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(54) **Title**: EXTRACT WITH HIGH AMOUNT OF BIOACTIVE COMPONENTS, AND ITS USE

(57) **Abstract**: The invention relates to a berry extract comprising at least 0.01 weight-%, preferably at least 1 weight-% of L-quebrachitol, i.e. (-)-2-O-methyl-L-*chiro*-inositol. Preferably, the extract is obtained by extracting aresidue from a CO_2 extraction processby using a solvent different from CO_2.The invention relates also to the use of the extract for manufacture of functional foodsupplements, cosmetics, health care and personal care products.

EXTRACT WITH HIGH AMOUNT OF BIOACTIVE COMPONENTS, AND ITS USE

The present invention relates to an extract with high amount of bioactive components according to the preambles of the enclosed claims. The invention relates also to use of the extract.

BACKGROUND OF INVENTION

Plant materials are rich sources of bioactive components that have beneficial effects for human health. Herbs and herbal extracts are used globally in traditional medicines and remedies. Plant extracts manufactured by different technologies have been used in products for health care and personal care.

Carbon dioxide (CO_2) extraction is a modern technology for isolating sensitive components from valuable raw materials. Instead of conventional solvents, carbon dioxide in the form of fluid or supercritical fluid is used for extracting the components of interest from the natural raw material. Due to the absence of organic solvents and oxygen the extracts are free of solvent residues and oxidative damages.

CO_2 extraction technology is used for manufacturing of essential oils, natural fragrances, specialty oils and lipid extracts. Carbon dioxide extracts from plant materials are widely used as ingredients of food, food supplements, personal care products and medicines.

Presently the residues from the CO_2 extraction process are largely unused. Most of the materials are discarded as waste, which often means significant cost for companies processing large quantities of raw materials and sometimes creates environmental concerns.

Berries are known to include many bioactive components. It is an increasing desire to define the bioactive components and to be able to concentrate the most interesting of these components so that they could be used as functional

ingredients of food supplements, cosmetic or healthcare products. Especially, many health benefits have been shown for sea buckthorn berry in scientific investigations, which benefits are believed to be a result of synergy among many different bioactive components in the berry. However, the bitter taste of the sea buckthorn berry has limited its use in food supplements.

OBJECT AND SUMMARY OF THE INVENTION

An object of this invention is to minimise or even eliminate the problems and disadvantages existing in the prior art.

Another object of the present invention is to provide an extract which is rich in selected bioactive components and which is suitable for use in food supplements and cosmetic products without extensive purification steps.

Still another object of the present invention is to provide an extract which is ecologically safe.

In order to achieve the above-mentioned objects the present invention is characterised in what is defined in the characterising parts of the independent claims presented hereafter.

Typical berry extract according to the present invention comprises at least 0.01 weight-%, preferably at least 1 weight-% of L-quebrachitol, i.e. (-)-2-O-methyl-L-*chiro*-inositol.

Typical use of the extract according to the present invention is for manufacturing of functional foods, food supplements, cosmetics, health care and personal care products.

Now it has been surprisingly found out that certain bioactive compounds are released from the cellular structure of the plant material, especially from berries, and enriched, for example, during CO_2 extraction process to the residual material,

whereby some of the compounds are enriched and present in the forms of high biological activity and bioavailability in the residual material. The extracts according to the present invention comprise typically a high content of selected bioactive compounds and/or a reduced content of undesirable substances that interfere with the formulation process, and they typically improve the stability or sensory properties, such as taste, of the final products.

According to one preferred embodiment the extract is obtained by extracting a residue from a CO_2 extraction process by using a solvent different from CO_2. The extracts obtained by further extracting the residual material have composition significantly different from those obtainable by extraction of native plant raw material. From the residues obtained from the CO_2 extraction process the enriched compounds may be recovered simply and fast by a further extraction with a different solvent. It has been found out that especially the extraction of polar, hydrophilic components such as sugars, sugar alcohols, sugar derivatives, phenolic compounds, proteins, peptides, amino acids, fibres, oligosaccharides or polysaccharides, from the residues is more efficient compared to the extraction from the corresponding native raw material. In other words, extracts rich in these bioactive compounds may be obtained easily. In addition, many steps of further cleaning may be omitted due to the low content of disturbing substances in the residue used as raw material.

According to another embodiment of the invention the extract rich in L-quebrachitol may be obtained by pressing of fresh berries. Especially berries of *Hippophaë rhamnoides* ssp. *sinensis* are preferred as a raw material for fresh pressing.

Especially, the extract according to the present invention is rich in L-quebrachitol, the amount of L-quebrachitol being at least 0.1 weight-%, preferably 5 weight-%, more preferably at least 5 weight-%, very preferably 1 – 5 weight-%. It has been surprisingly found out that L-quebrachitol, also known as (-)-2-O-methyl-L-*chiro*-inositol, may provide for many of the advantageous effects associated with berries, such as antioxidative, detoxifying and/or tissue protective activities, as well as effects on sugar metabolism and insulin sensitivity. The extract according to the

present invention may be used for treating disorders of sugar metabolism and insulin sensitivity, such as type II diabetes. The extract may also be used for manufacturing medicaments for treating and reducing the risk of disorders of sugar metabolism and insulin sensitivity, such as obesity and type II diabetes. The extract may also be used for the manufacture of medicaments for disorders of sugar metabolism and insulin sensitivity, such as type II diabetes and obesity.

According to one embodiment of the invention the extract comprises in addition to L-quebrachitol also other methyl inositols and/or inositols, such as *myo*-inositol, methyl *myo*-inositol and/or *chiro*-inositol. The extract may comprise 0.01 – 99.9 weight % L-quebrachitol, 0.01 – 20 weight-% *chiro*-inositol, 0.01 – 20 weight-% *myo*-inositol, and/or 0.01 – 20 weight-% methyl *myo*-inositol. Preferably the extract comprises 0.1 – 10 weight % L-quebrachitol, 0.01 – 1 weight-% *chiro*-inositol, 0.01 – 1 weight-% *myo*-inositol, and/or 0.01 – 1 weight-% methyl *myo*-inositol. More preferably the extract comprises 1 – 5 weight % L-quebrachitol, 0.1 – 1 weight-% *chiro*-inositol and 0.1 – 1 weight-% *myo*-inositol.

The extract may also comprise ethyl β-D-glucopyranose, phenolic compounds, fruit sugars, such as fructose and glucose, fruit acids, such as malic acid and quinic acid, and/or oligosaccharides. The extract may comprise 1 – 5 weight-% phenolic compounds, 10 – 20 weight-% fruit sugars, 5 – 15 weight-% fruit acids, optionally peptides and/or oligosaccharides. The extract may comprise phenolic compounds, such as ellagitannins and flavonol glycosides at ratio from 1:10 to 10:1, preferably 2:1 to 5:1. Preferably the extract comprises less than 0.5 weight-% lipids or less than 0.01 weight-% carotenoids in order to obtain physical properties for the extract, which are optimal for formulation and manufacturing of different end products, such as cosmetic preparations. For example, the extract is preferably colourless or very lightly coloured, and transparent.

According to another embodiment of the present invention the extract comprises 1 – 3 weight % L-quebrachitol, 0.01 – 0.5 weight-% *chiro*-inositol, 0.01 – 0.5 weight-% *myo*-inositol, 0.5 – 1 weight-% phenolic compounds, 1 – 30 weight-% fruit sugars, 5 – 20 weight-% fruit acids, and optionally peptides and/or

oligosaccharides. According to still another embodiment of the invention the extract comprises 1 – 5 weight % L-quebrachitol, 0.01 – 1 weight-% *chiro*-inositol, 0.01 – 1 weight-% *myo*-inositol, 0.1 – 5 weight-% ethyl β-D-glucopyranose, 0.1 – 5 weight-% phenolic compounds, 1 – 20 weight-% fruit sugars, and 5 – 15 weight-% fruit acids.

According to still another preferred embodiment of the present invention the extract comprises additionally up to 10 weight-%, preferably up to 5 weight-%, preferably 1 – 5 weight-% ethyl β-D-glucopyranose.

According to one preferred embodiment of the present invention the residue from a CO_2 extraction which is used as a raw material for the extract originates from berry material selected from the group comprising *Hippophaë rhamnoides, Vaccinium myrtillus, Vaccinium vitis-idaea, Vaccinum macrocarpon, Vaccinium oxycoccos, Rubus chamaemorus, Rubus idaeus, Ribes nigrum, Ribes rubrum, and Fragaria ananassa*. These natural materials comprise especially important bioactive compounds that may be used in cosmetics and health care products. Especially *Hippophaë rhamnoides* is preferred as a raw material. Berries of different subspieces of *H. rhamnoides* are used, such as berries of *H. rhamnoides* ssp. *sinensis,* ssp. *rhamnoides* and ssp. *mongolica.* According to one embodiment of the invention the extract originates from a residue of a CO_2 extraction of berries of *H. rhamnoides* ssp. *rhamnoides*, ssp. *sinensis* or their mixture, which is used as a raw material for the extraction. The first extraction is carried out with CO_2 and the residue from CO_2 extraction is extracted with ethanol/water.

Berries of *Hippophaë rhamnoides* ssp. *sinensis* are preferred as a raw material in order to achieve high content of L-quebrachitol in the extract.

It is possible to use as solvent water, ethanol, ethanol/water, acetone, butylene glycol, butylenes glycol/water, glycerine or their mixtures in the extraction of the residual material. According to one preferred embodiment of the invention a mixture of butylene glycol and water, a mixture of glycerine and water or a mixture of ethanol and water may be used as a solvent. The ratio between the two

solvents in the above mentioned mixtures may vary from 9.9:0.1 to 0.1:9.9, depending on the raw materials and components of interest. For example, a residue from CO_2 extraction of sea buckthorn may be extracted by using water as a solvent, whereby the obtained extract comprises bioactive compounds, inositols, methyl inositols, oligosaccharides, small peptides, soluble phenolic acids and flavonol glycosides. When the same raw material is extracted by using a solvent system comprising water and up to 70 volume-% of ethanol, an extract with increased amount of phenolic compounds is obtained. Also the proportion of proanthocyanidins and tannins is also increased from about 1 % to about 70 % of the total phenolic compounds in the obtained extract, as well as the amount of phospholipids and glycolipids.

Typically the fresh and dried berries may be extracted with water and polar solvents. Preferably the raw material is a residue obtained from supercritical CO_2 extraction process of dried berries.

According to one embodiment of the invention the extract is essentially free of disturbing solid particles originating from raw materials. Possible disturbing solid material may be separated from the obtained extract after the actual extraction with different solvent than CO_2. Disturbing solid material may be removed from the extract by for example filtration and/or centrifugation.

The obtained extracts are normally in form of liquid extracts. The extract may also be obtained in particulate powder form after solvent removal. According to one embodiment of the invention the extract is dried and brought into solid, often powder-like, form. The used solvent is first separated from the extract, which is then dried. The drying may be performed by any suitable drying method, for example, by air drying, oven-drying, freeze-drying, vacuum-drying or spray drying.

It is also possible to add further enriching, refining and/or purifying steps before or after the drying of the extract in order to produce extracts of high purity and/or high concentration of selected components. The refining and purifying methods may include, but not be limited to, extraction with different solvents or chromatography

in different columns. Suitable solvents are e.g. water, ethanol, or mixtures of acid/water, water/ethanol or acid/water/ethanol. Suitable column for chromatographic refining and purifying is e.g. an adsorption silica column or an ion exchange column.

Typically the extract according to the present invention that is obtained by extracting a berry residue from CO_2 extraction process comprises one or several of the following bioactive components: 0.01 – 30 weight-% sugar alcohols; 0.01 – 30 weight-% sugar derivatives; 0.01 – 30 weight-% phenolic compounds; proteins; peptides; amino acids; acids; monosaccharides, such as fructose and glucose; oligosaccharides; polysaccharides, such as pectin; polar lipids, such as phospholipids or glycolipids; minerals, such as potassium, calcium, iron, magnesium, zinc, tin; vitamins, such as vitamin C, vitamin E, folic acid, pantothenic acid; and antioxidants, such as tocopherols and tocotrienols.

The total amount of phenolic compounds, such as flavonoids, phenolic acids and tannins in extracts may be in the range of 0.1 weight-% to 99.9 weight-%, typically from 0.5 – 70 weight-%, preferably 0.5 – 50 weight-%, more preferably 1 – 10 weight-%, still more preferably 1 – 5 weight-%. The phenolic compounds in the extract provide effective antioxidant and protective activity when the extract is used for example, in food supplements or cosmetic products.

The extract composition may be controlled by careful selection of the raw materials. Different berry residues from the CO_2 extraction comprise different chemical compounds in different amounts. By careful selection of the berry raw material used the chemical composition of the extract may be tailored after requirements. The amount of sugar alcohols, sugar derivatives and/or phenolic compounds may also be controlled by suitable selection of the extraction parameters, such as extracting solvent. For example, by changing the solvent from water to mixtures of ethanol/water with increasing proportion of ethanol, the amount of sugar alcohols and sugar derivatives, as well as the amount and composition of phenolic compounds in the extract may be changed.

According to one embodiment of the invention residues obtained by extracting seeds and berries of sea buckthorn or cloudberry with CO_2 are further extracted by using a mixture of butylene glycol and water or a mixture of glycerine and water. The possible solid material is then removed by filtration. The final purified extract comprises multiple bioactive components, e.g. inositols, methyl inositols, sugar derivatives, phenolic compounds, proteins, peptides, amino acids, fruit acids, monosaccharides, oligosaccharides and polysaccharides, polar lipids, such as phospholipids, glycolipids, minerals, vitamins, and antioxidants.

The extract may also comprise high amounts of effective antioxidants. According to one embodiment the extract comprises cyclitol compounds, such as 1-D-1-*O*-methyl-*muco*-inositol, 3-*O*-methyl-D-*chiro*-inositol (pinitol) and 1-D-4-*O*-methyl-*myo*-inositol (ononitol). These compounds are important as effective scavengers of hydroxyl radicals and detoxifying compounds in biological systems. According to one embodiment of the invention the extract comprises 0.01 – 10 weight-% L-quebrachitol, and 0.01 -- 10 weight % inositols, preferably 0.5 – 5 weight-% L-quebrachitol, and 0.1 -- 1 weight % inositols. According to another embodiment of the invention the extract comprises 0.01 – 10 weight-% L-quebrachitol, 0.01 -- 10 weight % inositols and 0.01 – 10 weight-% ethyl β -D-glucopyranose; preferably 0.5 – 5 weight-% L-quebrachitol, 0.01 -- 1 weight % inositols and 0.01 – 5 weight-% ethyl β -D-glucopyranose.

The extract may also comprise sugars, such as glucose and fructose. The amount of fructose is typically 1 – 20 weight-%, more typically 1 – 10 weight-% and the amount of glucose is typically 1 – 20 weight-%, more typically 1 – 10 weight-%. Fructose may exist as a mixture of α- and β-furanose and β-pyranose. The glucose may exist as α- and β-anomers of pyranose. The amount of sucrose is typically less than 0.1 weight-%. The sugar composition of the extract is advantageous for use in different foods, food supplements and functional foods.

The extracts according to the present invention that are obtained by extracting a plant material comprising fresh and dried berries or berry residue from a CO_2 extraction process may be used as food or in feed or food supplements as a

source of macronutrients, micronutrients and/or other bioactive components. Typically the amount of the extract may vary at levels of 0.1 – 100 %, more typically 10 – 60 % and still more typically 30 – 50% of the end product. For example, the extracts may be used in the said products as sources of antioxidants, other bioactive components, proteins, fibres or nutrients with low energy values. They may also be used to improve the health of humans or animals or to improve the quality or quantity of products produced by animals, e.g. meat or milk.

The extracts that are preferably obtained by extracting a plant material comprising residue from a CO_2 extraction may be used as ingredients for health care, cosmetic or personal care products. They may be used as skin nourishing components and natural antioxidants as well as peeling and scrubbing agents. Examples of the products, where the extracts may be used, are orally administered products for skin care, topical creams and lotions, face scrubs, face gels, shower gels, shampoos and hair conditioners.

The extracts that are obtained by extracting a plant material or plant material residue from a CO_2 extraction may also be used as antioxidants, anti-microbial agents, natural preservatives or as anti-inflammatory ingredients. They may also be used as functional ingredients for angiotensin convertase activity, for maintaining the health of the heart and the vascular system, for maintaining skin health and reducing skin ageing, for maintaining and improving skin elasticity, or as functional ingredients for promoting skin regeneration and wound healing.

According to one embodiment of the invention the extract is used in a functional food or food supplement in amount corresponding to 0.01 – 100 weight-%, preferably 10 – 50 weight-% of the end product. According to another embodiment of the invention the extract is used in a cosmetics, such as face creams or body lotions, in amount corresponding to 0.01 – 20 weight-%, preferably 0.1 – 5 weight-% of the end product. According to a third embodiment of the invention the extract is used in a personal care product, such as face scrubs, face gels, shower gels, shampoos and hair conditioners, in amount corresponding to 0.01 – 20 weight-%,

preferably 0.05 – 10 weight-%, more preferably 0.1 – 5 weight-% of the end product.

Typically the residue from a CO_2 extraction and originating from berry plant material comprises at least one of the following: myricetin at least 4 mg/100 g residue, quercetin 20 mg/100 g residue, kamfaerol 10 mg/100 g residue, isorhamnetin 100 mg/100 g residue, or ellagitannins 800 mg/100 g residue.

The residues from the CO_2 extraction are enriched in certain compounds compared to the original plant materials. These enriched components comprise proteins, fibres, peptides, amino acids, phenolic compounds, phospholipids, glycolipids, polysaccharides, oligosaccharides, sugars, acids, minerals, water soluble vitamins and antioxidants. It is also possible to use the residues from the CO_2 extraction as such, as food or feed supplements, personal or health care products.

The invention is more closely described in the following non-limiting examples.

EXAMPLES

Example 1

Residues comprising plant material and obtained from CO_2 extraction are analysed. Tables 1 and 2 show amounts of certain quantities and compounds in the different residues.

Table 1. Composition of CO_2 extraction residues of berries and berry seeds.

	Unit	Sea buckthorn berry residue	Blackcurrant seed residue	Bilberry seed residue	Cloudberry seed residue
Energy	KJ/100 g	1375	1570	1518	1620
Protein	g/100 g	7,25	18,7	17,7	17,6
Carbohydrate	g/100 g	70,1	49,7	64,0	72,3
Fat	g/100 g	1,61	11,0	3,49	2,47
Water	g/100 g	7,55	6,71	6,15	5,54
Ash	g/100 g	13,5	13,9	8,71	2,14
Total fibre	g/100 g	26,6	50,6	57,5	65,8

Table 2. Flavonols and ellagitannins in CO_2 extraction residues of berries and berry seeds

Compounds	**Unit**	Sea buckthorn berry residue	Blackcurrant seed residue	Bilberry seed residue	Cloudberry seed residue
Myricetin	mg/100 g	4,6	4,1	7,7	-
Quercetin	mg/100 g	54	7,5	27,5	1,6
Kamfaerol	mg/100 g	14,3	2,3	2,5	-
Isorhamnetin	mg/100 g	122,3	-	-	-
Total flavonoids	mg/100 g	195	14	37,7	1,6
Ellagitannins	mg/100 g	-	0,85	5,7	1390

”- ” = concentration below detection limit

It may be concluded that these residues may be used as promising starting material for further extraction. They may also be used as such as ingredients in food, feed and personal care products.

Example 2

An extract is obtained by an extraction of a residue from CO_2 extraction of sea buckthorn berries. The extraction is carried out by using 50 % ethanol in water. The obtained extract is spray dried into powder form. The obtained extract comprises ethyl β-D-glucopyranose (3 weight-%) and L-quebrachitol, i.e. (-)-2-O-methyl-*chiro*-inositol, (1.5 weight-%), phenolic compounds (1 weight-%) comprising especially flavonol glycosides and proanthocyanidins, sugars (5 weight-%), acids (20 weight-%), oligosaccharides and peptides. The difference between the obtained extract according to the invention and conventional sea buckthorn extracts is the higher amount of ethyl β-glucopyranose and L-quebrachitol, soluble phenolic acids, proanthocyanidins of P1-P3 and bioactive peptides. The obtained extract is the absent of waxes, oily substances, colours, primarily carotenoids, and odours that may cause difficulties in formulation and instability of the final products.

The antioxidative activity of the obtained extract is investigated by using three different *in vitro* models:

Peroxyl radical scavenging capacity is determined by *in vitro* study, where peroxyl radicals are generated by thermal decomposition of 2,2'-azobis(2,4-dimethylvaleronitrile) and detected by chemiluminescence. Results are given as the stoichiometric factor, that is amount of test compounds required for scavenging of one mole of peroxyl radicals. The peroxyl radical scavenging capacity of the obtained extract is 4.3×10^3 g /mol.

Inhibition of lipid peroxidation is indicative of the capacity of the extract to prevent microsomal lipid peroxidation *in vitro*. Peroxidation of microsomal lipids is initiated by *tert*-butylhydroperoxide and lipid peroxidation is detected by

chemiluminescence. Results are given as the IC50-values, i.e. concentration of test material that inhibits lipid peroxidation by 50 % under these conditions.

Inhibition of LDL oxidation is indicative of the capacity of the extract to prevent oxidation of human low density lipoprotein (LDL) *in vitro*. Oxidation of isolated LDL is induced *in vitro* by copper. Detection of oxidation is performed by spectrophotometric diene conjugation analysis. Results given are as the IC50-values, i.e. concentration of test material that inhibits LDL oxidation by 50% under these conditions.

The results are summarised in Table 3.

Table 3. Antioxidative activities of sea buckthorn extract.

Compound	Prevention of microsomal lipid peroxidation [IC50, µg/mL]	Prevention of LDL lipid per-oxidation [IC50, µg/mg LDL]	Peroxyl radical scavenging [g/mol free radical]
Sea buckthorn extract	4.4	276	4300

Example 3

An inositol-rich extract is obtained by an extraction of a residue from CO_2 extraction of cloudberry or cloudberry seeds. The extract comprises ellagitannins and other phenolic compounds. The extract does not comprise appreciable amounts of triglycerides, waxes or colouring substances that dominate in the extracts prepared from native materials.

The elasticity of the skin decreases with time for many reasons: one of the causes is the natural aging. Degradation of elastin by the activity of elastase is among the major mechanisms of loss of skin elasticity. The potential inhibitory effect of

cloudberry extract on elastase activity is investigated *in vitro*. The results are summarized in Table 4.

Table 4. Inhibitory effect of cloudberry extract on porcine pancreatic elastase (PPE) activity

	Activity of PPE (percentage of control)
Control	100
Control + 1 weight % cloudberry extract	86.8
Control + 2 weight % cloudberry extract	88.6

Example 4

Biological activities of CO_2 extraction residues and extracts prepared from CO_2 extraction residues by further extraction

A range of efficacy studies is carried out with CO_2 extraction residues of a range of plant materials. The results are shown in Tables 5 – 8. A surprisingly wide range of biological activities of the tested materials and extracts prepared from these materials are observed with possible beneficial effects on human and animal health.

Table 5. Total radical-trapping antioxidant potential (TRAP) activity of CO_2 extraction residues.

Sample	Percentage of activity of Trolox C (*
CO_2 extraction residue of cloudberry seeds	0.99 %
CO_2 extraction residue of sea buckthorn berries	1.47 %
CO_2 extraction residue of sea buckthorn seeds	0.98 %

(*Trolox C is a water soluble form of alpha tocopherol, a commonly used antioxidant

Table 6: Inhibition of ethanol/water extract of CO_2 extraction residue on zymosan-induced white cell activation, measured as expression of Mac-1 receptors. Dilution: 10^{-2}.

Sample	Inhibition, % of control
CO_2 extraction residue of cloudberry seeds	79.4
CO_2 extraction residue of sea buckthorn berries	92.1
CO_2 extraction residue of sea buckthorn seeds	96.4

Table 7. Inhibitory effects of CO_2 extraction residues on angiotensin-converting enzyme (ACE).

Sample	IC-50 (µg)*
CO_2 extraction residue of cloudberry seeds	91
CO_2 extraction residue of sea buckthorn berries	93
CO_2 extraction residue of sea buckthorn seeds	110

*IC-50: quantity needed for reaching a final concentration that is needed for 50% inhibition of the ACE activity.

Table 8. Inhibitory effect of an ethanol extract of a residue from CO_2 extraction on the growth of *S. aureus* RN4220

Concentration % (v/v)	Cloudberry seed residue	Sea buckthorn berry residue	Lingonberry seed residue
15 %	**	**	***
20 %	***	***	***

99 % inhibition, * kill all bacteria

Extracts obtained from a further extraction of the plant material comprising residues from CO_2 extraction may be used as food, food supplements, nutraceuticals, cosmetic and personal care products as well as ingredients in these product groups. The concentration level of the extracts in the final products may vary from 0.0001 weight-% to 100 weight-%.

Example 5

A ready-to-drink juice rich in L-quebrachitol and other methyl inositols and/or inositols comprises an extract obtained by further extraction of a residue from CO_2 extraction of sea buckthorn berries. Juice ingredients are fruit juice 99 % by weight from fruits such as orange, lemon, grapefruit, apple, etc. and 1 % by weight spray dried sea buckthorn extract obtained by water/ethanol extraction.

Example 6

A food supplement in capsule or tablet form comprises an extract rich in L-quebrachitol and other methyl inositols and/or inositols obtained by further extraction of a residue from CO_2 extraction of sea buckthorn berries. Food supplement ingredients are direct compressible starch 50 weight-%, spray dried sea buckthorn extract 48.5 weight-%, Vitamin C 1 weight-%, and Vitamin E 0.5 weight-%.

Example 7

A food supplement rich in L-quebrachitol and other methyl inositols and/or inositols in capsule or tablet form comprises extracts obtained by further extraction of a residue from CO_2 extraction of cloudberry and sea buckthorn. Food supplement ingredients are direct compressible starch 50 weight-%, spray dried cloudberry extract 45 weight-%, Vitamin C 1 weight-% and other ingredients 4 weight-%.

Example 8

An anti-ageing and soothing emulsion cream composition for facial and throat skin care comprising spray dried extract rich in inositols obtained from further extraction of a residue from CO_2 extraction of cloudberry seeds. Cream ingredients are (in weight %): cyclopentasiloxane 6.0 %; steareth-2 4.0 %; steareth-21 2.0 %; octyldodecanol 2.0 %; stearic acid 2.0 %; cetearyl alcohol 1.5 %; peg-30 dipolyhydroxystearate 1.0 %; tocopheryl acetate 1.0 %; spray dried cloudberry seed extract 1 – 5 %; phenoxyethanol 0.80 %; ppg-15 stearyl ether 0.60 %; panthenol 0.50 %; perfume 0.20 %; dimethicone/vinyldimethicon crosspolymer 0.30 %; phospholipids 0.2 %; parabens 0.30 %; magnesium ascorbyl phosphate 0.10 %; tocopherol 0.05 %; glycerine 0.025 %; ascorbyl palmitate 0.05 %; sodium chloride 0.003 %; ascorbic acid 0.001 %; and water in order to arrive at 100%.

Even if the invention was described with the reference to what at present seems to be the most practical and preferred embodiments, it is appreciated that the invention shall not be limited to the embodiments above, but the invention is intended to cover also different modifications and equivalent technical solutions within the scope of the enclosed claims.

CLAIMS

1. Berry extract comprising at least 0.01 weight-%, preferably at least 1 weight-% of L-quebrachitol, i.e. (-)-2-O-methyl-L-*chiro*-inositol.

2. Extract according to claim 1, **characterised** in that it is obtained by extracting a residue from a CO_2 extraction process by using a solvent different from CO_2.

3. Extract according to claims 1 or 2, **characterised** in that in addition to L-quebrachitol it also comprises other methyl inositols and/or inositols, such as *myo*-inositol, methyl *myo*-inositol and/or *chiro*-inositol.

4. Extract according to claim 1, 2 or 3, **characterised** in that it comprises also ethyl β-D-glucopyranose, phenolic compounds, fruit sugars, fruit acids and/or oligosaccharides.

5. Extract according to claim 4, **characterised** in that it comprises 1 – 5 weight % L-quebrachitol, 0.01 – 1 weight-% *chiro*-inositol, 0.01 – 1 weight-% *myo*-inositol, 0.1 – 5 weight-% ethyl β-D-glucopyranose, 0.1 – 5 weight-% phenolic compounds, 1 – 20 weight-% fruit sugars, and 5 – 15 weight-% fruit acids.

6. Extract according to any of the claims 1 to 5, **characterised** in that it comprises ellagitannins and flavonol glycosides at ratio from 1:10 to 10:1.

7. Extract according to any of the claims 1 to 6, **characterised** in that it comprises less than 0.5 weight-% lipids or and less than 0.01 weight-% carotenoids.

8. Extract according any of the preceding claims, **characterised** in that it comprises one or several of the following: sugar alcohols and sugar derivatives, phenolic compounds, proteins, peptides, amino acids, acids, monosaccharides, oligosaccharides, polysaccharides, polar lipids, such as phospholipids or glycolipids, minerals, vitamins, or antioxidants.

9. Extract according any of the preceding claims, **characterised** in that it originates from berry material selected from the group comprising *Hippophaë rhamnoides, Vaccinium myrtillus, Vaccinium vitis-idaea, Vaccinum macrocarpon, Vaccinium oxycoccos, Rubus chamaemorus, Rubus idaeus, Ribes nigrum, Ribes rubrum,* and *Fragaria × ananassa.*

10. Extract according to claim 8, **characterised** in that it originates from a residue of a CO_2 extraction of berries of *H. rhamnoides* ssp. *rhamnoides*, ssp. *sinensis* or their mixture.

11. Extract according any of the preceding claims, **characterised** in that water, ethanol, ethanol/water, butylene glycol or butylene glycol/water is used as solvent in the extraction.

12. Use of extract according to any of the claims 1 – 11 for manufacture of functional foods, food supplements, cosmetics, health care and personal care products

13. Use according to claim 12, **characterised** in that the extract is used in a functional food supplement in amount corresponding to 0.01 – 100 weight-%, preferably 10 – 50 weight-% of the end product.

14. Use according to claim 12, characterised in that the extract is used in a cosmetics, such as face creams or body lotions, in amount corresponding to 0.01 – 20 weight-%, preferably 0.1 – 5 weight-% of the end product.

15. Use according to claim 12, characterised in that the extract is used in a personal care product, such as face scrubs, face gels, shower gels, shampoos and hair conditioners, in amount corresponding to 0.01 – 20 weight-%, more preferably 0.1 – 5 weight-% of the end product.

16. Use of the extract according to any of the claims 1 – 11 for the manufacture of medicament for disorders of sugar metabolism and insulin sensitivity, such as type II diabetes and obesity.