-stearoyl-2-monooleine (POSt), 1,3-distearoyl-2-monooleine (StOSt), triglyceride, diglyceride, monoglyceride, behenic acid triglyceride, trioleine, tripalmitine, tristearine, palm olein, palm stearin, palm kernel olein, palm kernel stearin, and triglycerides of medium chain fatty acids; their processed partially hydrogenated oils;

their processed fully hydrogenated oils; or their fractionated oils. They preferably comprise partially hydrogenated soybean oil, partially hydrogenated corn oil, partially hydrogenated cottonseed oil, fully hydrogenated soybean oil, fully hydrogenated corn oil, partially hydrogenated palm oil, partially hydrogenated palm kernel oil, fully hydrogenated palm oil, fully hydrogenated palm kernel oil, fractionated palm oil, fractionated palm kernel oil, fractionated partially hydrogenated palm oil, or fractionated partially hydrogenated palm kernel oil. The esters comprise any of wax esters, alkyl esters, methyl esters, ethyl esters, isopropyl esters, octadecyl esters, aryl esters, propylene glycol esters, ethylene glycol esters, 1,2-propanediol esters, or 1,3-propanediol esters.Preferred Property: The vegetable protein has a moisture content of less than 5, preferably 2-4%.Preferred Method: The types of vegetable protein and the lipase are packed in one or more columns. The purified substrate is prepared by mixing the initial substrate with the types of vegetable protein in a tank for a batch slurry purification reaction or mixing the initial substrate in a series of tanks for a series of batch slurry purification reactions. The method further includes mixing the purified substrate with the lipase in the tank for the batch slurry reaction, or flowing the purified substrate through a column containing the lipase; monitoring enzymatic activity by measuring one or more physical properties of the fats or oils after having contacted the lipase; adjusting the duration of time for which the purified substrate contacts the lipase, or adjusting the temperature of the initial substrate, the purified substrate, the types of vegetable protein or the lipase in response to a change in the enzymatic activity to produce fats or oils having a uniform increased proportion of esterification, interesterification, or transesterification relative to the initial substrate; and adjusting the amount and type of the types of vegetable protein in response to changes in the physical properties of the fats or oils to increase enzymatic productivity of the lipase. The method may comprise contacting the initial substrate comprising one or more glycerides with one or more types of purification media to generate the purified substrate; and contacting the purified substrate with lipase to effect esterification, interesterification or transesterification creating the fats or oils, where one or more amino acids or one or more protein materials are coated on the types of purification media. The enzymatic activity half-life of the lipase is more than 2.5 times greater than the enzymatic activity half-life resulting from contacting the lipase with the initial substrate.

Drawing:



Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
US2006257982-A1	16 Nov 2006	C12P-007/64	200711	Pages: 21	
WO2006124818-A2	23 Nov 2006	C11B-003/00 C11B-003/10	200711		English
EP1879988-A2	23 Jan 2008	C11B-003/00 C11B-003/10	200810		English
CA2608251-A1	23 Nov 2006	C11B-003/00 C11B-003/10	200864		English
BR200609628-A2	20 Apr 2010	C11B-003/10	201033		

Application Details and Date:

US2006257982-A1	US432494	12 May 2006
WO2006124818-A2	WOUS018804	15 May 2006
EP1879988-A2	EP759880	15 May 2006
CA2608251-A1	CA2608251	15 May 2006
BR200609628-A2	BR009628	15 May 2006

Further Application Details:

US2006257982-A1	Provisional	Application	US680483P
EP1879988-A2	Based on	Patent	WO2006124818
EP1879988-A2	PCT application	Application	WOUS018804
CA2608251-A1	Based on	Patent	WO2006124818
CA2608251-A1	PCT application	Application	WOUS018804
BR200609628-A2	PCT application	Application	WOUS018804
BR200609628-A2	Based on	Patent	WO2006124818

Record 6

Patent Assignee(s): ASAHI DENKA KOGYO KK (ASAE)

Patent Number(s): JP2006160906-A

Title: Fats-and-oils composition for foodstuffs such as margarine and shortening, contains beef tallow and/or beef tallow fraction fat and fats-and-oils containing saturated fatty acid as fatty acid component

Inventor Name(s): YAMAZAKI H; OGATA H; OKUMURA Y; NEZU T

Abstract: NOVELTY - A fats-and-oils composition contains beef tallow and/or beef tallow fraction fat, fats-and-oils containing 80 wt.% or more of 16-18C saturated fatty acid as fatty acid component, and 5-90 wt.% of fats-and-oils obtained by performing ester interchange of fats and oils compound.

USE - For foodstuffs such as margarine and shortening.

ADVANTAGE - The fats-and-oils composition has favorable mouth melting property, flavor and preservability.

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - FOOD - Preferred Components: The fats-and-oils is formed by performing extreme hardening of beef tallow, lard, lard fraction fat and/or beef tallow fraction fat. The fats-and-oils formed by performing ester interchange contain 20-40 wt.% of SSU type triglyceride and 40-60 wt.% of SUS type triglyceride. The oil phase contains more than 50 wt.% of animal fat and oil. The composition does not contain trans-fatty acid.

EXAMPLE - Sodium methylate (in weight parts) (0.1) was added to fats-and-oils compound consisting of beef tallow (40) and beef tallow extreme hardened oil (60), and random transesterification was performed at 80degreesC for 30 minutes to obtain ester interchange fats-and-oils. Ester interchange fats-and-oils (40), beef tallow (20) and soybean oil (40) were mixed uniformly to obtain fats-and-oils composition with excellent flavor and mouth melting property.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
JP2006160906-A	22 Jun 2006	C11C-003/00	200644	Pages: 14	

Application Details and Date:

JP2006160906-A	JP355328	08 Dec 2004

Record 7a

Patent Assignee(s): SOURCE FOOD TECHNOLOGY INC (SOUR-Non-standard)

Patent Number(s): CA2252312-A1

Title: Beef tallow fraction for preparing fried foods e.g. french fries, onion ring, comprises beef tallow stearin fraction and beef tallow volatiles

Inventor Name(s): MASSIE C T; SCHUH D A; SAN BUENAVENTURA L G; MUFFET D J

Abstract: NOVELTY - The beef tallow fraction comprises of beef tallow stearin fraction and beef tallow volatiles.

USE - For preparing fried foods (claimed) such as french fries and onion rings.

ADVANTAGE - The frying oil produces fried food which exhibits highly preferred flavor profile and flavor stability over the life of oil. The oil is cholesterol free.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(i) Preparation of fried foods which involves frying food in a frying oil.

(ii) Stimulating the formation of flavor compounds from non-Voltaire fraction of beef tallow. The method involves heating a mixture containing 50-400 ppm of beef tallow volatiles and 2-7.5 wt.% of beef tallow stearin fraction, in presence of air at a temperature greater than 300degreesF.

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - ORGANIC CHEMISTRY - Preferred Composition: The beef tallow fraction further contains vegetable oil, anti-oxidant and/or anti-foam agent and beef tallow olefin. The beef tallow components is cholesterol free.Preferred Oil: The vegetable oil is selected from soy oil, cottonseed oil, corn oil, safflower oil, sunflower oil, peanut oil, canola oil and olive oil. The frying oil contains beef tallow fraction.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
CA2252312-A1	30 Apr 1999	A23D-009/00	200026	Pages: 5	English

Application Details and Date:

CA2252312-A1	CA2252312	30 Oct 1998

Record 7(b)

Patent Assignee(s): SOURCE FOOD TECHNOLOGY INC (SOUR-Non-standard)

Patent Number(s): US6344225-B1

Title: Beef tallow fraction for use in frying oil comprises preset amount of non-volatile beef tallow stearin fraction and preset concentration of beef tallow volatiles, free from other components of beef tallow

Inventor Name(s): MASSIE C T; SCHUH D A; SAN BUENAVENTURA G; MUFFET D J

Abstract: NOVELTY - A beef tallow fraction comprises 2-7.5 weight% of non-volatile beef tallow stearin fraction and 50-400 ppm of beef tallow volatiles, free from other components of beef tallow.

USE - For use in frying oil for producing flavor profile in fried foods.

ADVANTAGE - The fraction used in frying oil produces fried foods exhibiting highly flavor profile and flavor stability over the life of the oil. Beef tallow containing frying oils having maximum flavor stability and intensity, is achieved by slightly reducing the oxidative stability of the frying oil. The resultant product contains only a small fraction of the original cholesterol concentration rendering oil which is nearly cholesterol free, in addition to highly favorable flavor property.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(a) frying oil comprising the beef tallow fraction;

(b) preparation of fried foods; and

(c) stimulating the formation of favorable flavor compounds from the non-volatile fraction of beef tallow fraction.

Technology Focus/Extension Abstract: TECHNOLOGY FOCUS - FOOD - Preferred Ingredients: The fraction further comprises beef tallow olein, vegetable oil fraction (selected from soy, cotton seed, corn, safflower, sunflower, peanut, canola, and olive-oil(s)), anti-oxidant and/or antifoaming agent.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
US6344225-B1	05 Feb 2002	A23D-009/02	200221	Pages: 3	

Application Details and Date:

US6344225-B1	US182507	30 Oct 1998

Further Application Details:

US6344225-B1	Provisional	Application	US063591P

Priority Application Information and Date:

US063591P	30 Oct 1997
US182507	30 Oct 1998

Record 8

Patent Assignee(s): SNOW BRAND MILK PROD CO LTD (SNOW)

Patent Number(s): JP5168434-A; JP3135964-B2

Title: Prepn. of food and drink with low cholesterol content - by dissolving animal oil and fat in mixed solvent, fractionating, removing solvent from cholesterol-free fraction, and using residue

Abstract: The method is effected by (a) dissolving animal oil and fat in mixed solvent, (b) treating the soln. by pseudo-moving bed type chromatography for fractionating to cholesterol-free and cholesterol-contg. fraction, (c) removing solvent from the cholesterol-free fraction and (d) using the residue for preparing food and drinks.

The oil and fat includes lard, tallow, fish oil, milk fat and their processed material. Pref. mixed solvent is composed of hexane, acetone, ethanol and water. Lard of cholesterol content 103 mg/100 g. 200 g. treated as above is reduced to a cholesterol content 11 mg/100 g. 188 g. By treating butter or butter oil as above, butter, margarine, reduced milk, cheese, ice cream etc. of decreased cholesterol content can be prepared.

USE/ADVANTAGE - Cholesterol in animal oil and fat can be removed in a short time by a simple process. A large amt. of oil and fat can be treated continuously on an industrial scale.

Equivalent Abstracts: (JP3135964-B2) The method is effected by (a) dissolving

animal oil and fat in mixed solvent, (b) treating the soln. by pseudo-moving bed type chromatography for fractionating to cholesterol-free and cholesterol-contg. fraction, (c) removing solvent from the cholesterol-free fraction and (d) using the residue for preparing food and drinks.

The oil and fat includes lard, tallow, fish oil, milk fat and their processed material. Pref. mixed solvent is composed of hexane, acetone, ethanol and water. Lard of cholesterol content 103 mg/100 g. 200 g. treated as above is reduced to a cholesterol content 11 mg/100 g. 188 g. By treating butter or butter oil as above, butter, margarine, reduced milk, cheese, ice cream etc. of decreased cholesterol content can be prepared.

USE/ADVANTAGE - Cholesterol in animal oil and fat can be removed in a short time by a simple process. A large amt. of oil and fat can be treated continuously on an industrial scale.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
JP5168434-A	02 Jul 1993	A23L-001/29	199331	Pages: 4	
JP3135964-B2	19 Feb 2001	A23L-001/29	200112	Pages: 4	

Application Details and Date:

JP5168434-A	JP357003	24 Dec 1991
JP3135964-B2	JP357003	24 Dec 1991

Further Application Details:

JP3135964-B2	Previous Publ.	Patent	JP5168434

Record 9
Patent Assignee(s): AJINOMOTO KK (AJIN)

Patent Number(s): JP4065493-A

Title: Fat and oil contg. no trans-acids - prepd. by reacting 1,3 position specific lipase with animal and plant fats and oils to selectively ester exchange

Abstract: Fat and oil is prepd. by reacting a 1,3-position-specific lipase(s) with at least one animal and plant fats and oils and their fractionated fats and oils and completely hydrogenated solid fats to ester-exchange selectively.

The ester exchange is pref. effected in a system of moisture content of up to 200 ppm or lower, to prevent hydrolysis. The reaction is effected under mild conditions. The lipases include those from Rhizopus, Aspergillus, Mucor, Humicola and Penicillium genela. The solid fats and oils include palm oil, kernel oil, coconut oil, lard and beef tallow. The liq. oils include soybean oil, rapeseed oil and maize oil. The lipase is pref. used in an immobilised form. Immobilised lipases are prepd. by dissolving lipases, and an enzyme-activating agent in water, immobilising them onto a support, e.g. anion exhange resin, and drying.

USE/ADVANTAGE - Without trans-acids, the fat and oil obtd. has improved properties as a solid or a semi-solid fat and a good flavour. The I number is

adjustable over a wide range.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
JP4065493-A	02 Mar 1992		199215	Pages: 4	

Application Details and Date:

JP4065493-A	JP179290	06 Jul 1990

Record 10

Patent Assignee(s): PROCTER & GAMBLE CO (PROC)

Patent Number(s): EP531325-A; WO9117666-A1; WO9117666-A; US5104678-A; US5169670-A; EP531325-A1; EP531325-A4; EP531325-B1; DE69120813-E; CA2081015-C

Title: Low saturate frying oil prepn. with fried or tallow flavour - by fractionating fatty acids to make (un)satd. fraction, esterifying glycerine with unsatd. fraction and deodorising tri:glyceride

Inventor Name(s): YANG D K; YANG D

Abstract: Mfr comprises a) fractionating fatty acids from animal fat to make an unsatd fraction and a satd fraction; b) esterifying glycerine with the unsatd fraction; and c) deodorising the resultant triglyceride.

Also claimed is a frying oil produced by the process and a compsn for imparting flavour to fried foods.

The unsatd fraction pref comprises 5-85 (esp 50-85) % oleic acid, less than 15 (esp 0-8) % satd fatty acids, 5-25 (esp 10-20) % minor fatty acids.

USE/ADVANTAGE - The oil imparts the beefy or tallow flavour to foods characteristic of animal fat. Less than 5 mg of cholesterol/100g is present in the oil. @(30pp Dwg.No.0/3)

Equivalent Abstracts: (US5104678-A) Frying oil is made by (a) fractionating fatty acids from animal fats to make an unsatd. fraction and a satd. fraction; (b) esterifying glycerine with the unsatd. fraction; and (c) deodorising the low satd. triglyceride obtd. Unsatd. fraction comprises 5-85% oleic acid, less than 15% satd. fatty acids, 5-25% minor fatty acids, and less than 10 mg per 100 g of cholesterol.

USE - To impart beefy or tallow flavour to foods.

(US5169670-A) Frying oil is made by (a) fractionating fatty acids from animal fats to make an unsatd. fraction and a satd. fraction; (b) esterifying glycerine with the unsatd. fraction at 100-250 deg.C while concurrently removing water from the reaction; and (c) deodorising low satd. triglyceride obtd. by steam stripping at 220-270 deg.C under vacuum.

Unsatd. fraction comprises 50-85% oleic acid, less than 15% satd. fatty acids, 5-25%

minor fatty acids, and less than 10mg per 100g of cholesterol. Ratio unsatd. fatty acid:glycerine is 3-8:1.

ADVANTAGE - Beefy or tallow flavour is imparted to foods.

(EP531325-A1) Mfr. comprises (a) fractionating fatty acids from animal fat to make an unsatd. fraction and a satd. fraction; b) esterifying glycerine with the unsatd. fraction; and c) deodorising the resultant triglyceride.

Also claimed is a frying oil produced by the process and a compsn. for imparting flavour to fried foods.

The unsatd fraction pref. comprises 5-85 (esp. 50-85)% oleic acid, less than 15 (esp. 0-8)% fatty acids, 5-25 (esp. 10-20)% minor fatty acids.

USE/ADVANTAGE - The oil imparts the beefy or tallow flavour to foods characteristic of animal fat. Less than 5 mg of cholesterol/100g is present in the oil.

(EP531325-B1) A process for making a low saturated frying oil with tallow flavour comprising: a) fractionating fatty acids from animal fat to make an unsaturated fraction and a saturated fraction wherein said unsaturated fraction comprises from 5% to 85% oleic acid, less than 15% saturated fatty acids and from 5% to 25% minor fatty acids, preferably, wherein said unsaturated fraction comprises from 50% to 85% oleic acid, 0% to 8% unsaturated fatty acids, and 10% to 20% minor fatty acids, and less than 10 mg/100 gm of cholesterol, b) esterifying glycerin with said unsaturated fraction; and c) deodorising the resultant triglyceride.

Drawing:

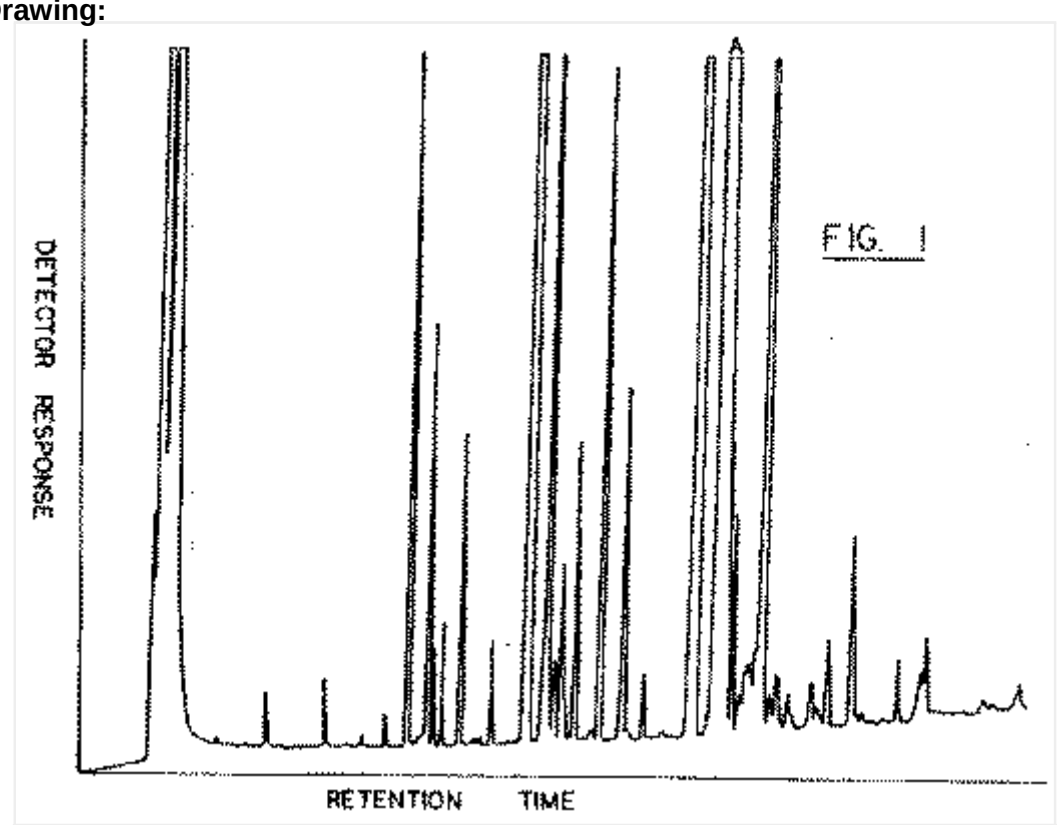


FIG. 1

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
EP531325-A					
WO9117666-A	28 Nov 1991		199150		
US5104678-A	14 Apr 1992		199218	Pages: 12	
US5169670-A	08 Dec 1992	A23D-009/00	199252	Pages: 12	
EP531325-A1	17 Mar 1993	A23D-009/00	199311		English
EP531325-A4	21 Apr 1993		199526		
EP531325-B1	10 Jul 1996	A23D-009/00	199632	Pages: 18	English
DE69120813-E	14 Aug 1996	A23D-009/00	199638		
CA2081015-C	30 Jul 1996	A23D-009/00	199641		

Application Details and Date:

WO9117666-A	WOUS02681	22 Apr 1991
US5104678-A	US645427	24 Jan 1991
US5169670-A	US803845	09 Dec 1991
EP531325-A1	EP909281	22 Apr 1991
EP531325-A4	EP909281	
EP531325-B1	EP909281	22 Apr 1991
DE69120813-E	DE620813	22 Apr 1991
CA2081015-C	CA2081015	22 Apr 1991

Further Application Details:

US5169670-A	Cont of	Patent	US5104678
US5169670-A	Cont of	Application	US645427
US5169670-A	CIP of	Application	US527510
EP531325-A1	Based on	Patent	WO9117666
EP531325-A1	PCT application	Application	WOUS02681
EP531325-B1	Based on	Patent	WO9117666
EP531325-B1	PCT application	Application	WOUS02681
DE69120813-E	Based on	Patent	WO9117666
DE69120813-E	Based on	Patent	EP531325
DE69120813-E	PCT application	Application	WOUS02681
DE69120813-E	EP application	Application	EP909281

Record 11

Patent Assignee(s): UNILEVER NV (UNIL)

Patent Number(s): NL8104823-A

Title: Fat compsn. for margarine prodn. - comprising tallow component and its

transesterification prod.

Abstract: Fat compsn. esp. suitable for prodn. of margarine-type w/o emulsions with butter-like properties, comprises (a) a material (I) selected from tallow and its fractions, and (b) a prod. obtained by transesterifying a mixt. of (I) and a liq. oil (II).

(I) is esp. tallow olein which is 45-60% solid at 10 deg.C, 15-25 % at 20 deg.C, 2-7% at 30 deg.C, and less than 2% at 35 deg.C. (II) is pref sunflower, soya, safflower, and/or peanut oil. Component (b) is pref. prepd. by transesterifying a mixt. of 55-75% (I) and 25-45% (II), and is pref. not more than 3% solid at 35 deg.C. The compsns. pref. comprise 40-75% (a) and 25-60% (b), opt. together with up to 10% of other fats.

Margarines prepd. from the compsns. have hardness and plasticity properties very similar to those of natural butter.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
NL8104823-A	16 May 1983		198323	Pages: 15	

Record 12

Patent Assignee(s): UNILEVER NV (UNIL)

Patent Number(s): EP74136-A; AU8287847-A; FI8203012-A; ZA8206430-A; US4460614-A; EP74136-B; DE3262996-G; CA1194360-A; JP91042865-B

Title: Fat blend for prodn. of margarine - comprising mixt. of tallow and interesterification prod. of tallow and liq. or hydrogenated oil

Inventor Name(s): STRATMANN W; LEGGE P F

Abstract: Fat blend comprises a non-interesterified component (I) consisting of tallow and/or a fraction of this, and an interesterified component (II) consisting of a mixt. of triglycerides obtd. by interesterification of tallow and/or a fraction of this with a liq. oil and/or a hydrogenated oil.

Pref. the fat blend has a fat solids profile N10=34-60; N20=10-25; N30 less than or equal to 7; and N35 less than or equal to 2.

The fat blends are esp. useful in the prodn. of spreads having an elasticity, a plasticity and melting behaviour comparable to those of natural butter, with relatively cheap prodn. cost.

Equivalent Abstracts: (US4460614-A) Fat blend resembling butter comprises: (a) a non-esterified component consisting of tallow, a tallow oleic, a tallow stearin or their mixts.; and (b) an interesterified component prepd. from tallow, tallow olein, tallow stearin or their mixts. and a liq. oil opt. mixed with an oil hydrogenated to a m.pt. not above 43 deg.C.. The ratio (a):(b) is 75:25 to 25-75. The ratio of tallow fat:oil in (b) is 75:25 to 25:75. The fat blend has the following fat solids profile: N 10 deg.C. = 34-60. N20 deg.C. = 10-25. N 30 deg.C. is not greater than 7. N 35 deg.C. is not greater than 2.

Theliq. oil and/or hydrogenated oil is pref. sunflower, soya bean, safflower,

groundnut, maize, cotton seed or rapeseed oil. Component (a) pref. comprises a mixt. of tallow olein and tallow in a ratio not greater than:13:1. (4pp)o

(EP74136-B) Fat blend comprising a non-interesterified component (i) consisting of tallow and/or a fraction thereof and an interesterified component (ii) consisting of a mixture of triglycerides obtained by interesterification of tallow and/or a fraction thereof with a liquid oil and/or a hydrogenated oil. (11pp)

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
EP74136-A	16 Mar 1983		198312	Pages: 19	
AU8287847-A	10 Mar 1983		198316		
ZA8206430-A	02 Mar 1984		198426		
US4460614-A	17 Jul 1984		198431		
EP74136-B	10 Apr 1985		198515		

Application Details and Date:

EP74136-A	EP201038	18 Aug 1982
ZA8206430-A	ZA006430	02 Sep 1982
US4460614-A	US414721	03 Sep 1982

Record 13

Patent Assignee(s): UNILEVER NV (UNIL)

Patent Number(s): EP41300-A1; EP41300-A; NL8003142-A; JP57021499-A; US4360536-A; ZA8103523-A; CA1150734-A; EP41300-B; DE3161942-G; JP86038958-B

Title: Dry fractionation of fats and oils - by mixing those of steep dilatation temp. line with tri:glyceride(s)

Inventor Name(s): KEUNING R; HAIGHTON A J; DIJKSHOORN W; HUIZINGA H

Abstract: Process for the dry fractionation of oils and fats (I) having a steep dilatation curve is as follows: before fractionation, (I) are mixed with triglycerides (II) of such a kind that in the temp. range in which it is wished to carry out the fractionation the difference in dilatation values of the mixt. decreases substantially.

Simple process is partic. suitable for the large scale industrial dry fractionation of (I). The prods. are partic. suitable for the prepn. of (low calorie) margarines, bakery fats, and cooking fats.

(II) have difference in dilatation values at 15 deg. and 25 deg. not above 600 cu.mm/25g, and may be palm oil, lard, or tallow (or hydrogenated and/or fractionated derivs.). Wt. ratio (I):(II) is 10-90:90-10 (40-60:60-40). (I) to be fractionated have difference in dilatation value at 15 deg. and 25 deg. at least 80 cu.mm/25 g. (I) are suitably coconut oil, palm kernel oil (pref. fractionated with palm oil in wt. ratio 20-80:80-20), and/or babassu oil.

Equivalent Abstracts: (EP41300-B) Process for the dry fractionation of oils and fats (I) having a steep dilatation curve is as follows: before fractionation, (I) are mixed with triglycerides (II) of such a kind that in the temp. range in which it is wished to carry out the fractionation the difference in dilatation values of the mixt. decreases substantially.

Simple process is partic. suitable for the large scale industrial dry fractionation of (I). The prods. are partic. suitable for the prepn. of (low calorie) margarines, bakery fats, and cooking fats.

(II) have difference in dilatation values at 15 deg. and 25 deg. not above 600 cu.mm/25g, and may be palm oil, lard, or tallow (or hydrogenated and/or fractionated derivs.). Wt. ratio (I):(II) is 10-90:90-10 (40-60:60-40). (I) to be fractionated have difference in dilatation value at 15 deg. and 25 deg. at least 80 cu.mm/25 g. (I) are suitably coconut oil, palm kernel oil (pref. fractionated with palm oil in wt. ratio 20-80:80-20), and/or babassu oil. (17pp)

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
EP41300-A1					
EP41300-A	09 Dec 1981		198151	Pages: 17	
JP57021499-A	04 Feb 1982		198211		
US4360536-A	23 Nov 1982		198249		
EP41300-B	18 Jan 1984	C11B-007/00	198404		

Application Details and Date:

EP41300-A	EP200569	27 May 1981
JP57021499-A	JP082432	29 May 1981
US4360536-A	US266697	26 May 1981
EP41300-B	EP200569	27 May 1981

Record 14 of 17

Patent Assignee(s): FATS RES INST (FATS)

Patent Number(s): SU603366-A

Title: Butter-like margarine with high linoleic acid content - contg. cream, milk and transesterified mixture of beef fat and sunflower oil

Inventor Name(s): VASILEV N F; MELAMUD N L; MELESHIN V A

Abstract: Margarine having consistency similar to butter contains 25-30 wt.@ of plastic cream, 8-10 wt.% of milk, and balance transesterified mixt. of fats consisting of beef fat and sunflower oil in a ratio of 45:55 to 50:50.

The compsn. contains 19-23 wt.% of linoleic acid, which promotes self-emulsification of the margarine without addition of any special emulsifier. The compsn. contains at

least 82% of fats and not more than 16.5% of moisture.

The colour of the margarine is cream. The taste is butter-like without any foreign tone.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
SU603366-A	29 Mar 1978		197910		

Record 15

Patent Assignee(s): US SEC OF COMMERCE (USDC); US SEC OF AGRIC (USDA)

Patent Number(s): FR2387287-A1; BE865992-A; DE2814211-A; NL7803780-A; SE7804224-A; US4127597-A; JP53128609-A; FR2387287-A; GB1558958-A; CH639995-A; IT1156961-B

Title: Fractionation of tallow by crystallisation - to give three portions including cocoa butter analogue

Inventor Name(s): Craig, J C jr; Kozempel, MF and Elias, S

Abstract: Two similar methods of separating tallow by crystallisation each result in three fractions: a hard solid (I) of high m.pt., a plastic solid (II) analogous to cocoa butter, and a liq. oil (III).

In the first method: the tallow is dissolved in solvent. pref. a hydrocarbon or ketone, partic. acetone, the solvent: tallow ratio being 8-10:1; the soln. is passed through 1 crystalliser, the crystallisation temp. beign 15-20 degrees C; (I) is sepd. out; the filtrate crystallised at 1-7 degrees C to give (II); and (III) is obtd. by removal of solvent.

In the second method: the tallow is dissolved in solvent, the solvent: tallow ratio being 7-10:1; the soln. is passed through teh crystallisers, the crystallisation temp. being 1-7 degree C; (I) and (II) are together sepd. out; (III) is obtd. by removal of solvent; the ppte. from teh first stage is redissolved, fed to the crystallisers, and (I) crystallised out at 15-20 degrees C; and (II) is obtd. by removal of solvent.

The fractionation of beef tallow into specific glyceride types is effected, thus augmenting its usefulness. Each fraction is useful as a foodstuff or food additive. Fraction (II), which is 5-30 wt. % of the starting prod. can be used as a replacement of diluent for cocoa butter. The process is effected much more quickly than prior art.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
~FR2387287-A1					
BE865992-A	31 Jul 1978		197834		

NL7803780-A	17 Oct 1978		197844		
SE7804224-A	06 Nov 1978		197847		
US4127597-A	28 Nov 1978		197849		
JP53128609-A	09 Nov 1978		197850		
~FR2387287-A	15 Dec 1978		197903		
GB1558958-A	09 Jan 1980		198002		
CH639995-A	15 Dec 1983		198404		

Priority Application Information and Date:

US787660	14 Apr 1977

Record 16

Patent Assignee(s): US SEC OF AGRIC (USDA)

Patent Number(s): US4049839-A; US4130572-A

Inventor Name(s): Luddy, Francis E; Hampson, James W; Herb, Samuel, F (and Rothbart, Herbert L for 1978 application)

Title: Beef tallow fraction useful for margarines and shortenings - does not require hydrogenation and is free of oleic acid isomers

Abstract: The fraction comprises a mixt. of trisatd. glycerides (I) and disatd. mono-unsatd. glycerides (II). Its GLC profile indicates a compsn. having 12%, 31%, 39% and 18% of glycerides contg. 48C, 50C, 52C and 54C respectively. Its thermal characteristics are such that it softens at ca 40 degrees C, commences rapidly to melt at ca. 50 degrees C and melts completely at ca. 57 degrees C.

The fraction replaces (partially) hydrogenated oils and does not require hydrogenation. It is free of oleic acid isomers and contains a high ratio of stearic acid which makes it valuable for many non-food uses (including cosmetic bases, pharmaceuticals, soaps and as a commercial source of stearic and palmitic acids).

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
US4049839-A	20 Sep 1977		197739		
US4130572-A	19 Dec 1978		197901		

Application Details and Date:

US4049839-A	US642837	22 Dec 1975
US4130572-A	US825742	18 Aug 1977

Record 17

Patent Assignee(s): US SEC OF AGRIC (USDA)

Patent Number(s): US3944585-A

Title: Separating triglycerides of beef tallow - into five fractions of greater usefulness

Inventor Name(s): Luddy, F E; Hampson, J W; Herb, S F; Rothbart, H L

Abstract: Beef tallow is sepd. into fine fractions of different melting ranges and contg. different combinations of fatty acids by (a) dissolving the tallow (10 wt. pts. (g)) in acetone (100 vol. pts. (ml)), (b) keeping the soln. at 25 degrees C for 12-20 hrs. to allow crystallisation, (c) filtering off the solid, composed of trisatd. and a small proportion of disatd. triglycerides, contg. 12%, 31%, 39% and 18% of triglycerides having 48, 50, 52 and 54 C atoms resp., and of softening pt. <40 degrees C (Fraction 1), (d) readjusting the concn. of the filtrate to 10 vols. acetone/wt. tallow, and cooling to 2 degrees C for 16-18 hrs., (e) removing the ppte., (f) removing the solvent from the filtrate of (e) to yield a liquid fat composed of monosatd. and triunsatd. triglycerides, contg. 5%, 22%, 44% and 29% of glycerides having 48, 50, 52 and 54 C atoms resp.; which is not completely solid at -15 degrees C, but is completely melted at 5 degrees C (Fraction 5), (g) ppte posn. (e) is dissolved in acetone, using 20 vols acetone/wt tallow, and allowed to crystallise at 15 degrees C for 16-18 hrs., (h) collecting the ppte from (g), consisting of trisatd. and monounsatd. triglycerides, contg. 15%, 28%, 36% and 21% of triglycerides having 48, 50, 52 and 54 C atoms resp.; which softens at 42 degrees C, and melts completely at 51 degrees C (Fraction 2), (i) adjusting filtrate concn. from (h) to 15 vol acetone/wt tallow, and crystallising at 2 degrees C for 16-18 hrs., (j) collecting the ppte., a plastic solid composed of disatd. triglycerides with minor amts. of mono- and tri-satd. glycerides, contg. trace, 30%, 49% and 21% of glycerides having 48, 50, 52 and 54 C atoms resp., which softens at 20 degrees C, begins melting at 30 degrees C, and is completely melted at 37 degrees C (Fraction 3), (k) removing the acetone from the filtrate of (j) to yield a liquid fat composed of mono-satd. and tri-unsatd. triglycerides contg. 4%, 18%, 45% and 33% of glycerides contg. 48, 50, 52 and 54 C atoms resp.; not completely solid at -15 degrees C, but completely molten at 5 degrees C (Fraction 4). Beef tallow itself has few uses. The 2 solid fractions may be used as hardening fats in shortening etc., and for soaps, pharmaceuticals etc. The liquid fractions may be used to make margarine, as shortenings, in salad oils, synthetic sperm oil,foam plastics, creams, lotions etc. The plastic fraction has similar props. to cocoa butter, for which it is a substitute. All are bland and nearly colourless.

Patent Details:

Patent Number	Publ. Date	Main IPC	Week	Page Count	Language
US3944585-A	16 Mar 1976		197613		

Record 18

Patent Assignee(s): PROCTER & GAMBLE CO (PROC)

Patent Number(s): US4169901-A

Title: Cooking fat contg. volatile meat flavouring - stabilised against flavour loss by addn. of non-deodorised vegetable oil

Inventor Name(s): KRAVIS D S

Abstract: A deep-fat frying compsn. which imparts a meaty flavour to food contains (a) 80-98 wt. % base fat having a smoke point >350 degrees F and iodine value 30-150, contg. >95% of edible triglycerides having 16-22C acyl gps.; (b) 0.02-10wt.% volatile artificial meat-like flavour, which is soluble in the base fat to a level of >10% at 70 degrees F; (c) 1-10 wt. % of non-deodorised coconut, palm kernel, cohune, muru muru, or babassu oil or ucuhuba tallow as steriliser.

The non-deodorised vegetable oil prevents loss of flavouring so the compsn. is effective for long periods of frying.

Patent Details:

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Application Details and Date:

US4169901-A	US882481	01 Mar 1978

Priority Application Information and Date:

US882481	01 Mar 1978

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Note on Sources – DII rewrites the titles of the patents entered in their database to expand this field to amore indicative version of what is claimed in the patent . For this project, where an English version of a selected patent exists this has been consulted and the reference entry made under that application's title - with the DII expanded title shown after it in brackets. Where no there is English language version only the title from the DII database is show as this was the only source consulted.

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