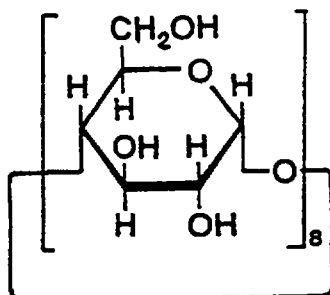


Description

The present invention is concerned with pharmaceutical compositions comprising an active ingredient and a γ -cyclodextrin ether or a mixed ether.

γ -cyclodextrin (γ -CD) is a cyclic oligosaccharide consisting of 8 glucose units which are joined together by α (1-4) linkages.



γ -CD is prepared by the enzymatic cleavage and religation of starch and a subsequent separation from the thus obtained cyclodextrin mixture containing i.a. α -cyclodextrin (containing 6 glucose units), β -cyclodextrin (β -CD) (7 glucose units) and γ -cyclodextrin (γ -CD).

Cyclodextrins are known in the art to possess the ability to form inclusion complexes and to have concomitant solubilizing properties. An exhaustive review which describes such complexes and their properties can be found in W. Sanger, *Angewandte Chemie*, **92**, 343-361 (1981).

Derivatives of cyclodextrins are also known to possess the above-mentioned properties. Said derivatives have been reviewed in an article by A.P. Croft and R.A. Bartsch in *Tetrahedron*, **39**, 1417-1474 (1983). More particularly, the German Offenlegungsschrift DE 3118218 discloses the 2,6-dimethyl derivatives of β -CD, while in U.S. Patent No. 3,459,731 there are described hydroxyethyl, hydroxypropyl and hydroxypropyl/hydroxyethyl ethers of β -CD. Furthermore, in U.S. Patent Appl. Ser. No. 6-603 839 there is described the use of specific derivatives of cyclodextrins to improve the systemic administration of sex hormones. Most of the cyclodextrin derivatives presently known in the art are derived from β -CD, while the derivatives of α -CD and particularly of γ -CD remain relatively unknown.

The use of derivatives of β -CD has the following advantages. β -CD is only poorly water soluble and therefore it is disadvantageous to use it as a complexant and solubilizer. Derivatives of β -CD on the other hand, due to their increased solubility, are more suitable complexants and solubilizers. In contrast herewith, α -CD and γ -CD having an excellent water solubility do not need such substitutions. Hence, it is obvious to use unsubstituted γ -CD (and α -CD) as complexant and solubilizer. Particularly for γ -CD, a number of such complexes with various useful compounds can be found in e.g. *Int. J. Pharm.* **10**, 1-15 (1982) with steroid hormones, in *Acta Pharm. Suec.* **20**, 11-20 (1983) with flutripofen, in *Chem. Pharm. Bull.* **31**, 286-291 (1983) with spiro lactone and in *Acta Pharm. Suec.* **20**, 287-294 (1983) with proscillaridin.

γ -CD does not form such inclusion complexes with any given compound. Often, such complexation is only established in the lower concentration range. At higher concentrations of γ -CD, the formed complex is precipitated.

It has now been found that an appropriately alkylated, hydroxyalkylated, carboxyalkylated or (alkyloxycarbonyl)alkylated form of γ -CD or a mixed ether thereof prevents the crystallization of such complexes. The advantages of γ -CD over its lower homologues, i.e. its larger cavity resulting in a superior propensity to form inclusion complexes, its favourable toxicological properties and the fact that it can be cleaved enzymatically by α -amylase (in contrast with β -CD), can therefore fully be exploited.

γ -CD contains three free hydroxy functions per glucose unit which can completely or partially be derivatized. In view of this, the average degree of substitution (D.S.) is introduced, which is the average number of substituted hydroxy functions per glucose unit. Said D.S. can vary from its minimal value 0.125 up to its maximal value 3. In the latter case all 24 hydroxy groups are substituted, while in the former case only one is substituted. A minimal D.S. is especially preferred when γ -CD is used as solubilizer of pharmaceuticals for use in parenteral applications, while a higher D.S. is preferred when used in technical applications, such as, for example, for pesticides or enzymes. In the latter instance, the higher D.S. causes that also those hydroxy groups are functionalized which are located in the cavity of the γ -CD molecule.

Consequently, the diameter of the cavity is decreased. By selecting the appropriate D.S. the size of the cavity can be adapted in order to obtain the optimum space required for a certain molecule to appropriately fit into the cavity of the cyclodextrin.

When introducing hydroxyalkyl substitutions on γ -CD, the hydroxy function of the thus obtained hydroxyalkyl ether group can further be hydroxyalkylated, generating multiple substitutions on one particular OH-group. In such cases the term average molar substitution (M.S.) is introduced. Said M.S. is defined as the average number of moles of the substituting agent per glucose unity. In view of this, it is evident that the M.S. can be greater than 3 and has, theoretically, no upper limit.

The present invention is concerned with pharmaceutical compositions comprising an active ingredient and a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C₁-C₃ alkyl, hydroxy C₂-C₄ alkyl, carboxy C₁-C₂ alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, compositions comprising partial methyl-, ethyl-, and 2-hydroxyethyl ethers of γ -cyclodextrin and a retinoid being excluded.

In the foregoing definitions the term "C₁-C₃-alkyl" is meant to include straight and branched saturated hydrocarbon radicals, having from 1 to 3 carbon atoms, such as methyl, ethyl, 1-methylethyl and propyl.

Preferred substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl and carboxyethyl and further (methyl)(hydroxyethyl), (methyl)(hydroxypropyl) and (methyl)(hydroxyethyl)(carboxymethyl) whereby the degree of substitution is of from 0.3 to 2 or the average molar substitution is of from 0.3 to 3.

Such γ -cyclodextrin ethers or mixed ethers can generally be prepared by reacting the starting γ -CD with an appropriate O-alkylating agent or a mixture of such agents in a concentration being selected so that the desired D.S. is obtained. The said reaction is preferably conducted in a suitable solvent in the presence of an appropriate base. An appropriate O-alkylating agent is, for example, an alkyl, hydroxyalkyl, carboxyalkyl or (alkyloxycarbonyl)alkyl halide or sulfonate, e.g. methyl chloride, ethyl bromide, propyl methylsulfonate, ethyl chloroacetate, α -chloroacetic acid; or an oxirane, e.g. oxirane, methyloxirane. Suitable solvents are, for example, water; an alcohol or polyalcohol, e.g. methanol, ethanol, 1-propanol, 2-propanol, 1-butanol, 1,2-ethanediol, 1,2-propanediol and the like; a ketone, e.g. 2-propanone, 2-butanone, 4-methyl-2-pentanone, and the like; an ether or polyether, e.g. ethoxyethane, 2-(2-propyloxy)propane, tetrahydrofuran, 1,2-dimethoxyethane and the like; and C₁-C₄-alkyloxy-C₂-C₃-alkanol and mixtures of such solvents. An appropriate base is, for example, an alkali or earth alkaline metal hydroxide, e.g. sodium hydroxide, potassium hydroxide; or an alkali or earth alkaline metal hydride or amide, e.g. sodium hydride, calcium hydride, sodium amide and the like bases.

Preferably the said O-alkylation reaction is conducted with 0.1 to 3 parts by weight of water per part by weight γ -CD in case there is no organic solvent used, and with 1 to 40 parts by weight organic solvent per part by weight γ -CD in case no water is used.

In a particularly preferred way of preparing these compounds, the reaction mixture containing the starting γ -CD, the solvent, base and O-alkylating agent is heated in an autoclave at a temperature comprised between 30° and 200°C. Depending on the reactivity of the O-alkylating agent, the reaction mixture is allowed to react at this temperature for 15 minutes up to 24 hours. Subsequently, the mixture is acidified and the reaction product is isolated and purified by standard separation and purification procedures such as, for example, column chromatography, ultra filtration, centrifugation, and dried.

The γ -cyclodextrin ethers or mixed ethers can also be converted into each other. For example, the (alkyloxycarbonyl)alkyl substituted γ -cyclodextrins may conveniently be converted to the corresponding carboxyalkyl substituted γ -cyclodextrins following art-known saponification procedures, e.g. by treating the starting compounds with an aqueous acidic or basic solution.

The γ -cyclodextrin ethers or mixed ethers are useful due to their ability to form inclusion complexes having a stabilizing effect on the complexed compounds, and due to their concomitant solubilizing activity. Compounds exhibiting a significantly increased water solubility and improved stability after having been transferred to inclusion complexes with the above-mentioned γ -CD derivatives, are those having the required shape and size, i.e. which fit into the cavity. The size of the cavity can be adapted by selecting the appropriate γ -CD derivatives having a suitable D.S. Examples of such compounds are, for example, non-steroid anti-rheumatic agents, steroids, cardiac glycosides and derivatives of benzodiazepine, benzimidazole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione or 2,3,5,6-tetrahydroimidazo[2,1-b]thiazoles, or amides, hydratropic acid derivatives or trialkylamines, whereby the derivatives of benzodiazepine, benzimidazole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione or 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole, or amides, hydratropic acid derivatives or trialkylamines are preferred.

Useful benzimidazole derivatives are thiabendazole, fuberidazole, ciclo bendazole, oxibendazole, parben-dazole, cambendazole, mebendazole, fenbendazole, flubendazole, albendazole, oxfendazole, nocodazole and astemizole.

Suitable piperidine derivatives are diphenoxylate, phenoperidine, haloperidol, haloperidol decanoate, bromperidol decanoate, bromperidol, moperone, trifluoperidol, pipamperone, piritramide, fentanyl, benperidol, droperidol, benzitramide, benzetimide, domperidone, sufentanil, carfentanil, alfentanil, dexetimide, milen-perone, difenoxin, fluspirilene, penfluridol, pimozi-., lorcaidine, loperamide, astemizole, ketanserine, levocabastine, cisapride, altanserine, ritanserine, 3-[2-[4-(4-fluorobenzoyl)-1-piperidinyl]ethyl]-2,7-dimethyl-4H-pyrido[1,2-a]pyrimidin-4-one, 3-[2-[4-[bis(4-fluorophenyl)methylene]-1-piperidinyl]ethyl]-2-methyl-4H-pyrido-
[1,2-a]pyrimidin-4-one and 3-[2-[4-[3-(2-furanylmethyl)-3H-imidazo[4,5-b]pyridin-2-yl]amino]-1-piperidinyl]-ethyl]-2-methyl-4H-pyrido[1,2-a]pyrimidin-4-one. Suitable piperazine derivatives include azaperone, fluanisone, lidoflazine, flunarizine, mianserine, oxatamide, miflazine, clocinizine and cinnarizine.

Examples of suitable imidazole derivatives are metronidazole, ornidazole, ipronidazole, tinidazole, isoconazole, nimorazole, miconazole, burimamide, metiamide, metomidate, enilconazole or imazalil, etomidate, econazole, clotrimazole, carnidazole, cimetidine, doconazole, sulconazole, parconazole, or-conazole, butoconazole, triadiminole, tioconazole, valconazole, fluotrimazole, ketoconazole, oxiconazole, lombazole, bifonazole, oxmetidine, fenticonazole, tubulazole and (Z)-1-[2-chloro-2-(2,4-dichlorophenyl)-ethenyl]-1H-imidazole.

As suitable triazole derivatives there may be mentioned virazole, azaconazole, etaconazole, pro-piconazole, penconazole, itraconazole and terconazole.

Useful pyridazine derivative are, for example, 3-chloro-6-[3,6-dihydro-4-(3-methylphenyl)-1-(2H)-pyridinyl]pyridazine, 3-methoxy-6-[4-(3-methylphenyl)-1-piperazinyl]pyridazine and the compounds of Publ. Eur. Pat. Appl. No. 0,156,433.

Useful 1,2,4-triazinediones are, for example, 2-chloro- α -(4-chlorophenyl)-4-(4,5-dihydro-3,5-dioxo-1,2,4-triazin-2(3H)-yl)benzeneacetonitrile, 2,6-dichloro- α -(4-chlorophenyl)-4-(4,5-dihydro-3,5-dioxo-1,2,4-triazin-2-(3H)-yl)benzeneacetonitrile and the compounds of Publ. Eur. Pat. Appl. No. 0,170,316.

Useful trialkylamines are, for example, diisopromine, prozapine.

Useful 2,3,5,6-tetrahydro-imidazo[2,1-b]thiazoles comprise, for example, tetramisole or levamisole.

Useful amides are, for example, closantel, ambucetamide, isopropamide, buzepide metiodide, dex-tromoramide.

A useful hydratropic acid derivative is, for example, suprofen.

Particularly valuable pharmaceutical compositions are obtained when converting etomidate, ketoconazole, tubulazole, itraconazole, levocabastine or flunarizine into a water-soluble form using the complex forming agents of the invention. Such compositions are therefore a special subject of the present invention.

Compositions comprising an active ingredient and a γ -cyclodextrin ether or mixed ether are prepared by dissolving the γ -cyclodextrin ether or mixed ether in water and adding thereto the selected compound as well as optionally drying the solution of the formed inclusion compound using methods known per se. Formation of the solution may preferably take place at temperatures between 15 and 35 °C.

The drug is suitably added batchwise. The water may further comprise physiologically compatible compounds such as sodium chloride, potassium nitrate, glucose, mannitol, sorbitol, xylitol or buffers such as phosphate, acetate or citrate buffer.

Using γ -cyclodextrin ethers or mixed ethers in accordance with the invention it is possible to prepare commonly known application forms of drugs for oral, parenteral, topical, rectal or vaginal application, e.g. infusion and injection solutions, drop solutions (e.g. eye drops or nasal drops), sprays, tablets, powders, capsules, aerosols, sirups, jellies, ointments, medical baths, rectalia and vaginalia.

The aqueous solutions may further comprise suitable physiologically compatible preserving agents such as, for example, quaternary ammonium soaps, chlorbutanol, phenoxetol, bromopol, and the like, and also anti-oxidantia, such as, for example, ascorbic acid.

For the preparation of solid formulations the solutions of the inclusion compounds are dried using conventional methods; thus the water may be evaporated in a rotation evaporator or by lyophilisation. The residue is pulverized and, optionally after addition of further inert ingredients, converted into uncoated or coated tablets, suppositories, capsules, creams or ointments.

Examples

The following examples are meant to illustrate and not to limit the present invention in all its aspects. Unless stated otherwise, all parts therein are by weight.

A. Preparation examples.Example 1

5 1 Part of γ -CD and a solution of 1.5 parts of sodium hydroxide in 1.5 parts of water were mixed in an autoclave. Then there were added 3 parts of methyl chloride and 0.5 parts of methyloxirane. The mixture was heated for 1 hour at 65°C and subsequently for 2 hours at 100°C. After cooling, the remaining methyloxirane was expelled and the reaction mixture was neutralized with hydrochloric acid. The volatile components were evaporated and the remainder was filtered. The filtrate was liberated from sodium chloride over an ion exchanger and subsequently freeze-dried, yielding the (methyl)(hydroxypropyl) derivative of γ -CD. Following the same procedures and using the appropriate starting materials the (ethyl)-(hydroxyethyl) derivative of γ -CD was also prepared.

Example 2

15 In an autoclave there were mixed 2.5 parts of 1,2-dimethoxyethane, 1 part of γ -CD and a solution of 1 part of sodium hydroxide in 1.2 parts of water. To this mixture, there were added 2 parts of oxirane and the whole was heated to 110°C for 5 hours. After cooling, the remaining oxirane was expelled and the reaction mixture was neutralized with hydrochloric acid. The volatile components were evaporated and the remainder was filtered. The filtrate was subsequently liberated from sodium chloride over an ion exchanger and subsequently freeze-dried, yielding the hydroxyethyl derivative of γ -CD with a M.S. of 0.77.

Following the same procedures and using the appropriate starting materials there was also prepared the 2-hydroxypropyl derivative of γ -CD with a M.S. of 0.66.

Example 3

25 1 Part of γ -CD, 3 parts of 1,2-dimethoxyethane and 1.5 parts of sodium hydroxide in 1.5 parts of water were mixed in an autoclave. Subsequently, there were added 4 parts of chloromethane and the whole was heated at 120°C for 4 hours. After cooling the reaction mixture was neutralized with hydrochloric acid and the volatile components evaporated. The remainder was filtered and the filtrate was liberated from sodium chloride over an ion exchanger and subsequently freeze-dried, yielding the methyl derivative of γ -CD with a D.S. of 1.49.

Following the same procedures and using the appropriate starting materials there were also prepared the methyl derivative of γ -CD with a D.S. of 0.13; the carboxymethyl derivative of γ -CD with a D.S. of 0.86; and the (ethoxycarbonyl)methyl derivative of γ -CD; the ethyl derivative of γ -CD; the butyl derivative of γ -CD; the isobutyl derivative of γ -CD; the isopropyl derivative of γ -CD; the carboxyethyl derivative of γ -CD; the 3-hydroxypropyl derivative of γ -CD; and the 4-hydroxybutyl derivative of γ -CD.

B. Examples illustrating the properties of the γ -CD derivativesExample 4

40 Starting from a 5% stock solution of a particular γ -CD derivative in a phosphate buffer of pH 7.4, a dilution series was obtained with concentrations varying of from 0% to 5% with 0.5% steps. 3 ml of these solutions were pipetted into a closed container containing an appropriate amount of progesteron. After 5 days shaking at 25°C, the thus obtained mixture was filtered over a membrane filter (pore diameter: 0.22 μ m), and the content of progesteron was determined with high pressure liquid chromatography (using a column of 25 cm length; 5 mm internal diameter; packed with 5 μ m ODS-hypersil (RP-18); eluent: acetonitrile/water; U.V. detection). The results of these concentration measurements for a number of the γ -CD derivatives of the present invention and for unsubstituted γ -CD gathered in the following table.

concentration of γ -CD derivative in % (weight by volume)	content of progesteron in $\mu\text{g/ml}$					
	unsubstituted γ -CD	methyl substituted D.S.=0.13	methyl substituted D.S.=1.49	carboxy-methyl subst. M.S.=0.86	hydroxy ethyl subst. M.S.=0.77	hydroxy propyl subst. M.S.=0.66
0	5.9	5.9	5.9	5.9	5.9	5.9
0.5	425	488	379	102	234	302
1	343	972	748	209	452	582
1.5	275	1458	1144	313	673	872
2	203	1902	1470	417	860	1165
2.5	163	2149	1888	517	1055	1431
3	93	2258	2260	610	1291	1704
3.5	60	2392	2686	79	1472	1987
4	54	2592	3050	796	1722	2287
4.5	46	2627	3411	891	1817	2595
5	45	2602	3876	979	2065	2865

Table: Content of progesteron in solutions containing various concentrations of γ -CD derivative and γ -CD.

Example 5.

Following the procedures described in example 4 the content of 3-chloro-6-[3,6-dihydro-4-(3-methylphenyl)-1(2H)-pyridinyl]pyridazine was determined in solutions containing various concentrations of γ -CD derivatives. Said pyridazine compound is described in Published Europ. Pat. Appl. No. 0,156,433 as a useful anti-viral agent.

concentration of γ -CD derivative in % (weight by volume)	content of 3-chloro-6-[3,6-dihydro-4-(3-methylphenyl)-1(2H)-pyridinyl]pyridazine in $\mu\text{g/ml}$		
	unsubstituted γ -CD	methyl-substituted D.S.=1.49	hydroxypropyl substituted M.S.=0.66
0	0.4	0.4	0.4
1	2.0	2.0	1.5
2.5	0.8	8.0	4.5
3.5	-	12.6	7.0
5	0.8	20.0	10.0

C. Composition examples.Example 6

- 5 In 100 ml water 7 g hydroxyethyl- γ -CD (M.S. = 0.77) and 0.5 g medroxyprogesterone acetate were dissolved. The water was evaporated. 75 mg of the residue was powdered and mixed with 366 mg $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$, 60 mg corn starch, 120 mg cellulose powder (microcrystalline), 4.2 mg highly dispersed silica (Aerosil® 200) and 4.8 mg magnesium stearate and pressed to a tablet.

10 Example 7

5 g hydroxyethyl γ -cyclodextrin (M.S. = 0.77) and 0.5 g lidocaine were dissolved in 100 ml of a physiological sodium chloride solution at 30 °C and filtered through a membrane filter (0.45 microns). The solution was filled into ampules and sterilized.

15

Claims

Claims for the following Contracting States : BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

- 20 1. A composition comprising an active ingredient and a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, compositions comprising partial methyl-, ethyl-, and 2-hydroxy ethyl ethers of γ -cyclodextrin and a retinoid being excluded.
- 25 2. A composition according to claim 1 wherein the γ -cyclodextrin substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl or carboxyethyl.
3. A composition according to claim 2 wherein the substituents are hydroxyethyl or hydroxypropyl.
- 30 4. A composition according to any of claims 1 to 3, wherein the degree of substitution of γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
- 35 5. A composition according to claims 1 to 4 wherein the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glycoside or a derivative of benzodiazepine, benzimidazole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole or hydratropic acid, or an amide or trialkylamine derivative.
- 40 6. A composition according to claim 5, wherein the active ingredient is etomidate, ketoconazole, itraconazole, or flunarizine.
- 45 7. Use of a γ -cyclodextrin for the preparation of inclusion complexes comprising active ingredients, characterized in that the γ -cyclodextrin is a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, retinoids being excluded as active ingredients.
8. Use of a γ -cyclodextrin according to claim 7, characterized in that the γ -cyclodextrin substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl or carboxyethyl.
- 50 9. Use of a γ -cyclodextrin according to claim 8, characterized in that the γ -cyclodextrin substituents are hydroxyethyl or hydroxypropyl.
- 55 10. Use of a γ -cyclodextrin according to claims 7 to 9, characterized in that the degree of substitution of the γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
11. Use of a γ -cyclodextrin according to claims 7 to 10, characterized in that the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glycoside or a derivative of benzodiazepine, benzimid-



C. Composition examples.

Example 6

- 5 In 100 ml water 7 g hydroxyethyl- γ -CD (M.S. = 0.77) and 0.5 g medroxyprogesterone acetate were dissolved. The water was evaporated. 75 mg of the residue was powdered and mixed with 366 mg $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$, 60 mg corn starch, 120 mg cellulose powder (microcrystalline), 4.2 mg highly dispersed silica (Aerosil® 200) and 4.8 mg magnesium stearate and pressed to a tablet.

10 Example 7

5 g hydroxyethyl γ -cyclodextrin (M.S. = 0.77) and 0.5 g lidocaine were dissolved in 100 ml of a physiological sodium chloride solution at 30°C and filtered through a membrane filter (0.45 microns). The solution was filled into ampules and sterilized.

15 Claims

Claims for the following Contracting States : BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

- 20 1. A composition comprising an active ingredient and a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, compositions comprising partial methyl-, ethyl-, and 2-hydroxy ethyl ethers of γ -cyclodextrin and a retinoid being excluded.
- 25 2. A composition according to claim 1 wherein the γ -cyclodextrin substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl or carboxyethyl.
3. A composition according to claim 2 wherein the substituents are hydroxyethyl or hydroxypropyl.
- 30 4. A composition according to any of claims 1 to 3, wherein the degree of substitution of γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
5. A composition according to claims 1 to 4 wherein the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glycoside or a derivative of benzodiazepine, benzimidazole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole or hydratropic acid, or an amide or trialkylamine derivative.
- 35 6. A composition according to claim 5, wherein the active ingredient is etomidate, ketoconazole, itraconazole, or flunarizine.
- 40 7. Use of a γ -cyclodextrin for the preparation of inclusion complexes comprising active ingredients, characterized in that the γ -cyclodextrin is a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, retinoids being excluded as active ingredients.
- 45 8. Use of a γ -cyclodextrin according to claim 7, characterized in that the γ -cyclodextrin substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl or carboxyethyl.
- 50 9. Use of a γ -cyclodextrin according to claim 8, characterized in that the γ -cyclodextrin substituents are hydroxyethyl or hydroxypropyl.
10. Use of a γ -cyclodextrin according to claims 7 to 9, characterized in that the degree of substitution of the γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
- 55 11. Use of a γ -cyclodextrin according to claims 7 to 10, characterized in that the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glycoside or a derivative of benzodiazepine, benzimid-



azole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole or hydratropic acid, or an amide or trialkylamine derivative.

12. Use of a γ -cyclodextrin according to claim 11, characterized in that the active ingredient is etomidate, ketoconazole, itraconazole, or flunarizine.

Claims for the following Contracting State : AT

1. Method for preparing a composition comprising an active ingredient and a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution in the range of 0.125 to 10, compositions comprising partial methyl, ethyl, or 2-hydroxyethyl ethers of γ -cyclodextrin and a retinoid being excluded, which method comprises the steps of dissolving of the γ -cyclodextrin ether or mixed ether in water, adding thereto the selected active ingredient and optionally drying the solution thus obtained.
2. A method according to claim 1, wherein the γ -cyclodextrin substituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl or carboxyethyl.
3. A method according to claim 2, wherein the substituents are hydroxyethyl or hydroxypropyl.
4. A method according to any of claims 1 to 3, wherein the degree of substitution of γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
5. A method according to claims 1 to 4, wherein the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glycoside or a derivative of benzodiazepin, benzimidazol, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole or hydratropic acid, or an amide or trialkylamine derivative.
6. A method according to claim 5, wherein the active ingredient is etomidate, ketoconazole, itraconazole, or flunarizin.
7. A method for the preparation of inclusion complexes comprising active ingredients and a γ -cyclodextrin, characterized in that the γ -cyclodextrin is a γ -cyclodextrin ether or mixed ether wherein the ether substituents are C_{1-3} alkyl, hydroxy C_{2-4} alkyl or carboxy C_{1-2} alkyl and wherein the degree of substitution is in the range of 0.125 to 2 or the average molar substitution is in the range of 0.125 to 10, retinoids being excluded as active ingredients, which method comprises the steps of dissolving the γ -cyclodextrin ether or mixed ether in water, adding thereto the selected active ingredient and optionally drying the solution of the formed inclusion compound.
8. A method according to claim 7, characterized in that the γ -cyclodextrinsubstituents are methyl, ethyl, isopropyl, hydroxyethyl, hydroxypropyl, hydroxybutyl, carboxymethyl, or carboxyethyl.
9. A method according to claim 8, characterized in that the γ -cyclodextrinsubstituents are hydroxyethyl or hydroxypropyl.
10. A method according to claims 7 to 9, characterized in that the degree of substitution of the γ -cyclodextrin is in the range of 0.3 to 2 and the average molar substitution is in the range of 0.3 to 3.
11. A method according to claims 7 to 10, characterized in that the active ingredient is a non-steroid anti-rheumatic agent, a steroid, a cardiac glykoside or a derivative of benzodiazepine, benzimidazole, piperidine, piperazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tetrahydroimidazo[2,1-b]thiazole, or hydratropic acid, or an amide or trialkylamine derivative.
12. A method according to claim 11, characterized in that the active ingredient is etomidate, ketoconazole, itraconazole, or flunarizine.

**Patentansprüche**

Patentansprüche für folgende Vertragsstaaten : BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

- 5 1. Eine Zusammensetzung enthaltend einen aktiven Bestandteil und einen γ -Cyclodextrinether oder gemischten Ether, worin die Ethersubstituenten C_1 - $_3$ -Alkyl, Hydroxy- C_2 - $_4$ -alkyl oder Carboxy- C_1 - $_2$ -alkyl sind und worin der Substitutionsgrad im Bereich von 0,125 bis 2 oder die durchschnittliche molare Substitution im Bereich von 0,125 bis 10 liegt, wobei Zusammensetzungen ausgenommen sind, die partielle Methyl-, Ethyl- und 2-Hydroxyethylether des γ -Cyclodextrins und ein Retinoid enthalten.
- 10 2. Eine Zusammensetzung gemäß Anspruch 1, worin die γ -Cyclodextrinsubstituenten Methyl, Ethyl, Isopropyl, Hydroxyethyl, Hydroxypropyl, Hydroxybutyl, Carboxymethyl oder Carboxyethyl sind.
3. Eine Zusammensetzung gemäß Anspruch 2, worin die Substituenten Hydroxyethyl oder Hydroxypropyl sind.
- 15 4. Eine Zusammensetzung gemäß einem der Ansprüche 1 bis 3, worin der Substitutionsgrad des γ -Cyclodextrins im Bereich von 0,3 bis 2 und die durchschnittliche molare Substitution im Bereich von 0,3 bis 3 liegt.
- 20 5. Eine Zusammensetzung gemäß den Ansprüchen 1 bis 4, worin der aktive Bestandteil ein nicht-steroides antirheumatisches Mittel, ein Steroid, ein Herzglykosid oder ein Derivat von Benzodiazepin, Benzimidazol, Piperidin, Piperazin, Imidazol, Triazol, Pyridazin, 1,2,4-Triazindion, 2,3,5,6-Tetrahydroimidazo[2,1-b]thiazol oder Hydratropasäure oder ein Amid oder Trialkylaminderivat ist.
- 25 6. Eine Zusammensetzung gemäß Anspruch 5, worin der aktive Bestandteil Etomidat, Ketoconazol, Itraconazol, oder Flunarizin ist.
- 30 7. Verwendung eines γ -Cyclodextrins zur Herstellung von Einschlußkomplexen, die aktive Bestandteile enthalten, dadurch gekennzeichnet, daß das γ -Cyclodextrin ein γ -Cyclodextrinether oder gemischter Ether ist, worin die Ethersubstituenten C_1 - $_3$ -Alkyl, Hydroxy- C_2 - $_4$ -alkyl oder Carboxy- C_1 - $_2$ -alkyl sind und worin der Substitutionsgrad im Bereich von 0,125 bis 2 oder die durchschnittliche molare Substitution im Bereich von 0,125 bis 10 liegt, wobei Retinoide als aktive Bestandteile ausgenommen sind.
- 35 8. Verwendung eines γ -Cyclodextrins gemäß Anspruch 7, dadurch gekennzeichnet, daß die γ -Cyclodextrinsubstituenten Methyl, Ethyl, Isopropyl, Hydroxyethyl, Hydroxypropyl, Hydroxybutyl, Carboxymethyl oder Carboxyethyl sind.
- 40 9. Verwendung eines γ -Cyclodextrins gemäß Anspruch 8, dadurch gekennzeichnet, daß die γ -Cyclodextrinsubstituenten Hydroxyethyl oder Hydroxypropyl sind.
- 45 10. Verwendung eines γ -Cyclodextrins gemäß den Ansprüchen 7 bis 9, dadurch gekennzeichnet, daß der Substitutionsgrad des γ -Cyclodextrins im Bereich von 0,3 bis 2 und die durchschnittliche molare Substitution im Bereich von 0,3 bis 3 liegt.
- 50 11. Verwendung eines γ -Cyclodextrins gemäß den Ansprüchen 7 bis 10, dadurch gekennzeichnet, daß der aktive Bestandteil ein nicht-steroides antirheumatisches Mittel, ein Steroid, ein Herzglykosid oder ein Derivat von Benzodiazepin, Benzimidazol, Piperidin, Piperazin, Imidazol, Triazol, Pyridazin, 1,2,4-Triazindion, 2,3,5,6-Tetrahydroimidazo[2,1-b]thiazol oder Hydratropasäure oder ein Amid oder ein Trialkylaminderivat ist.
- 55 12. Verwendung eines γ -Cyclodextrins gemäß Anspruch 11, dadurch gekennzeichnet, daß der aktive Bestandteil Etomidat, Ketoconazol, Itraconazol oder Flunarizin ist.

Patentansprüche für folgenden Vertragsstaat : AT

1. Verfahren zur Herstellung einer Zusammensetzung, die einen aktiven Bestandteil und einen γ -Cyclodextrinether oder gemischten Ether enthält, worin die Ethersubstituenten C_1 - $_3$ -Alkyl, Hydroxy- C_2 - $_4$ -alkyl



oder Carboxy-C₁₋₂-alkyl sind und worin der Substitutionsgrad im Bereich von 0,125 bis 2 oder die durchschnittliche molare Substitution im Bereich von 0,125 bis 10 liegt, wobei Zusammensetzungen ausgenommen sind, die einen partiellen Methyl-, Ethyl- und 2-Hydroxyethylether des γ -Cyclodextrins und ein Retinoid enthalten und wobei das Verfahren die Schritte Lösen des γ -Cyclodextrinethers oder gemischten Ethers in Wasser, Zugabe des aktiven Bestandteils zu der Lösung und wahlweise Trocknen der Lösung des gebildeten Einschlußkomplexes umfaßt.

2. Verfahren gemäß Anspruch 1, worin die γ -Cyclodextrinsubstituenten Methyl, Ethyl, Isopropyl, Hydroxyethyl, Hydroxypropyl, Hydroxybutyl, Carboxymethyl oder Carboxyethyl sind.
3. Verfahren gemäß Anspruch 2, worin die Substituenten Hydroxyethyl oder Hydroxypropyl sind.
4. Verfahren gemäß einem der Ansprüche 1 bis 3, worin der Substitutionsgrad des γ -Cyclodextrins im Bereich von 0,3 bis 2 und die durchschnittliche molare Substitution im Bereich von 0,3 bis 3 liegt.
5. Verfahren gemäß den Ansprüchen 1 bis 4, worin der aktive Bestandteil ein nicht-steroides antirheumatisches Mittel, ein Steroid, ein Herzglykosid oder ein Derivat von Benzodiazepin, Benzimidazol, Piperidin, Piperazin, Imidazol, Triazol, Pyridazin, 1,2,4-Triazindion, 2,3,5,6-Tetrahydroimidazo[2,1-b]thiazol oder Hydratropasäure oder ein Amid oder Trialkylaminderivat ist.
6. Verfahren gemäß Anspruch 5, worin der aktive Bestandteil Etomidat, Ketoconazol, Itraconazol, oder Flunarizin ist.
7. Verfahren zur Herstellung von Einschlußkomplexen, die aktive Bestandteile enthalten, unter Verwendung von γ -Cyclodextrin, worin das γ -Cyclodextrin ein γ -Cyclodextrinether oder gemischter Ether ist, worin die Ethersubstituenten C₁₋₃-Alkyl, Hydroxy-C₂₋₄-alkyl oder Carboxy-C₁₋₂-alkyl sind und worin der Substitutionsgrad im Bereich von 0,125 bis 2 oder die durchschnittliche molare Substitution im Bereich von 0,125 bis 10 liegt, wobei Retinoide als aktive Bestandteile ausgenommen sind und wobei das Verfahren die Schritte Lösen des γ -Cyclodextrinethers oder gemischten Ethers in Wasser, Zugabe des aktiven Bestandteils zu der Lösung und wahlweise Trocknen der Lösung des gebildeten Einschlußkomplexes umfaßt.
8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß die γ -Cyclodextrinsubstituenten Methyl-Ethyl, Isopropyl, Hydroxyethyl, Hydroxypropyl, Hydroxybutyl, Carboxymethyl oder Carboxyethyl sind.
9. Verfahren nach Anspruch 8, dadurch gekennzeichnet, daß die γ -Cyclodextrinsubstituenten Hydroxyethyl oder Hydroxypropyl sind.
10. Verfahren nach den Ansprüchen 7 bis 9, dadurch gekennzeichnet, daß der Substitutionsgrad des γ -Cyclodextrins im Bereich von 0,3 bis 2 liegt und die durchschnittliche molare Substitution im Bereich von 0,3 bis 3 liegt.
11. Verfahren nach den Ansprüchen 7 bis 10, dadurch gekennzeichnet, daß der aktive Bestandteil ein nicht-steroides antirheumatisches Mittel, ein Steroid, ein Herzglykosid oder ein Derivat von Benzodiazepin, Benzimidazol, Piperidin, Piperazin, Imidazol, Triazol, Pyridazin, 1,2,4-Triazindion, 2,3,5,6-Tetrahydroimidazo[2,1-b]thiazol oder Hydratropasäure oder ein Amid oder ein Trialkylaminderivat ist.
12. Verfahren nach Anspruch 11, dadurch gekennzeichnet, daß der aktive Bestandteil Etomidat, Ketoconazol, Itraconazol oder Flunarizin ist.

Revendications

Revendications pour les Etats contractants suivants : BE, CH, DE, FR, GB, IT, LI, LU, NL, SE

1. Une composition comprenant une substance active et un éther ou un éther mixte de γ -cyclodextrine dans lequel les substituants éther sont des groupes alkyle en C₁-C₃, hydroxyalkyle en C₂-C₄, carboxy-(alkyle en C₁-C₂) et dans lequel le degré de substitution est dans la gamme de 0,125 à 2 ou la substitution molaire moyenne est dans la gamme de 0,125 à 10, à l'exclusion des compositions comprenant des éthers méthyliques, éthyliques et 2-hydroxyéthyliques partiels de γ -cyclodextrine et un



rétinoïde.

2. Une composition selon la revendication 1, dans laquelle les substituants de la γ -cyclodextrine sont un groupe méthyle, éthyle, isopropyle, hydroxyéthyle, hydroxypropyle, hydroxybutyle, carboxyméthyle ou carboxyéthyle.
3. Une composition selon la revendication 2, dans laquelle les substituants sont un groupe hydroxyéthyle ou hydroxypropyle.
4. Une composition selon l'une quelconque des revendications 1 à 3, dans laquelle le degré de substitution de la γ -cyclodextrine est dans la gamme de 0,3 à 2 et la substitution molaire moyenne est dans la gamme de 0,3 à 3.
5. Une composition selon l'une quelconque des revendications 1 à 4, dans laquelle la substance active est un agent antirhumatismal non stéroïdien, un stéroïde, un glycoside cardiaque ou un dérivé de benzodiazépine, benzimidazole, pipéridine, pipérazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tétrahydroimidazo[2,1-b]thiazole ou d'acide hydratropique, ou un amide ou un dérivé de trialkylamine.
6. Une composition selon la revendication 5, dans laquelle la substance active est l'étomidate, le kétoconazole, l'itraconazole ou la flunarizine.
7. Utilisation d'une γ -cyclodextrine pour la préparation de complexes d'inclusion comprenant des substances actives, caractérisée en ce que la γ -cyclodextrine est un éther ou un éther mixte de γ -cyclodextrine dans lequel les substituants éther sont des groupes alkyle en C₁-C₃, hydroxyalkyle en C₂-C₄ ou carboxy(alkyle en C₁-C₂) et dans lequel le degré de substitution est dans la gamme de 0,125 à 2 ou la substitution molaire moyenne est dans la gamme de 0,125 à 10, à l'exclusion des rétinoïdes comme substances actives.
8. Utilisation d'une γ -cyclodextrine selon la revendication 7, caractérisée en ce que les substituants de la γ -cyclodextrine sont un groupe méthyle, éthyle, isopropyle, hydroxyéthyle, hydroxypropyle, hydroxybutyle, carboxyméthyle ou carboxyéthyle.
9. Utilisation d'une γ -cyclodextrine selon la revendication 8, caractérisée en ce que les substituants de la γ -cyclodextrine sont un groupe hydroxyéthyle ou hydroxypropyle.
10. Utilisation d'une γ -cyclodextrine selon l'une quelconque des revendications 7 à 9, caractérisée en ce que le degré de substitution de la γ -cyclodextrine est dans la gamme de 0,3 à 2 et la substitution molaire moyenne est dans la gamme de 0,3 à 3.
11. Utilisation d'une γ -cyclodextrine selon l'une quelconque des revendications 7 à 10, caractérisée en ce que la substance active est un agent anti-rhumatismal non stéroïdien, un stéroïde, un glycoside cardiaque ou un dérivé de benzodiazépine, benzimidazole, pipéridine, pipérazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tétrahydroimidazo[2,1-b]thiazole ou d'acide hydratropique, ou un amide ou un dérivé de trialkylamine.
12. Utilisation d'une γ -cyclodextrine selon la revendication 11, caractérisée en ce que la substance active est l'étomidate, le kétoconazole, l'itraconazole ou la flunarizine.

Revendications pour l'Etat contractant suivant : AT

1. Procédé de préparation d'une composition comprenant une substance active et un éther ou un éther mixte de γ -cyclodextrine dans lequel les substituants éther sont des groupes alkyle en C₁-C₃, hydroxyalkyle en C₂-C₄ ou carboxy(alkyle en C₁-C₂) et dans lequel le degré de substitution est dans la gamme de 0,125 à 2 ou la substitution molaire moyenne est dans la gamme de 0,125 à 10, à l'exclusion des compositions comprenant des éthers méthyliques, éthyliques et 2-hydroxyéthyliques partiels de γ -cyclodextrine et un rétinoïde, ce procédé comprenant les étapes qui consistent à dissoudre l'éther ou l'éther mixte de γ -cyclodextrine dans de l'eau, à y ajouter la substance active



choisie et, le cas échéant, à sécher la solution ainsi obtenue.

2. Procédé selon la revendication 1, dans lequel les substituants de la γ -cyclodextrine sont un groupe méthyle, éthyle, isopropyle, hydroxyéthyle, hydroxypropyle, hydroxybutyle, carboxyméthyle ou carboxyéthyle.
3. Procédé selon la revendication 2, dans lequel les substituants sont un groupe hydroxyéthyle ou hydroxypropyle.
4. Procédé selon l'une quelconque des revendications 1 à 3, dans lequel le degré de substitution de la γ -cyclodextrine est dans la gamme de 0,3 à 2 et la substitution molaire moyenne est dans la gamme de 0,3 à 3.
5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel la substance active est un agent antirhumatismal non stéroïdien, un stéroïde, un glycoside cardiaque ou un dérivé de benzodiazépine, benzimidazole, pipéridine, pipérazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tétrahydroimidazo[2,1-b]thiazole ou d'acide hydratropique, ou un amide ou un dérivé de trialkylamine.
6. Procédé selon la revendication 5, dans lequel la substance active est l'étomidate, le kétoconazole, l'itraconazole ou la flunarizine.
7. Procédé de préparation de complexes d'inclusion comprenant des substances actives et une γ -cyclodextrine, caractérisé en ce que la γ -cyclodextrine est un éther ou un éther mixte de γ -cyclodextrine dans lequel les substituants éther sont des groupes alkyle en C_1 - C_3 , hydroxyalkyle en C_2 - C_4 , carboxy(alkyle en C_1 - C_2) et dans lequel le degré de substitution est dans la gamme de 0,125 à 2 ou la substitution molaire moyenne est dans la gamme de 0,125 à 10, à l'exclusion des rétinoïdes comme substance active, ce procédé comprenant les étapes qui consistent à dissoudre l'éther ou l'éther mixte de γ -cyclodextrine dans de l'eau, à y ajouter la substance active choisie et, le cas échéant, à sécher la solution du composé d'inclusion formé.
8. Procédé selon la revendication 7, caractérisé en ce que les substituants de la γ -cyclodextrine sont un groupe méthyle, éthyle, isopropyle, hydroxyéthyle, hydroxypropyle, hydroxybutyle, carboxyméthyle ou carboxyéthyle.
9. Procédé selon la revendication 8, caractérisé en ce que les substituants de la γ -cyclodextrine sont un groupe hydroxyéthyle ou hydroxypropyle.
10. Procédé selon l'une quelconque des revendications 7 à 9, caractérisé en ce que le degré de substitution de la γ -cyclodextrine est dans la gamme de 0,3 à 2 et la substitution molaire moyenne est dans la gamme de 0,3 à 3.
11. Procédé selon l'une quelconque des revendications 7 à 10, caractérisé en ce que la substance active est un agent anti-rhumatismal non stéroïdien, un stéroïde, un glycoside cardiaque ou un dérivé de benzodiazépine, benzimidazole, pipéridine, pipérazine, imidazole, triazole, pyridazine, 1,2,4-triazinedione, 2,3,5,6-tétrahydroimidazo[2,1-b]thiazole ou d'acide hydratropique, ou un amide ou un dérivé de trialkylamine.
12. Procédé selon la revendication 11, caractérisé en ce que la substance active est l'étomidate, le kétoconazole, l'itraconazole ou la flunarizine.