US009034388B2

(12) **United States Patent**
Bruheim et al.

(10) **Patent No.: US 9,034,388 B2**
(45) **Date of Patent: May 19, 2015**

(54) **BIOEFFECTIVE KRILL OIL COMPOSITIONS**

(75) Inventors: **Inge Bruheim**, Volda (NO); **Mikko Griinari**, Espoo (FI); **Snorre Tilseth**, Bergen (NO); **Sebastiano Banni**, Cagliari (IT); **Jeffrey Stuart Cohn**, Camperdown (AU); **Daniele Mancinelli**, Orsta (NO)

(73) Assignee: **AKER BIOMARINE ANTARTIC AS**, Stamsund (NO)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1181 days.

(21) Appl. No.: **12/057,775**

(22) Filed: **Mar. 28, 2008**

(65) **Prior Publication Data**

US 2008/0274203 A1 Nov. 6, 2008

Related U.S. Application Data

(60) Provisional application No. 60/920,483, filed on Mar. 28, 2007, provisional application No. 60/975,058, filed on Sep. 25, 2007, provisional application No. 60/983,446, filed on Oct. 29, 2007, provisional application No. 61/024,072, filed on Jan. 28, 2008.

(51) **Int. Cl.**

A61K 9/48	(2006.01)
A61K 31/23	(2006.01)
A61K 31/122	(2006.01)
A61K 31/202	(2006.01)
A61K 31/683	(2006.01)
A61K 31/685	(2006.01)
C11B 3/00	(2006.01)
A61K 45/06	(2006.01)

(52) **U.S. Cl.**

CPC ***A61K 35/612*** (2013.01); ***A61K 9/4858*** (2013.01); ***A61K 31/122*** (2013.01); ***A61K 31/23*** (2013.01); ***A61K 31/683*** (2013.01); ***A61K 31/685*** (2013.01); ***A61K 45/06*** (2013.01); ***C11B 3/006*** (2013.01); ***A61K 31/202*** (2013.01)

(58) **Field of Classification Search**

CPC . A61K 2300/00; A61K 31/122; A61K 31/23; A61K 31/683; A61K 31/685; A61K 35/612; A61K 31/202; A61K 45/06; A61K 9/4858; A61K 9/2054; A61K 47/44; A61K 31/05; A61K 31/12; A61K 31/133; A61K 31/198; A61K 31/57; C11B 3/006

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,652,235	A	9/1953	Samuelsen	
4,036,993	A	7/1977	Ikeda	
4,119,619	A	10/1978	Rogozhin et al.	
4,505,936	A	3/1985	Meyers et al.	
4,714,571	A	12/1987	Kearns et al.	
4,749,522	A	6/1988	Kamarei	
4,814,111	A	3/1989	Kearns et al.	
5,006,281	A	4/1991	Rubin et al.	
5,266,564	A	11/1993	Modolell	
5,434,183	A	7/1995	Larsson-Backstrom	
6,214,396	B1	4/2001	Barrier	
6,346,276	B1	2/2002	Tanouchi et al.	
6,537,787	B1	3/2003	Breton	
6,800,299	B1	10/2004	Beaudoin et al.	
7,488,503	B1	2/2009	Porzio et al.	
7,666,447	B2	2/2010	Rockway	
8,030,348	B2	10/2011	Sampalis	
8,278,351	B2	10/2012	Sampalis	
8,383,675	B2	2/2013	Sampalis	
8,697,138	B2	4/2014	Bruheim et al.	
2002/0076468	A1	6/2002	Saxby	
2003/0044495	A1	3/2003	Kagan et al.	
2003/0113432	A1 *	6/2003	Yoshitomi et al.	426/643
2004/0241249	A1	12/2004	Sampalis	
2006/0078625	A1	4/2006	Rockway	
2006/0193962	A1 *	8/2006	Kamiya et al.	426/615
2008/0166419	A1	7/2008	Sones	
2008/0166420	A1	7/2008	Sones	
2010/0143571	A1	6/2010	Breivik	

(Continued)

FOREIGN PATENT DOCUMENTS

AU	2002322233	2/2003
BR	8701265	3/1987

(Continued)

OTHER PUBLICATIONS

Ando and Hatano, 1988, "Isolation of apolipoproteins from carotenoid-carrying lipoprotein in the serum of chum salmon, *Oncorhynchus keta*", J. Lipid Research, 29: 1264-1271.

(Continued)

Primary Examiner — Debbie K Ware

(74) *Attorney, Agent, or Firm* — Casimir Jones S.C.

(57) **ABSTRACT**

This invention discloses new krill oil compositions characterized by having high amounts of phospholipids, astaxanthin esters and/or omega-3 contents. The krill oils are obtained from krill meal using supercritical fluid extraction in a two stage process. Stage 1 removes the neutral lipid by extracting with neat supercritical CO_2 or CO_2 plus approximately 5% of a co-solvent. Stage 2 extracts the actual krill oils by using supercritical CO_2 in combination with approximately 20% ethanol. The krill oil materials obtained are compared with commercially available krill oil and found to be more bioeffective in a number of areas such as anti-inflammation, antioxidant effects, improving insulin resistances and improving blood lipid profile.

DOCKET ALARM

Find authenticated court documents without watermarks at docketalarm.com.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2010/0160659	A1	6/2010	Catchpole
2011/0130458	A1	6/2011	Breivik

FOREIGN PATENT DOCUMENTS

CA	1098900		4/1981
CA	2251265		4/2000
CL	40348		7/1997
EP	0609078		8/1994
EP	670306		6/1995
EP	1127497		8/2001
EP	1392623		3/2004
EP	1406641		4/2004
EP	1542670		6/2005
EP	0973532		9/2005
EP	1660071		5/2006
EP	1689413		8/2006
EP	1743531		1/2007
EP	1631280		3/2008
EP	1123368		4/2008
EP	1406641		1/2009
EP	1419768		1/2009
EP	1292294		3/2009
EP	1706106		7/2009
EP	1385500		7/2010
GB	2097014		10/1982
GB	921537		6/1999
JP	A-S51-125774		11/1976
JP	A-S52-114046		9/1977
JP	60-153779		8/1985
JP	61281159		12/1986
JP	02049091		2/1990
JP	2215351		8/1990
JP	4012665		1/1992
JP	2963152		2/1992
JP	04057853		2/1992
JP	3081692		7/1994
JP	2524217		8/1996
JP	H08-231391		9/1996
JP	3344887		7/1997
JP	3611222		8/1997
JP	2001-158736	A	6/2001
JP	2003-003192	A	1/2003
JP	2003-048831	A	2/2003
JP	2003-146883	A	5/2003
JP	3467794		9/2003
JP	2003-530448		10/2003
JP	2003-531857	A	10/2003
JP	3486778		10/2003
JP	2004-525180	A	8/2004
JP	2004-534800		11/2004
JP	2004-536059	A	12/2004
JP	3678317		5/2005
JP	2005-245379	A	9/2005
JP	2006-502196	A	1/2006
JP	2006-069948	A	3/2006
JP	2006-083136	A	3/2006
JP	2006-290784	A	10/2006
JP	2006-316073	A	11/2006
JP	2006-328014	A	12/2006
JP	2006-528233	A	12/2006
JP	2007-502805	A	2/2007
JP	2007-509131	A	4/2007
JP	2007-126455	A	5/2007
JP	2007-518764	A	7/2007
JP	2007-246404	A	9/2007
SU	220741		1/1971
WO	86/06082		10/1986
WO	89/01031		2/1989
WO	89/10960		11/1989
WO	90/05765		5/1990
WO	93/24142		12/1993
WO	98/34498		8/1998
WO	99/39589		8/1999
WO	00/23546		4/2000
WO	00/25608		5/2000
WO	00/38708		7/2000
WO	01/28526		4/2001
WO	01/82928		11/2001
WO	02/083122		10/2002
WO	02/092540		11/2002
WO	02/102394		12/2002
WO	03/011873		2/2003
WO	03/013497		2/2003
WO	2004/028529		4/2004
WO	2004/047554		6/2004
WO	2004/100943		11/2004
WO	2004/112767		12/2004
WO	2005/004393		1/2005
WO	2005/018632		3/2005
WO	2005/037848		4/2005
WO	2005/038037		4/2005
WO	2005/070411		8/2005
WO	2006/030552		3/2006
WO	2006/111633		10/2006
WO	2007/080514		7/2007
WO	2007/080515		7/2007
WO	2007/108702		9/2007
WO	2007/123424		11/2007
WO	2008/006607		1/2008
WO	2008/072563		6/2008
WO	2008/117062		10/2008
WO	2009/027692		3/2009

OTHER PUBLICATIONS

Aoi et al., 2003, "Astaxanthin limits exercise-induced skeletal and cardiac muscle damage in mice", Antioxidants & Redox Signaling, 5(1): 139-44.

Britton, 1985, "General Carotenoid Methods", Methods in Enzymology, vol. 111, pp. 113-149.

Calder, 2006, "n-3 polyunsaturated fatty acids, inflammation, and inflammatory diseases", Am. J. Clin. Nutr., 83: 1505S.

Charest et al., 2001, "Astaxanthin Extraction from Crawfish Shells by Supercritical CO2 with Ethanol as Cosolvent", J. Aquatic Food Product Technology, 10(3): 79-93.

Chen and Meyers, 1982, "Extraction of Astaxanthin Pigment from Crawfish Waste Using a Soy Oil Process", J. Food Sci., 47: 892-896.

Clarke, 1980, "The Biochemical Composition of Krill, *Euphausia superba* dana,from South Georgia", J. Exp. Mar. Biol. Ecol., 43: 221-236.

Czeczuga, 1974, "Comparative Studies of Carotenoids in the Fauna of the Gullmar Fjord (Bohuslan, Sweden). II. Crustacea: *Eupagurus bernhardus, Hyas coarctatus* and *Upogebia deltaura*", Marine Biology, 28: 95-98.

De Ritter and Purcell, 1981, "Carotenoid Analytical Methods", Carotenoids as Colorants and Vitamin A Precursors: Technological and Nutritional Applications, pp. 815-882.

Deutch, 1995, "Menstrual pain in Danish women correlated with low n-3 polyunsaturated fatty acid intake", Eur. J. Clin. Nutr., 49(7): 508-16.

Diez et al., 2003, "The role of the novel adipocyte-derived hormone adiponectin in human disease", Eur. J. Endocrinol., 148(3): 293-300.

Ellingsen et al., 1987, "Biochemistry of the autolytic processes in Antarctic krill post mortem. Autoproteolysis." Biochem. J. 246, 295-305.

Emodi, 1978, "Carotenoids: Properties and Applications", Food Technology, 32(5): 38.

Felix-Valenzuela et al., 2001, "Supercritical CO2/Ethanol Extraction of Astaxanthin from Blue Crab (*Callinectes sapidus*) Shell Waste", Journal of Food Process Engineering, 24: 101-112.

Fox and Scheer, 1941, "Comparative Studies of the Pigments of Some Pacific Coast Echinoderms", The Biological Bulletin, 441-455.

Fricke, et al., 1984, "Lipid, Sterol and Fatty Acid Composition of

DOCKET ALARM
Find authenticated court documents without watermarks at docketalarm.com.

(56) **References Cited**

OTHER PUBLICATIONS

Geusens et al., 1994, "Long-term effect of omega-3 fatty acid supplementation in active rheumatoid arthritis. A 12-month, double-blind, controlled study", Arthritis Rheum., 37(6): 824-9.
Gilchrist and Green, 1960, "The Pigments of Artemia", Proceedings of the Royal Society, Series B Biological Sciences, vol. 152 No. 946, pp. 118-136.
Goodwin and Srisukh, 1949, "Some Observations on Astaxanthin Distribution in Marine Crustacea", Department of Biochemistry, University of Liverpool, pp. 268-270.
Gulyaev and Bugrova, 1976 Removing fats from the protein paste "Okean". Konservnaya I Ovoshchesushil'naya Promyshlennost, (4), 37-8.
Hardardottir and Kinsella, 1988, "Extraction of Lipid and Cholesterol from Fish Muscle with Supercritical Fluids" Journal of Food Science, 53(6): 1656-1658.
International Aqua Feed, 2006, vol. 9.
International Search Report and Written Opinion for PCT/GB2008/002934, Dated Mar. 11, 2009.
International Search Report and Written Opinion for PCT/IB2010/000512; dated Jun. 24, 2010.
International Search Report for PCT/IB2007/000098, dated: Jun. 26, 2007.
Itoh et al., 2007; "Increased adiponectin secretion by highly purified eicosapentaenoic acid in rodent models of obesity and human obese subjects", Arteriosclerosis, Thrombosis, and Vascular Biology; 27(9): 1918-1925.
Johnson et al., 1978, "Simple Method for the Isolation of Astaxanthin from the Basidiomycetous Yeast *Phaffia rhodozyma*", Applied and Environmental Microbiology, 35(6): 1155-1159.
Kolakowska, 1989, "Krill lipids after frozen storage of about one year in relation to storage time before freezing", Die Nahrung Food, 33(3): 241-244.
Kris-Etherton et al., 2002, "Fish Consumption, Fish Oil, Omega-3 Fatty Acids, and Cardiovascular Disease", Circulation, 106:2747-2757.
Kristensen et al., 1989, "Dietary supplementation with n-3 polyunsaturated fatty acids and human platelet function: a review with particular emphasis on implications for cardiovascular disease", J. Intern. Med. Suppl. 731:141-50.
Kunesova et al., 2006, "The influence of n-3 polyunsaturated fatty acids and very low calorie diet during a short-term weight reducing regimen on weight loss and serum fatty acid composition in severely obese women", Physiol Res.; 55 (1):63-72.
Laight et al., 1999, "F2-isoprostane evidence of oxidant stress in the insulin resistant, obese Zucker rat: effects of vitamin E", Eur. J. Pharmacol. 377(1): 89-92.
Lambertson and Braekkan, 1971, "Method of Analysis of Astaxanthin and its Occurrence in some Marine Products," J. Sci. Food. Agr., vol. 22(2): 99-101.
Libby et al., 2006, "Inflammation and Atherothrombosis: From Population Biology and Bench Research to Clinical Practice", J. Amer. Coll. Card., 48 (9, Suppl. A): A33-A46.
Lopez et al., 2004, "Selective extraction of astaxanthin from crustaceans by use of supercritical carbon dioxide", Talanta, 64: 726-731.
Mandeville, 1991, "Isolation and Identification of Carotenoid Pigments, Lipids and Flavor Active Components from Raw Commercial Shrimp Waste", Food Biotechnology, 5(2): 185-195.
Meyers and Bligh, 1981, "Characterization of Astaxanthin Pigments from Heat-Processed Crawfish Waste", J. Agric. Food Chem., 29: 505-508.
Meyers, 1977, "Using Crustacean Meals and Carotenoid-Fortified Diets", Feedstuffs, vol. 49(19).
Meyers, 1994, "Developments in world aquaculture, feed formulations, and role of carotenoids", Pure & Appl. Chem, vol. 66(5): 1069-1076.
Mills et al., 1989, "Dietary N-6 and N-3 fatty acids and salt-induced
Moates and Van Bentem, 1990, "Separating out the value", Food Science and Technology Today, 4(4): 213-214.
Nikolaeva, 1967 "Amino acid composition of protein-coagulate in krill", VNIRO, 63:161-4.
Phleger, et al. (2002) "Interannual and between species comparison in the lipids, fatty acids, and sterols of Antarctic krill from the US AMLR Elephant Island survey area: 1997 and 1998". Comp Biochem Physiol 131B:733-747.
Popp-Snijders et al., 1987, "Dietary supplementation of omega-3 polyunsaturated fatty acids improves insulin sensitivity in non-insulin-dependent diabetes", Diabetes Res. 4(3): 141-7.
Sachindra, 2006, "Recovery of carotenoids from shrimp waste in organic solvents", Waste Management, 26: 1092-1098.
Saether et al., 1986, "Lipids of North Atlantic krill", J Lipid Res., 27(3):274-85.
Shahidi et al., 1998, "Carotenoid Pigments in Seafoods and Aquaculture" Critical Reviews in Food Science, 38(1): 1-67.
Sidehu et al., 1970, "Biochmical Composition and Nutritive Value of Krill (*Euphausia superb* dana)", J. Sci Food Agr., vol. 21, 293-296.
Simopoulos, 1991, "Omega-3 fatty acids in health and disease and in growth and development", Am. Clin. Nutr. 54:438-63.
Somiya, 1982, "'Yellow lens' eyes of a stomiatoid deep-sea fish, *Malacosteus niger*", Proc. R. Soc. Lond., 215: 481-489.
Takaichi et al., 2003, "Fatty Acids of astaxanthin esters in krill determined by mild mass spectrometry", Comparative Biochemistry and Physiology Part B, Biochemistry and Molecular Biology, Elsevier, Oxford, vol. 136, Jan. 1, 2003, p. 317-322.
Tanaka et al., 2004, "Extraction of Phospholipids from Salmon Roe with Supercritical Carbon Dioxide and an Entrainer", J. Oleo Sci, 53(9): 417-424.
Tanaka et al., 2005, "Extraction of Phospholipids from Unused Natrual Resources with Supercritical Carbon Dioxide and an Entrainer", Journal of Oleo Science, vol. 54(11): 569-576.
Todoric et al., 2006, "Adipose tissue inflammation induced by high-fat diet in obese diabetic mice is prevented by n-3 polyunsaturated fatty acids", Diabetologia, 49(9): 2109-2119.
Tou et al., 2007, "Krill for human consumption: nutritional value and potential health benefits.", Nutrition Rev 65 (2):63-77.
Trayhurn et al., 2004, "Adipokines: inflammation and the pleiotropic role of white adipose tissue", Br. J. Nutrition, 92(3): 347-355.
Trebble et al., 2003, "Inhibition of tumour necrosis factor-alpha and interleukin 6 production by mononuclear cells following dietary fish-oil supplementation in healthy men and response to antioxidant co-supplementation", Br. J. Nutrition, 90(2): 405-412.
Ukkola et al., 2002, "Adiponectin: a link between excess adiposity and associated comorbidities?", J. Mol. Med., 80 (11): 696-702.
Van Der Veen et al., 1971 "The Lipids of Krill (Euphausia Species) and Red Crab (*Pleuroncodes planipes*)", Lipids, 6(7): 481-485.
Virtue, et al. 1996, Reproductive trade-off in male Antarctic krill, *Euphausia superba*, Marine Biology, vol. 126, No. 3, pp. 521-527.
Yamaguchi et al., 1983, "The Composition of Carotenoid Pigments in the Antarctic Krill *Euphausia superba*", Bulletin of the Japanese Society of Scientific Fisheries, 49(9): 1411-1415.
Yamaguchi et al., 1986, "Supercritical Carbon Dioxide Extraction of Oils From Antarctic Krill," Journal of Agricultural and Food Chemistry, vol. 34, pp. 904-907.
Yanase M; 1974, "Modification of a Russian method for separation of heat-coagulated protein from Antarctic krill", Database FSTA (online); International Food Information Service (IFIS); Frankfurt-Main, DE.
Yen et al., 1994, "Effect of dietary omega-3 and omega-6 fatty acid sources on PUVA-induced cutaneous toxicity and tumorogenesis in the hairless mouse", Arch. Dermatol. Res., 286(6): 331-6.
Database WPI Week 200682, Thomson Scientific, London, GB, 2006.
English Abstract; JP 2003-531857; See abstract from corresponding WO 2001/082928 filed herewith.
English Abstract; JP 2004-525180; See abstract from corresponding WO 2002/083122 filed herewith.
English Abstract; JP 2006-528233; See abstract from corresponding WO 2004/100943 filed herewith.

DOCKET ALARM
Find authenticated court documents without watermarks at docketalarm.com.

(56) **References Cited**

OTHER PUBLICATIONS

English Abstract; JP 2007-509131; See abstract from corresponding WO 2005/037848 filed herewith.
English Abstract; JP 2007-518764; See abstract from corresponding WO 2005/070411 filed herewith.
English Abstract; JP 2004-536059; See abstract from corresponding WO 2002/09254 filed herewith.
English Abstract; JP 2006-502196; See abstract from corresponding WO 2004/028529 filed herewith.
Sikorski, E., "The Utilization of Krill for Food," Food Process Eng., 1:845-855 (1980).
Budzinskli, E., et al., "Possibilities of processing and marketing of products made from Antarctic Krill", FAO Fish. Tech. Pap. (268) 46 pages (1985).
Bunea R., et al.., "Evaluation of the Effects of Neptune Krill Oil on the Clinical Course of Hyperlipidemia," Alternative Medicine Review, Thorne Research Inc., Sandpoint, US, vol. 9, No. 4, Jan. 1, 2004.
Gordeev, K.Y., et al. "Fatty Acid Composition of the Main Phospholipids of the Antarctic Krill, *Euphausia superba*," Khim. Prirod. Soed. 2 (1990), pp. 181-187.
Dec. 8, 2011 Office Action, KR Patent Application No. 10-2010-7006897 and its English translation.
JP Office Action mailed Feb. 23, 2012, JP Patent Application No. 2010-522444 (and English translation).
Valeri, D., et al., "Visocities of Fatty acids, triglycerides and their binary mixtures," JAOCS 74 (1997) pp. 1221-1226.
CRC 2013-2014, 94th ed., pp. 6-231-6-235.
European Search Report, EP Patent Application No. EP12187516, mailed Jun. 10, 2013.
EP Opposition filed Feb. 13, 2014 by Olympic Seafood AS, EP Patent Application No. EP0871891016.
Brzustowicz, Michael R., et al., "Controlling Membrane Cholesterol Content. A Role for Polyunsaturated (Docosahexaenoate) Phospholipids," Biochemistry (2002), 41, pp. 12509-12519.
Jong-Ho Lee, "A Review: Antioxygenic and Peroxide-decomposing Activities of Antarctic Krill Lipids," J. Korean Soc. Food Mutr. 13(3) pp. 326-333 (1984).
Ki Woong Cho, et al., "Lipid and Fatty Acid Composition of the Antarctic Krill *Euphausia superba*," Ocean Research 21(2): 109-116 (1999).
Hvattum, Erlend, et al., "Effect of soybean oil and fish oil on individual molecular species of Atlantic salmon . . . ", Journal of Chromatography B, 748 (2000) 137-149.
Igarashi, Daisuke, et al., "Positional Distribution of DHA and EPA in Phosphatidylcholine and Phosphatidylethanolamine from Different Tissues of Squids," J. Oleo Sci. vol. 50, No. 9 (2001).
Tochizawa, Kaoru, et al., "Effects of Phospholipds Containing Docosahexaenoic Acid on Differentiation and Growth of HL-60 Human Promyelocytic Leukemia Cells," J. Jpn. Oil Chem. Soc. vol. 46, No. 4 (1997).
Zerouga, Mustapha, et al., "Comparison of phosphatidylcholines containing one or two docosahexaenoic acyl chains on properties of phospholipid monolayers and bilayers," Biochimica et Biophysica Acta 1236 (1995) 266-272.
Eung-Ho Lee, et al., "Studies on the Processing of Krill Sauce," J. Korean Soc. Food Nutr. 13(1) 97-106 (1984).
Hyun-Ku Kim, et al., "Effects of Cooking and Drying Methods on the Polar Lipds Composition of Shrimp," Korean J. Food Sci. Technol. vol. 21, No. 1, pp. 25-30 (1989).
Shon, Mi-Yae, et al., "Effects of Krill and Cadmium on Lipid Composition of Plasma in Cholesterol-Fed Rats," J. Korean Soc. Food Nutr. 23(1), 38-43 (1994).
Summons Materials downloaded from Espace on Dec. 16, 2014 for EP Patent Application No. 08 718 910.6.
"Neptune Technologies & Bioressources Soon to Obtain a Major Patent in Over 30 Countries" ("2001 Press Release,").
Balassa et al., Microencapsulation in the Food Industry, Critical Reviews in Food Technology, 2:2, 245-265 (1971).
Bell and Dick, Molecular Species Composition of the Major Diacyl Glycerophospholipids from Muscle, Liver, Retina and Brain of Cod (*Gadus morhua*), Lipids, vol. 26, No. 8, pp. 565-573 (1991).
Bell, Molecular Species Analysis of Phosphoglycerides from the Ripe Roes of Cod, Lipids, vol. 24, No. 7 (1989).
Bell, Molecular Species Composition of Phosphatidylcholine from *Crypthecodinium cohnii* in Relation to Growth Temperature Lipids 25, 115-118 (1990).
Bergelson (ed.), Lipid Biochemical Preparations, Chapter 1.1, pp. 1-13 (1980).
Bottino, N.R., "Lipid Composition of Two Species of Antarctic Krill: *Euphausia Superba* and *E. Crystallorophias*," Comp. Biochem. Physiol., 1975, vol. 50B, pp. 479-484.
Buchi R-220 Rotovapor® Manual.
Buda, Structural order of membranes and composition of phospholipids in fish brain cells during thermal acclimatization, Proc. Natl. Acad. Sci. USA vol. 91, pp. 8234-8238, Aug. 1994.
Certificate of translation of Ex. 1072: Fisheries Agency, General Report on Research and Development of Techniques in Processing and Utilization of Marine Products, Chapter 6, Development of technology for recovery of valuable substances (astaxanthin) from krill, by Takao Fujita, pp. 273-307 (Mar. 1985); Japanese language document.
Certificate of translation of Ex. 1074: Japanese Patent No. 60-153779, entitled "Nutritional Supplement".
Certificate of translation of Ex. 1076: Japanese Patent Publication No. H08-231391, entitled "Medicine for Improvement of Dementia Symptoms".
Certification of translation of Ex. 1070: Japanese Unexamined Patent Application Publication No. 02-215351.
Certified translation of Ex. 1070: Japanese Unexamined Patent Application Publication No. 02-215351, titled Krill Phospholipids Fractioning Method ("Maruyama,"); Certificate of Translation provided as Ex. 1071.
Certified translation of Ex. 1072: Fisheries Agency, General Report on Research and Development of Techniques in Processing and Utilization of Marine Products, Chapter 6, Development of technology for recovery of valuable substances (astaxanthin) from krill, by Takao Fujita, pp. 273-307 (Mar. 1985) ; Certificate of Translation provided as Ex. 1073.
Certified translation of Ex. 1074: Japanese Patent No. 60-153779, entitled "Nutritional Supplement" ("Fukuoka"); Certificate of Translation provided as Ex. 1075.
Certified translation of Ex. 1076: Japanese Patent Publication No. H-108-231391, entitled "Medicine for Improvement of Dementia Symptoms" ("Yasawa"); Certificate of Translation provided as Ex. 1077.
Declaration of Bjorn Ole Haugsgjerd in support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Bjorn Ole Haugsgjerd submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Albert Lee in Support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Dr. Albert Lee in Support of Inter Partes Review of U.S. Pat. No. 8,383,675.
Declaration of Dr. Chong Lee submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Earl White submitted during prosecution of parent patent U.S. 8,030,348.
Declaration of Dr. Ivar Storm in support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Dr. Ivar Storm in support of Inter Partes Review of U.S. Pat. No. 8,383,675.
Declaration of Dr. Jacek Jaczynski from inter partes reexamination of the parent patent U.S. 8,030,348.
Declaration of Dr. Jaczynski submitted during prosecution of parent patent U.S. 8,278,351.
Declaration of Dr. Jeff Moore in Support of Inter Partes Review of U.S. Pat. No. 8,278,351.

DOCKET ALARM
Find authenticated court documents without watermarks at docketalarm.com.

(56) **References Cited**

OTHER PUBLICATIONS

Declaration of Dr. Richard van Breemen in Support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Dr. Richard van Breemen in Support of Inter Partes Review of U.S. Pat. No. 8,383,675.
Declaration of Dr. Shahidi submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Shahidi submitted during prosecution of parent patent U.S. 8,278,351.
Declaration of Dr. Suzanne Budge in Support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Dr. Suzanne Budge in Support of Inter Partes Review of U.S. Pat. No. 8,383,675.
Declaration of Dr. Thomas Brenna in support of Inter Partes Review of U.S. Pat. No. 8,278,351.
Declaration of Dr. Thomas Brenna in support of Inter Partes Review of U.S. Pat. No. 8,383,675.
Declaration of Dr. Thomas Gundersen submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Tina Sampalis submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Van Breemen submitted during Ex parte Reexamination of the '351 patent.
Declaration of Dr. Van Breemen submitted during Inter partes Reexamination of the '348 patent.
Declaration of Dr. Yeboah submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Declaration of Dr. Yeboah submitted during prosecution of parent patent U.S. 8,278,351.
Eichberg, "Lecithin—It Manufacture and Use in the Fat and Oil Industry," Oils and Soap 51-54, 1939.
Expert Witness Report of Dr. Theodore Welch submitted in relation to ITC Investigation No. 337-TA-877.
Farkas, Composition and Physical State of Phospholipids in Calanoid Copepods from India and Norway, Lipids, vol. 23, No. 6 (1988).
Final Prospectus dated May 11, 2001.
Fisheries Agency, General Report on Research and Development of Techniques in Processing and Utilization of Marine Products, Chapter 6, Development of technology for recovery of valuable substances (astaxanthin) from krill, by Takao Fujita, pp. 273-307 (Mar. 1985); Japanese language document.
Folch, et al., A Simple Method for the Isolation and Purification of Total Lipids from Animal Tissues. J. Biol. Chem., 226, 497-509 (1957).
Grant of Request for Ex parte Reexamination of the '351 patent.
Grit et al., Hydrolysis of phosphatidylcholine in aqueous liposome dispersions, Int. J. Pharmaceutics 50:1-6 (1989).
Henderson et al., Lipid Composition of the Pineal Organ from Rainbow Trout (*Oncorhynchus mykiss*), Lipids, vol. 29, No. 5, pp. 311-317 (1994).
Herman and Groves, The Influence of Free Fatty Acid Formation on the pH of Phospholipid-Stabilized Triglyceride Emulsions, Pharmaceutical Research 10(5):774-776 (1993).
Itano Refrigerated Food Co., Ltd., Bio & High Technology Announcement and Natural Astaxanthin & Krill Lecithin, pp. 1-16 (on or before Dec. 28, 1994).
Johnson and Lucas, Comparison of Alternative Solvents for Oils Extraction, JAOCS 60(2):229-242 (1983).
Le Grandois et al., Investigation of Natural Phosphatidylholine Sources: Separation and Identification by Liquid Chromatography -Electrospray Ionization-Tandem Mass Spectrometry (LC-ESI-MS2) of Molecular Species, J. Agric. Food Chem., 57, 6014-20 (2009).
Lin et al., Effect of Dietary N-3 Fatty Acids Upon the PhospholipidMolecular Species of the Monkey Retina, Invest Ophthalmol Vis Sci. 1994;35:794-803.
Medina et al., C Nuclear Magnetic Resonance Monitoring of Free Fatty Acid Release After Fish Thermal Processing, J. Amer. Oil Chem. Soc. 71(5):479-82 (1994).
Oct. 24, 2012 Office Action, '675 patent.
Office Action dated Jan. 5, 2012, '351 patent.
U.S. Appl. No. 60/307,842 (Priority document for the '351 patent).
Supplemental Declaration of Bjorn Ole Haugsgjerd submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Supplemental Declaration of Dr. Earl White submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Supplemental Declaration of Dr. Earl White submitted during prosecution of parent patent U.S. 8,278,351.
Supplemental Declaration of Dr. Thomas Gundersen submitted during inter partes reexamination of parent patent U.S. 8,030,348.
Suzuki, T. T and Shibata, N., "The utilization of Antarctic krill for human food," Food Rev. Intl, 6:1, 119-147 (1990).
Takahashi et al., Compositional Changes in Molecular Species of Fish Muscle Phosphatidylcholine During Storage, Bull. Fac. Fish. Hokkaido Univ. 37(1), 80-84 1986.
Takahashi et al., Molecular Species of Fish Muscle Lecithin, Bulletin of the Japanese Society of Scientific Fisheries 48 (12), 1803-1814 (1982).
Takahashi et al., Prediction of Relative Retention Value of the Individual Molecular Species of Diacyl Glycerolipid on High Performance Liquid Chromatography, Bull. Fac. Fish. Hokkaido Univ. 38(4), 398-404. 1987.
Tanaka, Biosynthesis of 1,2-dieicosapentaenoyl-sn-glycero-3-phosphocholine in *Caenorhabditis elegans*, Eur. J. Biochem. 263, 189±194 (1999).
Tocher, Chapter 6, Glycerophospholipid metabolism, Biochemistry and molecular biology of fishes, vol. 4, Hochachka and Mommsen (eds.)(1995).
Watanabe et al., Effective Components in Cuttlefish Meal and Raw Krill for Improvement of Quality of Red Seabream Pagrus major Eggs, Nippon Suisan Gakkaishi 57(4):681-694 (1991).
WHO News and Activities, Bulletin of the World Health Organization, 73(4), pp. 547-51 (1995).
CN Office Action mailed Apr. 27, 2012, JP Patent Application No. 200880112125.6 (and English translation).
Fricke, et al., Lipid, Sterol and Fatty Acid Composition of Antarctic Krill (*Euphausia superba* Dana), Lipids (1984) 19 (11): 821-827.
Fricke, et al., 1-0-Alkylglycerolipids in Antarctic Krill (*Euphausia Superba* Dana), Comp. Biochem. Physiol. (1986) 85B(1): 131-134.
Gordeev, K.Y., et al. "Fatty Acid Composition of the Main Phospholipids of the Antarctic Krill, *Euphausia superba*," Chem. Nat. Cmpds. (1990) 26(2), pp. 143-147.
Grantham (1977) Southern Ocean Fisheries Survey Programme, FAO Rome, GLO/SO/77/3: 1-61.
Raventos et al., Application and Posssibilities of Supercritical CO2 Extraction in Food Processing Industry: An Overview, Food Science and Technology International (2002) 8: 269-284.
Tanaka, T., et al., Platelet-activating Factor (PAF)-like Phospholoipds Formed during Peroxidation of Phosphatidylcholines from Different Foodstuffs, Biosci. Biotech. Biochem. (1995) 59 (8), pp. 1389-1393.
Winther, et al., Elucidation of Phosphatidylcholine Composition in Krill Oil Extracted from *Euphausia superba*, Lipids (2011) 46: 25-36.

* cited by examiner

DOCKET ALARM
Find authenticated court documents without watermarks at docketalarm.com.

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.