[0019]

The "alkoxy group" is a group in which an oxygen atom is bonded to the terminal carbon atom of the alkyl group. The alkoxy group may be a linear chain or a branched chain. The alkoxy group is preferably an alkoxy group having 1 - 6 carbon atoms, and particularly preferably an alkoxy group having 1 - 4 carbon atoms. Examples of the alkoxy group include methoxy group, ethoxy group, propoxy group, butoxy group and the like.

[0020]

The "halogen atom" is a fluorine atom, a chlorine atom, a bromine atom, or an iodine atom.

[0021]

The "aryl group" is an aromatic hydrocarbon group, preferably an aryl group having 6 - 18 carbon atoms, particularly preferably an aryl group having 6 - 10 carbon atoms. Examples of the aryl group include phenyl group, naphthyl group, anthryl group and the like, and phenyl group is particularly preferable.

[0022]

The "aralkyl group" is an alkyl group to which an aryl group is bonded. The aryl group of the aralkyl group is preferably an aryl group having 6 - 10 carbon atoms, particularly preferably a phenyl group. The alkyl group of the aralkyl group is preferably an alkyl group having 1 - 4 carbon atoms. Examples of the aralkyl group include benzyl group, benzhydryl group, trityl group, phenylethyl group and the like.

[0023]

The "cycloalkyl group" is a cyclic alkyl group having a ring with three or more members, preferably a 3- to 6-membered cycloalkyl group. Examples of the cycloalkyl group include cyclopropyl group, cyclobutyl group, cyclopentyl group, cyclohexyl group, cycloheptyl group and the like.

[0024]

The "alkylsulfonyl group" is a monovalent group in which

alkyl group in the alkoxyalkyl group is preferably an alkyl group having 1 - 4 carbon atoms. The carbon number of the alkoxyalkyl group is preferably 2 to 6, more preferably 2 to 4. Examples of the alkoxyalkyl group include methoxymethyl group, ethoxymethyl group, propoxymethyl group, ethoxyethyl group and the like.

[0030]

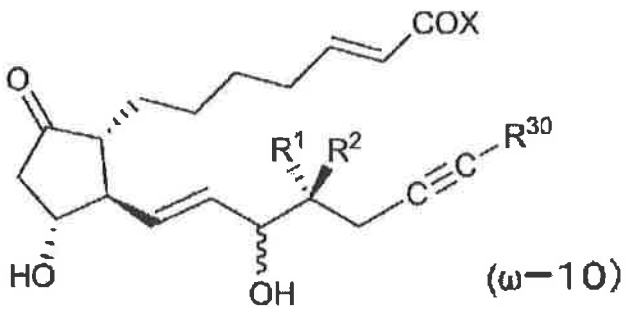
The "hydroxyalkyl group" is a group in which one or more hydrogen atoms in the alkyl group is/are substituted by a hydroxy group. The carbon number of the hydroxyalkyl group is preferably 2 to 6. The number of hydroxy groups of the hydroxyalkyl group is preferably one. Examples of the hydroxyalkyl group include 2-hydroxyethyl group, 3-hydroxypropyl group, 2-hydroxypropyl group, 4-hydroxybutyl group and the like.

[0031]

The "alkoxycarbonyl group" is a group in which the aforementioned alkoxy group is bonded the carbonyl group. The alkoxycarbonyl group is preferably an alkoxycarbonyl group in which an alkoxy group having 1 - 6 carbon atoms is bonded to a carbonyl group. Examples of the alkoxycarbonyl group include methoxycarbonyl group, ethoxycarbonyl group, n-propoxycarbonyl group, isopropoxycarbonyl group, n-butoxycarbonyl group, t-butoxycarbonyl group, amyloxycarbonyl group and the like.

[0032]

The substituted alkyl group is a group in which one or more hydrogen atoms of the alkyl group is/are substituted by a substituent(s). Examples of the substituent include halogen atom, hydroxy group, alkoxy group, halogenated alkoxy group, acyl group, acyloxy group, halogenated acyloxy group, alkylsulfonyloxy group, halogenated alkylsulfonyloxy group, arylsulfonyloxy group, arylsulfonyloxy group substituted halogenated alkyl group, alkoxycarbonyloxy group, amino group, substituted amino group, aryl group, heterocyclic group and the like, with preference given to halogen atom, hydroxy group or



(ω−10)

[0051]

The symbols in the formula (ω-10) have the same meanings as in the formula (1). R^{30} is an alkyl group having 1 - 4 carbon atoms (preferably an alkyl group having 2 - 3 carbon atoms), or a cycloalkyl group having 3 - 6 carbon atoms (preferably a cycloalkyl group having 3 - 5 carbon atoms).

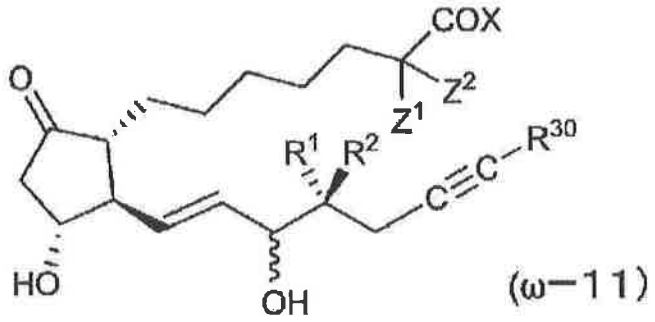
[0052]

It is preferable that R^1 is a hydrogen atom, R^2 is an alkyl group having 1 - 2 carbon atoms, X is OR^4, and R^4 is a hydrogen atom or an alkyl group having 1 - 4 carbon atoms.

[0053]

[Compound (ω-11)]

[0054]



(ω−11)

[0055]

The symbols in the formula (ω-11) have the same meanings as in the formula (1). R^{30} is an alkyl group having 1 - 4 carbon atoms (preferably an alkyl group having 2 - 3 carbon atoms), or a cycloalkyl group having 3 - 6 carbon atoms (preferably a cycloalkyl group having 3 - 5 carbon atoms).

[0056]

It is preferable that R^1 is a hydrogen atom, R^2 is an alkyl group having 1 - 2 carbon atoms, X is OR^4, and R^4 is a hydrogen atom or an alkyl group having 1 - 4 carbon atoms. Both Z^1 and Z^2 are preferably

cyclodextrin, β-cyclodextrin, γ-cyclodextrin, sulfobutylether-β-cyclodextrin, hydroxypropyl-β-cyclodextrin, or a mixture of two or more kinds selected from these is used. As the cyclodextrin, α-cyclodextrin or β-cyclodextrin is preferable, and α-cyclodextrin is particularly preferable.

As the production method of a cyclodextrin clathrate compound, methods generally known widely as emulsion method, saturated aqueous solution method, kneading method, mixing and pulverizing method and the like can be used. Specifically, it can be produced using compound (1) or a pharmaceutically acceptable salt thereof, and cyclodextrin and by the method described in JP-B-50-3362, JP-B-2-31404 or JP-B-61-52146. By formulating compound (1) as a cyclodextrin clathrate compound, properties such as stability and water solubility increase, and properties preferable as pharmaceutical products can be imparted.

[0081]

(Production method of the compound of the present invention)

The compound of the present invention can be synthesized by a general PG synthesis method. The concept of the synthetic route is shown in the following formulas.

For example, a compound wherein the -A-B- moiety is a double bond can be synthesized using a compound in which α-chain is introduced into Corey lactone as a starting material, by reducing the 15-position carbonyl group of the α,β-unsaturated carbonyl moiety in the ω-chain (compound of the following formula wherein W is H) introduced by a Horner-Wadsworth-Emmons reaction, introducing a double bond into the α-chain when desired, oxidizing the 9-position and deprotecting the hydroxy-protecting group.

A PG derivative having fluorine at the 2-position can be synthesized by, for example, synthesizing the starting material by introducing α-chain having a difluoro unit into Corey lactone, and performing a reaction similar to the above-mentioned reaction.