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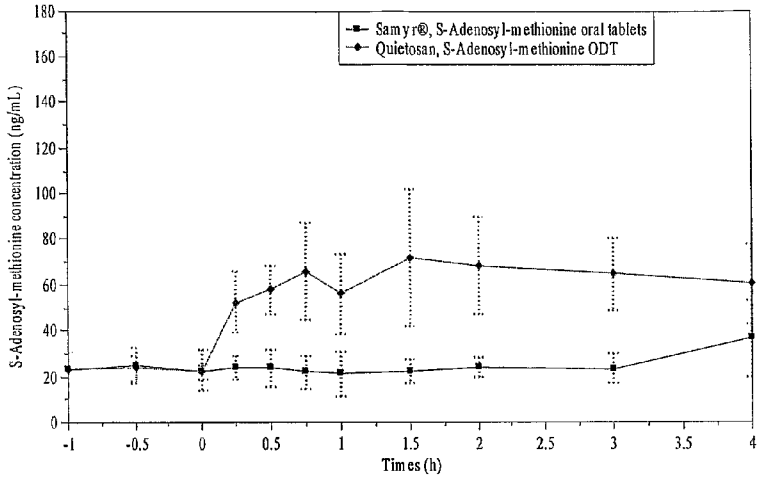
(54) Title: OROSOLUBLE AND/OR EFFERVESCENT COMPOSITIONS CONTAINING AT LEAST A SALT OF S- ADENOSYL METHIONINE (SAME)

FIGURE 1



(57) Abstract: The present invention refers to pharmaceutical, dietary and/or nutraceutical orosoluble and/or effervescent compositions for oral use containing at least a salt of S-adenosyl methionine (SAMe), combined with physiologically acceptable excipients and optionally additional active ingredients. In particular the invention refers to compositions with high palatability formulated in tablet, capsule or granules. The present invention also refers to the use of at least a salt of SAMe combined with physiologically acceptable excipients and optionally further active ingredients for treating, human or veterinarian, neuropsychiatric, osteoarticular or hepatic diseases.

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Orosoluble and/or effervescent compositions containing at least a salt of S-adenosyl methionine (SAMe)

S-adenosyl methionine (SAMe) is an important physiological molecule discovered in 1952 which is formed in the body from the combination of the methionine essential amino acid with adenosine triphosphate (ATP), in a highly demanding reaction as far as energy consumption is concerned, controlled by the SAMe synthetase enzyme.

The main natural source of SAMe for human beings is through intake of food with high protein content of its methionine precursor. It is calculated that a person under normoprotein diet averagely ingests about 1 gram of methionine to be converted into SAMe per day.

The half-life of SAMe in the liver is very short (about 5 minutes) which demonstrates the avidity of the organ for this molecule.

A good and balanced nutrition represents the key factor to supply the body with the required daily bioavailability of SAMe which may be assumed to be about 500 mg and plasma levels between 20 and 50 mg/ml (Bottiglieri T.:SAMe: from the bench to the beside-molecular basis of a pleiotropic molecule. Am. J. Clin. Nutr., 2002, 76:1151S-1157S).

The most known deficiency conditions are for example represented by senescence wherein there occurs a drop of SAMe exceeding 50%, neurological diseases which involve the emotional sphere (depression syndromes in general) and cognitive sphere (dementia), both acute and chronic hepatic disorders (alcoholic steatosis, acute and chronic hepatitis, alcoholic and post-viral cirrhosis, intrahepatic cholestasis) and by degenerative skeletal-muscular diseases distinguished by mobility disorders (osteoarthrosis) (Grazi S., Costa M. :SAMe : The safe and natural way to combat depression and relieve the pain of osteoarthiritis. Prima Health, Rocklin, CA, 1999).

Supplementation with exogenous SAMe follows the same metabolic path as the natural molecule derived from nutritional methionine.

The idea of administering exogenous SAMe to patients was pursued since the discovery of the molecule in the fifties, but it was only after the second half of the seventies that it was put into practice with the introduction into the pharmaceutical market of the first preparations, administered parenterally (both endovenous and intramuscular) or orally (swallowable, either gastro-protected or gastro-resistant tablets) of salts of SAMe (such as for example tosylate, butanedisulfonate or phytate), stable at room temperature.

In particular, United States patents US3954726 and US4057672 describe relatively stable salts of S-adenosyl methionine, i.e. up to 25°C and 45°C, respectively. Furthermore, the United States patent US4465672 describes stable salts of S-adenosyl methionine with 5 moles of a sulfonic acid with pK lower than 2.5.

In brief, non-salified SAMe is very unstable at temperatures above 0°C. Alongside thermolability, the second important factor of degradation of the molecule is represented by its hygroscopicity which can be bypassed by preserving the thermostable salts of SAMe in special protection casings or freeze-drying the salt under vacuum and putting it into a vial.

The availability of stable pharmaceutical preparations based on salts of SAMe allowed carrying out several clinical trials in various therapeutic uses such as depression syndromes, dementia, hepatopathies, osteoarthrosis, fibromyalgia, with the observation of proven clinical effectiveness combined with high tolerance to the molecule (Friedel HA, Goa KL, Benfield P.:SAMe : A review of its therapeutic potential in liver dysfunction and affective disorders in relation to its physiological role in cell metabolism. Drugs, 1989, 38:389-416).

After being first used in Italy, the use of SAMe in the pharmaceutical industry spread into other countries such as Spain, Germany, Russia, and China in the 80s-90s.

Lastly, starting from 1999 SAMe, salified with tosylate or butanedisulfonate, was introduced in the USA as a food supplement still in form of gastro-protected swallowable tablets dosed at 200 and 400 mg of active ingredient.

While parenteral administration (i.e. endovenous or intramuscular) of exogenous SAMe guarantees high levels of plasma bioavailability (corresponding to about 90-100% of the administered dose), oral intake of SAMe through swallowable gastro-protected tablets only produces low plasma levels of the non-modified molecule i.e. < 5-10% of the administered dose.

This considerable bioavailability difference derives from the high presystemic metabolism at the hepatic level of the SAMe taken orally in gastro-protected form (i.e. gastro-resistant, capable of passing unaltered through the gastric environment and dissolving solely at the intestinal level, tributary of the portal vein).

As a matter of fact, it is known that oral intake of SAMe, radiolabeled on the carbon of the methyl group, leads to an intensive hepatic metabolism assessable at about 60% of the administered radioactivity (Giulidori P. et al.-Metabolism of exogenous SAMe in humans and its significance in the therapeutic use of the drug. Proceedings of the Workshop "*Methionine Metabolism: Molecular Mechanisms and Clinical Implications*". Madrid, Spain, Jarpyo Editores, 1998:159-163).

The high presystemic metabolism in the liver depends on the selective absorption of the SAMe at enteric level, due to the gastro-protected formulation thereof suitable to facilitate direct transfer thereof to the liver through the dominating enterohepatic portal venous system.

The systemic bioavailability levels of the molecule are drastically lowered by the metabolic avidity of the liver for SAMe.

Whereas this high presystemic metabolism of the SAMe is not prejudicial in subjects suffering from hepatic diseases, on the contrary it strongly jeopardises subjects who take orally the molecule to obtain clinical benefit related to other morbid diseases, in particular subjects suffering from depression syndromes or from osteoarthrosis, in which case molecular tropism of the extrahepatic SAMe is required.

It has been demonstrated in depressed subjects that the small plasma amount of SAMe that escapes the hepatic uptake is still capable of overcoming the obstacle of the hematoencephalic barrier and accumulating in small amounts in the cephalorachidian liquid. Regarding patients suffering from osteoarthrosis, SAMe is also capable of concentrating in the synovial fluid of the joints.

Thus, though penalised by the extensive first pass effect, the gastro-protected oral SAMe reaches the elected therapeutic sites in very little amounts.

Therefore, there is the need to increase the systemic bioavailability of the SAMe and/or its salts, when administered orally, so as to make it more suitable for treating extrahepatic diseases, for example, those regarding the central nervous system or the osteoarticular system.

Now, it has been surprisingly found that it is possible to overcome the obstacle of the hepatic presystemic metabolism of the salts of SAMe, related to the current swallowable and gastro-resistant oral formulations, through formulation in specific non-gastro-resistant orosoluble and/or effervescent compositions.

Preferably, said orosoluble and/or effervescent compositions are characterised in that they have a high palatability, which guarantees easy oral administration thereof.

Through orosoluble and/or effervescent formulations, the salts of SAMe are administered and absorbed directly in the oral cavity generating a much quicker absorption and a considerably higher bioavailability with respect to the current method of administration by means of gastro-resistant tablets, considering the same dose of active ingredient.

A similar technical effect is interpretable in the light of the fact that the oral haematic system drains in the superior vena cava avoiding the portal venous system responsible for the known first pass effect, thus improving the systemic bioavailability.

Thus, the present invention refers to orosoluble and/or effervescent compositions for oral use containing at least a salt of SAMe combined with physiologically acceptable excipients.

The orosoluble and/or effervescent compositions of the invention are preferably characterised in that they have a high palatability which guarantees easy oral administration thereof.

Said high palatability also determines in the treated subject (human or animal) a greater period of permanence of the composition in the oral cavity, and an ensuing lower impulse to swallow, which contributes to improve the rate of absorption and the bioavailability of the active ingredient.

According to the present invention the term "SAMe" is used to indicate both the racemic mixture and the single diastereoisomers (RS)-(+)-S-adenosyl-L-methionine [(RS)-(+)-SAMe)] and (SS)-(+)-S-adenosyl-L-methionine [(SS)-(+)-SAMe)], even in mixtures different from the racemic one.

According to the present invention the salts of SAMe are preferably selected from among tosylate (para-toluenesulfonate), butanedisulfonate, phytate or a mixture thereof. Said at least a salt of SAMe is comprised in the compositions according

to the invention in an amount ranging from 5 to 70% by weight, preferably from 7 to 50 % by weight, with respect to the weight of the composition.

According to the invention, said percentage ranges refer to the total amount of the salt of SAMe, or to the total amount of the salts of SAMe in the mixture, contained in the composition.

The orosoluble and/or effervescent compositions of the invention may thus be formulated in form of tablet, capsule and/or granules, preferably in form of orosoluble and/or effervescent tablet. The compositions of the invention may also be formulated in form of sublingual tablet.

According to the invention, the term "sublingual" refers to compositions which must specifically be placed under the tongue in order to dissolve and release the active ingredient.

According to the invention the term "orosoluble" refers to a composition capable of immediately dissolving and releasing the active ingredient contained therein upon contact with the oral mucosa. In this manner, the active ingredient may be directly absorbed in the oral mucosa, thus bypassing the hepatic system.

According to the invention the term orosoluble is therefore preferably used to indicate compositions to be introduced into the oral cavity.

In order to obtain the orosoluble form, the compositions of the invention are preferably formulated using the following classes of excipients: diluents, aggregants or binding agents, lubricants, glidants, disaggregants, solubilisers, sweeteners, flavouring agents and/or pH adjusters.

More preferably, the orosoluble compositions according to the invention are formulated with light magnesium oxide, magnesium hydroxide, alginic acid, stearic acid, hydrogenated vegetable oils (palm, oleic, behenic), cocoa butter, cocoa paste, xylitol, maltitol, sorbitol, mannitol, sucralose, acesulfame K, cyclamate, aspartame, sucrose, neohesperidine, fructose, dextrose, maltose, spray

dried malt, sodium aspartate, maltodextrines, inositol, inulin, chitosan, beer yeast or a mixture thereof.

In particular, in order to obtain the orosoluble form, said excipients are present in the compositions of the invention in an amount ranging from 20% to 95% by weight, with respect to the total weight of the formulation.

According to the invention, the term "effervescent" instead refers to compositions capable of developing carbon dioxide when at contact with water and/or with the buccal environment, in the presence of saliva and they are divided into:

- A: slightly effervescent orosoluble tablets. Thus capable of developing slight effervescence capable of guaranteeing high palatability associated to a dissolution time within 10 minutes.
- B: classic effervescent tablets. To be dissolved in water and to be taken at small sips.

In order to obtain the effervescent form, the compositions of the invention are preferably formulated using di- and tri-carboxylic acids or a mixture thereof.

More preferably, the effervescent compositions according to the invention are formulated with dihydrate and monohydrate sodium citrate, sodium carbonate, disodium carbonate, potassium bicarbonate, citric acid, tartaric acid, adipic acid, monosodium phosphate, alginic acid, magnesium hydroxycarbonate or a mixture thereof.

In particular, in order to obtain the effervescent form, said excipients are present in the compositions of the invention in an amount ranging from 30% to 95% by weight, with respect to the total weight of the formulation.

The compositions of the invention may therefore be formulated in orosoluble form, effervescent form or a combined orosoluble and effervescent form.

The term "high palatability" according to the invention refers to compositions having a particularly pleasant taste that can be easily administered orally

regardless of the fact that the active ingredients contained therein may have an unpleasant, bitter and/or sour taste.

Further useful excipients according to the invention are selected from among sodium-, calcium-, magnesium-, potassium-citrate, sodium-, calcium-, magnesium-, potassium-phosphate, light magnesium oxide, magnesium hydroxide, magnesium hydroxycarbonate, sodium carbonate, sodium chloride, potassium carbonate, sodium hydrogen carbonate, potassium hydrogen carbonate, adipic acid, citric acid, tartaric acid, alginic acid, stearic acid and its salts, oleic acid, l-leucine, glycerol behenate, hydroxypropylmethylcellulose, hydrogenated vegetable oils (such as for example palm oil), palm butter, cocoa butter, cocoa paste, cocoa powder, xylitol, maltitol, sorbitol, mannitol, sucralose, acesulfame K, sodium cyclamate, aspartame, sucrose, erythritol, citrus extract, fructose, dextrose, maltose, spray dried malt, sodium aspartate, neohesperidine, maltodextrines, inositol, inulin, beer yeast, silica gel, vegetable fibres (such as for example pea fibre), chitosan, flavouring agents (essential oils, powders and the like): mint (peppermint, spearmint, sweet mint), badian anethole, vanilla, sage, liver, sodium glutamate, fish meal, chicken, grapefruit, peach, lime or a mixture thereof.

The compositions according to the present invention may also contain at least a further active ingredient in combination with said at least a salt of SAMe, maintaining the high palatability of the compositions. Said further active ingredient is preferably selected from among vitamins, amino acids, glycosaminoglycans, flavolignans, hormones, natural substances of animal or vegetable origin, enzymes, polysaccharides, probiotics or a mixture thereof.

In particular, said further active ingredient may be selected from among vitamins of group B such as, for example, vitamin B6, vitamin B12, vitamin B9 (folic acid), methylfolate, vitamin C; magnesium salts; taurine, tryptophan, reduced

glutathione, n-acetylcysteine, tyrosine; hyaluronic acid, silymarin, silybin, l-theanine, melatonin, bromelain, hypericum, lipoic acid, lycopenes, bioflavonoids, rutin, valerian, glucosamine, chondroitin sulphate, chitosan, ursodeoxycholic acid, *lactobacillus acidophilus*, lactobacillus vulgaris, *bifidum bacterium brevi, bifidum infantis, bifidum bacterium lactis, bifidum bacterium longum, lactobacillus bulgaricus, lactobacillus casei, lactobacillus plantarum, lactobacillus rhamnosus;* melissa, cinnamon, hawthorn, granadilla, fennel, dried garlic, onion, melaleuca, sweet orange, camomile, thyme (in form of essential oils, mother tinctures, retted glycerides or powders), betaine, aspartic acid, glutamine, phosphoserine, phosphatidylserine, choline, coenzyme Q10, dimethylglycine, hydroxymethylbutyrate, lactoferrin, methylsulfonylmethane, homotaurine, p-aminobenzoic acid (PABA), *monacus purpureus* or a mixture thereof.

Said at least an additional active ingredient is contained in the composition of the invention in an amount ranging from 0.05% to 70%, preferably from 0.1 to 55%, with respect to the total weight of the composition.

Said amount varies depending on the characteristics of the selected additional active ingredient.

In particular, in case the additional active ingredient is one of the abovementioned vitamins of group B the dose according to the invention ranges from 0.00001 to 3%, preferably from 0.00005 to 1%, with respect to the total weight of the composition.

As mentioned above, administration of the composition according to the present invention guarantees an improved bioavailability of the drug, with respect to the compositions already available in the market; as a matter of fact, the administration of the invention allows reaching the plasma peak of the SAMe ion (maximum plasma concentration) within a period of time comprised between 1 and 2 hours from intake, preferably within about 1 and a half hours, with respect

to a period of time of about 5 hours observed regarding a swallowable gastro-resistant tablet available in the market.

Said plasma peak of the invention corresponds to a plasma concentration value of the SAMe ion greater than 40-50% with respect to the base value, preferably equivalent to a value higher than 48% with respect to the base value, instead of the 1% observed on a swallowable gastro-resistant tablet available in the market.

Thus, the present invention is also aimed at providing a method for obtaining the plasma peak of the SAMe ion within a period of time comprised between 1 and 2 hours from the intake, preferably within a period of time of about 1 and a half hours, characterized by the intake of the composition according to the present invention.

In particular, the method of the present invention determines a plasma concentration of the SAMe ion greater than 40-50% with respect to the base value, preferably greater than a value of about 48%, with respect to the base value.

The present invention is thus aimed at providing a method for increasing the plasma concentration of the SAMe ion characterized by administering the composition of the invention.

In particular, according to the method of the invention the value of the plasma concentration of the SAMe ion increases from 30 to 40% within a period of time preferably comprised between 20 and 40 minutes after administering the abovementioned composition. More preferably, the plasma concentration value of the SAMe ion increases by about 35% after about 30 minutes from the intake of the composition of the invention.

According to the method of the invention, the plasma peak of the SAMe ion (maximum plasma concentration) is attained within a period of time comprised between 1 and 2 hours, while the plasma concentration already increases

considerably after a period of time comprised between 20 and 40 minutes from intake, thus guaranteeing the fast effectiveness.

Furthermore, the present invention refers to orosoluble and/or effervescent compositions containing at least a salt of SAMe combined with physiologically acceptable excipients used for treating, human or veterinarian, neuropsychiatric, osteoarticular or hepatic diseases and/or for treating disorders or discomforts deriving from the abovementioned diseases, in particular, diseases and/or disorders regarding the emotional sphere (depression syndromes in general, anxiety) and cognitive sphere (dementia), hepatic disorders both acute and chronic (alcoholic steatosis, acute and chronic hepatitis, alcoholic and post-viral cirrhosis, intrahepatic cholestasis) and degenerative skeletal-muscular diseases distinguished by mobility disorders (osteoarthrosis).

The abovementioned compositions for use in the treatment of human or veterinarian, neuropsychiatric, osteoarticular or hepatic diseases and/or disorders or discomforts deriving from the abovementioned diseases may also contain additional active ingredients. Said additional active ingredients being preferably selected from among vitamins, amino acids, glycosaminoglycans, flavolignans, hormones, natural substances of animal or vegetable origin, enzymes, polysaccharides, probiotics.

The compositions of the present invention may be prepared through a process comprising the following steps:

Scheme A (for orosoluble and/or effervescent tablets or granules and capsules):

1) Weighing the active components and excipients;

2) Mixing (mixer with rotating screw);

3) Compression;

4) Dry granulation of the obtained tablets;

5) Final compression or using the granules obtained in step 4 directly packaged in sachets or capsules.

Scheme B (for orosoluble tablets or granules and capsules):

1) Weighing components except light magnesium oxide and at least a salt of SAMe;
2) Granulation by means of a slurry with a moistening mixture made up of an aqueous solution of a binding excipient;
3) Drying on a fluid bed until moisture below about 1% is obtained;
4) Adjusting the granules size by means of an oscillating granulator provided with a perforated stainless steel mesh (preferably with 1.5 mm diameter holes);
5) Mixing the granules + at least a salt of SAMe + light magnesium oxide + flavouring agents;
6) Final compression or using the granules obtained in step 5 directly packaged in sachets or capsules.

Scheme C (for orosoluble tablets or granules and capsules):

1) Weighing all components;
2) Granulation by mixing with rendered vegetable fats;
3) Refrigeration and granulation of the mixture;
4) Adjusting the granules size by means of an oscillating granulator provided with a perforated stainless steel mesh (preferably with 1.5 mm diameter holes);
5) Final compression or using the granules obtained in step 4 directly packaged in sachets or capsules.

The process of the present invention is preferably performed maintaining the temperature between about 20°C and 30°C, more preferably at about 25°C, with relative humidity preferably not exceeding 28%.

According to the abovementioned process the finished product has relative humidity preferably below 3%, more preferably below 1.5%.

The following examples represent a detailed description of the compositions of the invention without limiting the contents thereof in any way whatsoever.

EXAMPLES

Example 1

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate) 200 mg (equivalent to 100 mg of the SAMe ion) (13.33%)	
Folic acid	0.15 mg (0.010 %)
Vitamin B12	0.001 mg ($6.6*10^{-5}$ %)
Light magnesium oxide	40 mg (2.67 %)
Stearic acid	90 mg (6 %)
Glycerol behenate	7 mg (0.47 %)
Magnesium stearate	10 mg (0.66 %)
Mint flavour	3.53 mg (0.24%)
Mixture of flavours:	0.3 mg (0.020 %)
(Lime, Granadilla and Hawthorn)	
Silica gel	4.53 mg (0.3 %)
Xylitol	350 mg (23.33 %)
Mannitol	793 mg (52.86 %)
Sucralose	1.45 mg (0.1 %)
Neohesperidin	0.16 mg (0.010 %)
TOTAL weight of the tablet	1500.12 mg

Orosoluble tablets are preferably made having a diameter of 19 mm and weighing about 1.50 g

Example 2

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate) 233 mg (equivalent to 119.76 mg of the SAMe ion) (10.53 %)

Light magnesium oxide	44 mg (2 %)
Stearic acid	80 mg (3.6 %)
Glycerol behenate	7 mg (0.3 %)
Magnesium stearate	10 mg (0.45 %)
Mint flavour	3.53 mg (0.16 %)
Essential Melissa oil	0.1 mg (0.007 %)
Anethole	0.056 mg (0.005 %)
Silica gel	4.53 mg (0.2 %)
Inositol	908 mg (41.08 %)
Mannitol	470.21 mg (21.25 %)
Xylitol	450 mg (20.34 %)
Sucralose	1.6 mg (0.07 %)
Neohesperidin	0.18 mg (0.008 %)
TOTAL tablet weight	2212.21 mg

Orosoluble tablets are preferably made having a diameter of 22 mm and weighing about 2.2 g

Example 3

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate) 420 mg (equivalent to 200 mg of the SAMe ion)

(17.87 %)

Light magnesium oxide	150 mg (6.38 %)
Stearic acid	160 mg (6.8 %)
Glycerol behenate	13 mg (0.55 %)

Magnesium stearate	20 mg (0.85 %)
Xylitol	859.57 mg (36.57 %)
Mannitol	700 mg (29.78 %)
Sucralose	4.5 mg (0.19 %)
Neohesperidine	0.3 mg (0.01 %)
Orange flavour	14.63 mg (0.62 %)
Silica gel	8 mg (0.34 %)
TOTAL tablet weight	2350.00 mg

Orosoluble tablets are preferably made having a diameter of 22 mm and weighing about 2.4 g

Example 4

Effervescent orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate)	233 mg (equivalent to 119.762 mg of the SAMe ion) (10.30 %)
Light magnesium oxide	20.5 mg (0.9 %)
L-leucine	24 mg (1.06 %)
Glycerol behenate	4 mg (0.18 %)
Magnesium stearate	1 mg (0.04 %)
Grapefruit flavour powder	50 mg (2.21 %)
Inositol	800 mg (35.36 %)
Sucralose	10 mg (0.44 %)
Anhydrous disodium carbonate	400 mg (17.68 %)
Citric acid	250 mg (11.05 %)
Adipic acid	250 mg (11.05 %)
Sodium carbonate	200 mg (8.85 %)
Silica gel	20 mg (0.88 %)
TOTAL tablet weight	2262.50 mg

Tablets are preferably made having a diameter of 22 mm and weighing about 2.2 g

Example 5

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate) (veterinary use)

SAMe tosylate (para-toluenesulfonate)	233 mg (equivalent to 119.762 mg of the SAMe ion) (9.19 %)
Light magnesium oxide	38.5 mg (1.52 %)
Glycerol behenate	7 mg (0.27 %)
Stearic acid	80 mg (3.15 %)
Liver flavour	2 mg (0.08 %)
Yeast flavour	1 mg (0.04 %)
Silica gel	20 mg (0.79 %)
Dry liver	500 mg (19.72 %)
Dry yeast	1200 mg (47.32 %)
Glucosamine sulphate	250 mg (9.87 %)
Monosodium glutamate	50 mg (1.97 %)
Sodium chloride	20 mg (0.79 %)
Xylitol	134 mg (5.28 %)
Neohesperidine	0.2 mg (0.01 %)
TOTAL tablet weight	2535.70 mg

Orosoluble tablets are preferably made having a diameter of 22 mm and weighing about 2.5 g.

Example 6

Orosoluble tablet based on SAMe butanedisulfonate (veterinary use)

SAMe butanedisulfonate	233 mg (equivalent to 119.762 mg of the SAMe ion) (10.19 %)
Light magnesium oxide	38.5 mg (1.68 %)

Glycerol behenate	7 mg (0.31 %)
Stearic acid	80 mg (3.5 %)
Liver flavour	2 mg (0.09 %)
Yeast flavour	1 mg (0.04 %)
Silica gel	20 mg (0.87 %)
Dry liver	500 mg (21.88 %)
Dry yeast	1200 mg (52.5 %)
Monosodium glutamate	50 mg (2.19 %)
Sodium chloride	20 mg (0.88 %)
Xylitol	134 mg (5.86 %)
Neohesperidine	0.2 mg (0.01 %)
TOTAL tablet weight	2285.70 mg

Orosoluble tablets are preferably made having a diameter of 22 mm and weighing about 2.25 g

Example 7

Orosoluble tablet based on SAMe phytate

SAMe phytate	215 mg (equivalent to 113.10 mg of the SAMe ion) (14.41 %)
Silymarin	100 mg (6.7 %)
Reduced glutathione	25 mg (1.68 %)
Ursodeoxycholic acid	150 mg (10.05 %)
Light magnesium oxide	42 mg (2.82 %)
Palm oil	25 mg (1.68 %)
Maltodextrine	200 mg (13.52 %)
Mannitol	700 mg (46.94 %)
Magnesium stearate	15 mg (1 %)
Dextrose	5 mg (0.33 %)

Spray dried malt	2,5 mg (0.17 %)
Mixture of flavours	6 mg (0.4 %)
(thyme, mint, spearmint, vanilla)	
Silica gel	4 mg (0.20 %)
Sucralose	2 mg (0.10 %)
TOTAL tablet weight	1491.50 mg

Orosoluble tablets are preferably made having a diameter of 19 mm and weighing about 1.5 g

Example 8

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate)	243 mg (equivalent to 121.5 mg of the SAMe ion) (11.61 %)
Valerian	150 mg (7.17 %)
Hypericum	7 mg (0.33 %)
Tryptophan	100 mg (4.78 %)
Light magnesium oxide	33 mg (1.58 %)
Glycerol behenate	85 mg (4.06 %)
Magnesium stearate	11 mg (0.52 %)
Xylitol	500 mg (23.90 %)
Mannitol	950 mg (45.40 %)
Silica gel	3.7 mg (0.18 %)
Acesulfame K	1.2 mg (0.05 %)
Cyclamate	0.9 mg (0.04 %)
Mixture of flavours:	4.5 mg (0.21 %)
(Peppermint, fennel and cinnamon)	
Silica gel	3.5 mg (0.17 %)
TOTAL tablet weight	2092.80 mg

Orosoluble tablets are preferably made having a diameter of 22 mm and weighing about 2 g

Example 9

Effervescent orosoluble tablet based on SAMe tosylate (para-toluenesulfonate) and SAMe butanedisulfonate

SAMe tosylate (para-toluenesulfonate) (7.37 %)	90 mg (equivalent to 45 mg of the SAMe ion)
SAMe butanedisulfonate (7.37 %)	90 mg (equivalent to 45 mg of the SAMe ion)
N-acetylcysteine	50 mg (4.09 %)
Vitamin C	60 mg (4.91 %)
Bioflavonoids	150 mg (12.29 %)
Light magnesium oxide	29 mg (2.37 %)
Potassium bicarbonate	400 mg (32.77 %)
Tartaric acid	230 mg (18.85 %)
Citric acid	50 mg (4.1 %)
Leucine	40 mg (3.28 %)
Glycerol behenate	6 mg (0.49 %)
Magnesium stearate	7 mg (0.57 %)
Sodium aspartate	3,5 mg (0.28 %)
Maltitol	5 mg (0.42 %)
Mixture of flavours: (sweet mint, sage)	5 mg (0.42 %)
Silica gel	5 mg (0.42 %)
TOTAL tablet weight	1220.50 mg

Tablets are preferably made having a diameter 19 mm and weighing about 1.2 g

Example 10

Orosoluble tablet based on SAMe butanedisulfonate

SAMe butanedisulfonate	243 mg (equivalent to 127.8 mg of the SAMe ion) (14.38 %)
Lactobacillus acidophilus (150 mld)	10 mg (0.59 %)
Bifidum bacterium longum (100 mld)	20 mg (1.18 %)
Sodium citrate	100 mg (5.91 %)
Stearic acid	85 mg (5.22 %)
Maize starch	50 mg (2.95 %)
Magnesium stearate	14 mg (0.93 %)
Silica gel	4.3 mg (0.25 %)
Inulin	400 mg (23.65 %)
Mannitol	300 mg (17.74 %)
Sucrose	300 mg (17.74 %)
Glycine	151 mg (8.99 %)
Mixture of flavours: (melissa, granadilla and hawthorn)	3 mg (0.18 %)
Silica gel	4 mg (0.23 %)
Acesulfame K	1 mg (0.06 %)
TOTAL tablet weight	1691.30 mg

Orosoluble tablets are preferably made having a diameter of 19 mm and weighing about 1.6 g

Example 11

Orosoluble tablet based on SAMe tosylate (para-toluenesulfonate) (sublingual)

SAMe tosylate (para-toluenesulfonate)	mg (equivalent to 30.84 mg of the SAMe ion)

(24.83 %)

Melatonin	1 mg (0.42 %)
Light magnesium oxide	4.8 mg (1.99 %)
Glycerol behenate	19 mg (7.86 %)
Magnesium stearate	2.5 mg (1.03 %)
Xylitol	95 mg (39.32 %)
Hydroxypropylcellulose	55 mg (22.77 %)
Sucralose	0.5 mg (0.21 %)
Mixture of flavours:	1.8 mg (0.74 %)
(sweet orange oil and cinnamon)	
Silica gel	2 mg (0.83 %)
TOTAL tablet weight	241.60 mg

Sublingual tablets are preferably made weighing 0.24 g

Example 12

Effervescent granules based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate)	mg (equivalent to 80 mg of the
SAMe ion)	
(13.20 %)	
Glucosamine	100 mg (8.25 %)
Chondroitin sulphate	100 mg (8.25 %)
Hyaluronic acid	5 mg (0.41 %)
Light magnesium oxide	29 mg (2.2 %)
Potassium bicarbonate	400 mg (33.00 %)
Tartaric acid	230 mg (18.98 %)
Citric acid	150 mg (12.37 %)
Magnesium stearate	4 mg (0.33 %)
Aspartame	4 mg (0.33 %)

Xylitol	20 mg (1.76 %)
Mixture of flavours:	5 mg (0.41 %)
(granadilla, hawthorn and chamomile)	
Silica gel	5 mg (0.41 %)
TOTAL weight	1212.00 mg

Sachets are preferably made weighing about 1.2 g

Example 13

Slightly effervescent orosoluble tablet based on SAMe tosylate (para-toluenesulfonate)

SAMe tosylate (para-toluenesulfonate)	400 mg (equivalent to 200 mg of the SAMe ion) (32.24%)
N-acetylcysteine	50 mg (4.03 %)
Vitamin C	60 mg (4.83 %)
Bioflavonoids	150 mg (12.09 %)
Light magnesium oxide	29 mg (2.34 %)
Potassium bicarbonate	200 mg (16.12 %)
Tartaric acid	230 mg (18.54 %)
Citric acid	50 mg (4.0.3 %)
Leucine	40 mg (3.22 %)
Glycerol behenate	6 mg (0.48 %)
Magnesium stearate	7 mg (0.56 %)
Sodium aspartate	3.5 mg (0.28 %)
Citrus extract	5 mg (0.4 %)
Mixture of flavours:	5 mg (0.4 %)
(bitter orange)	

Silica gel	5 mg (0.4 %)
TOTAL tablet weight	1240.50 mg

Tablets are preferably made having a diameter 19 mm and weighing about 1.2 g

EXPERIMENTAL PART

Using the formulation in the orosoluble tablet containing SAMe tosylate (para-toluenesulfonate) of example 2 (Quietosan ♦) a comparative trial was carried out to evaluate the bioavailability thereof compared to a composition formulated in swallowable gastro-resistant tablets available in the market (Samir® ■).

For such purpose, six subjects from both genders, healthy volunteers, took under fasting, in a randomised manner and crossover pattern (i.e. a pattern according to which all patients take both treatments one after the other) 119.76 mg of the SAMe ion formulated according to the invention (formula example 2) and 200 mg of the SAMe ion in the swallowable gastro-resistant tablet available in the market (Samir®).

The results obtained were normalised to take into account the concentration difference of the two pharmaceutical forms.

The plasma bioavailability, expressed as AUC, of the formulation in orosoluble tablets of SAMe tosylate according to the invention was considerably higher, averagely from about 150% to about 200% higher, with respect to the swallowable gastro-resistant one.

The concentration peak time was about one hour, one and a half hours (plasma bioavailability started increasing immediately after intake) for the orosoluble tablet of the invention and about 5 hours for the swallowable gastro-resistant one (Figure 1).

Furthermore as shown in Figure 1, plasma concentration after one hour – one and a half hours from the intake of the orosoluble tablet of the invention was about

48% higher than the base value, while the plasma bioavailability after one hour – one and a half hours from the intake of the swallowable gastro-resistant tablet is about 1% higher with respect to the base value.

In addition, considering the plasma concentration of SAMe tosylate after 12 hours from intake of the tablet of the invention, as shown in Figure 2, it is about 30% higher than the base value, while the plasma concentration of SAMe tosylate after 12 hours from the intake of the swallowable gastro-resistant tablet is about 11% higher with respect to the base value.

Analogously, a trial was carried out on two healthy volunteers with respect to the orosoluble and effervescent composition of example 2 of the present invention which showed an intermediate pharmacokinetic behaviour between the orosoluble form tablets of the invention and the swallowable gastro-resistant one available in the market.

The orosoluble and effervescent composition revealed an AUC about 30-40% higher with respect to the swallowable gastro-resistant form and a time of about 1-2 hours.

Thus, the advantage deriving from the compositions based on at least a salt of SAMe in orosoluble and/or effervescent form with high palatability according to the present invention is observable from the data indicated above.

CLAIMS

1. Pharmaceutical, dietary and/or nutraceutical orosoluble and/or effervescent composition containing at least a salt of S-adenosyl methionine combined with physiologically acceptable excipients.
2. Composition according to claim 1, wherein said at least a salt of S-adenosyl methionine is selected from among tosylate (para-toluenesulfonate), butanedisulfonate, phytate or a mixture thereof.
3. Composition according to claims 1 and 2, wherein said at least a salt of S-adenosyl methionine is contained in an amount ranging from 5 to 70% by weight, with respect to the total weight of the formulation.
4. Composition according to claim 3, wherein said at least a salt of S-adenosyl methionine is contained in an amount ranging from 7 to 50% by weight, with respect to the total weight of the formulation.
5. Composition according to any one of the preceding claims comprising at least a further active ingredient.
6. Composition according to claim 5, wherein said at least a further active ingredient is selected from among vitamins, amino acids, glycosaminoglycans, flavolignans, hormones, natural substances of animal or vegetable origin, enzymes, polysaccharides, probiotics or a mixture thereof.
7. Composition according to claim 6, wherein said a further active ingredient is selected from among vitamins of group B, methylfolate, vitamin C, magnesium salts, taurine, tryptophan, reduced glutathione, n-acetylcysteine, tyrosine; hyaluronic acid, silymarin, silybin, melatonin, l-theanine, bromelain, hypericum, lipoic acid, lycopenes, bioflavonoids, rutin, valerian, glucosamine, chondroitin sulphate, chitosan, ursodeoxycholic acid; *lactobacillus acidophilus*, lactobacillus vulgaris, *bifidum bacterium brevi,*

bifidum infantis, bifidum bacterium lactis, bifidum bacterium longum, lactobacillus bulgaricus, lactobacillus casei, lactobacillus plantarum, lactobacillus rhamnosus, melissa, cinnamon, hawthorn, granadilla, fennel, dried garlic, onion, melaleuca, sweet orange, camomile, thyme, betaine, phosphoserine, phosphatidylserine, aspartic acid, glutamine, choline, coenzyme Q10, dimethylglycine, hydroxyethylbutyrate, lactoferrin, methylsulfonylmethane, homotaurine, p-aminobenzoic acid (PABA), *monacus purpureus* or a mixture thereof.

8. Composition according to any one of the preceding claims in form of tablet, capsule or granules.
9. Composition according to claim 8 in form of orosoluble and/or effervescent tablet.
10. Composition according to claim 8 in form of orosoluble and/or effervescent granules.
11. Composition according to claims 1 to 10, characterized in that it has high palatability.
12. Method for obtaining the plasma peak of the SAMe ion within a period of time comprised between 1 and 2 hours characterized by administering a composition according to any one of claims 1 to 11.
13. Method according to claim 12, for obtaining the plasma peak of the SAMe ion after about one and a half hours from intake of the composition.
14. Method for determining a plasma concentration of the SAMe ion higher than 40-50% with respect to the base value within a period of time comprised between 1 and 2 hours characterized by administering a composition according to any one of claims 1 to 11.

15. Method according to claim 14, for determining a plasma concentration of the SAMe ion higher than about 48% with respect to the base value after about 1 and a half hours from intake.
16. Composition according to claims 1 to 11 for use in the treatment of neuropsychiatric, osteoarticular or hepatic diseases.
17. Composition according to claim 16, for use in the treatment of depression syndromes, anxiety, dementia, alcoholic steatosis, acute hepatitis, chronic hepatitis, alcoholic cirrhosis, post-viral cirrhosis, intrahepatic cholestasis and degenerative skeletal-muscular diseases with mobility disorders.
18. Composition according to claims 16 and 17 for use in the human or veterinary treatment.

FIGURE 1

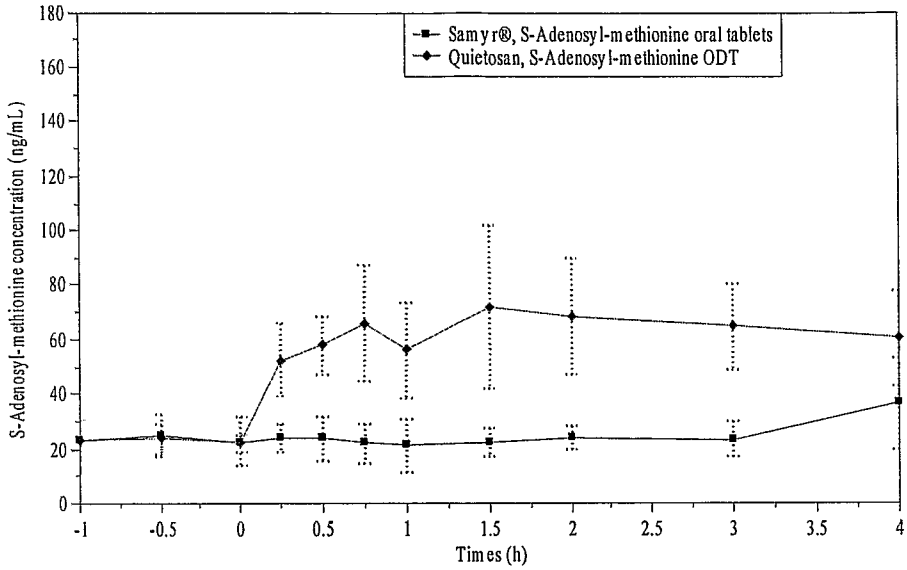
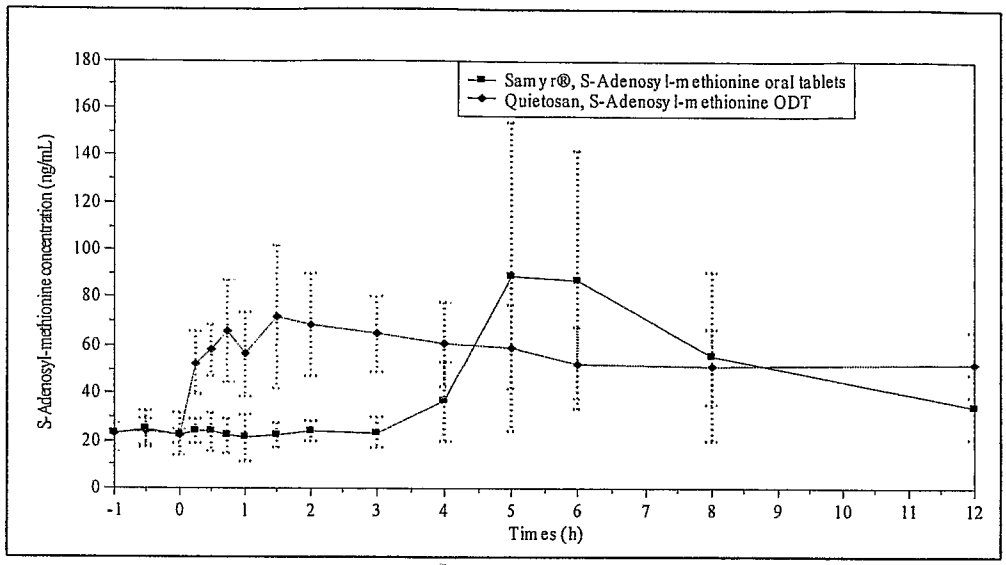

Samyr®, S-Adenosyl-methionine oral tablets
Quietosan, S-Adenosyl-methionine ODT
S-Adenosyl-methionine concentration (ng/mL)
Times (h)
180
160
140
120
100
80
60
40
20
0
-1
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4

FIGURE 2


Samyr®, S-Adenosyl-methionine oral tablets
Quietosan, S-Adenosyl-methionine ODT
S-Adenosyl-methionine concentration (ng/mL)
Times (h)
0
20
40
60
80
100
120
140
160
180
-1
0
1
2
3
4
5
6
7
8
9
10
11
12

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/050087

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61K9/00
ADD. A61K9/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61K

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

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 3 954 726 A (FIECCHI ALBERTO) 4 May 1976 (1976-05-04) cited in the application column 1, lines 43-52 column 2, lines 7-30 column 13, lines 19-22 column 14, lines 22-29 column 15, lines 23-59	1-4,8-18 5-7
X	WO 2007/080010 A (TRUFFINI & REGGE FARMACEUTICI [IT]; SENECI ALESSANDRO [IT]; GIOVANNONE) 19 July 2007 (2007-07-19) page 1, lines 1-9 page 2, line 6 - page 3, line 2 examples 3-7 claims 1,2,4,5,8-11,13,14,23-28	1-18

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 July 2010	15/07/2010

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	van de Wetering, P

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2010/050087

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/004244 A (DE LUCA MARIA [IT]) 11 January 2007 (2007-01-11) page 5, lines 19-30 page 8, lines 9-23 page 10, lines 3-8 claims 1-13,16-20	1-18
Y	US 2006/127506 A1 (HEBERT ROLLAND F [US]) 15 June 2006 (2006-06-15) page 5, paragraph 38 page 6, paragraph 47 - page 7, paragraph 53 page 8, paragraphs 62,63 examples	1-18
E	EP 2 189 154 A1 (GNOSIS S P A [IT]) 26 May 2010 (2010-05-26) page 2, paragraphs 3,4,11 page 3, paragraphs 19-23,29 page 4, paragraph 40 examples	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2010/050087

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3954726 A	04-05-1976	AR 202219 A1	23-05-1975
		AT 347604 B	10-01-1979
		AU 7068974 A	08-01-1976
		BE 816915 A1	16-10-1974
		CA 1024088 A1	10-01-1978
		CH 592686 A5	15-11-1977
		DD 112451 A5	12-04-1975
		DE 2430999 A1	16-01-1975
		DK 342974 A	17-03-1975
		FI 195474 A	28-12-1974
		FR 2234891 A1	24-01-1975
		GB 1443587 A	21-07-1976
		HK 31680 A	20-06-1980
		IE 39517 B1	25-10-1978
		JP 905944 C	18-04-1978
		JP 50076215 A	21-06-1975
		JP 52035727 B	10-09-1977
		LU 79038 A1	26-06-1978
		NL 7408688 A	31-12-1974
		RO 64135 A1	15-11-1978
		SE 408712 B	02-07-1979
		SE 7408388 A	30-12-1974
WO 2007080010 A	19-07-2007	AU 2006334639 A1	19-07-2007
		CA 2636618 A1	19-07-2007
		EP 1971370 A1	24-09-2008
		US 2009317463 A1	24-12-2009
		US 2007160660 A1	12-07-2007
WO 2007004244 A	11-01-2007	AT 419256 T	15-01-2009
		DK 1896489 T3	20-04-2009
		EP 1896489 A1	12-03-2008
		ES 2320489 T3	22-05-2009
		JP 2009500319 T	08-01-2009
		KR 20080028949 A	02-04-2008
		PT 1896489 E	01-04-2009
		SI 1896489 T1	30-06-2009
		US 2009175914 A1	09-07-2009
US 2006127506 A1	15-06-2006	NONE	
EP 2189154 A1	26-05-2010	NONE	