[0007]

Patent document 1: JP H7-10811 A

Patent document 2: JP 2001-129397 A

Patent document 3: WO 2015/156245

Patent document 4: JP 2013-181028 A

DISCLOSURE

PROBLEMS TO BE SOLVED

[0008]

Phosgene is generally used for producing a carbonate derivative as described above. Even if phosgene is not used in a certain production method, such a production method has problems that the other toxic compound and an expensive catalyst are used or phosgene must be used for producing a raw material compound.

The reason why a halogenated formate ester can be obtained by the invention of Patent document 3 is considered to be that the reaction does not further proceed without using a base. On the one hand, for example, when a base is used in the case of a polycarbonate, a remaining base may cause coloration and decomposition, and the value as an optical material may be decreased in some cases. In addition, hydrogen chloride generated from a halogenated hydrocarbon is preferably recovered to be reused. Specifically, recovered hydrogen chloride is decomposed into chlorine and water, and the obtained chlorine is reacted with methane to produce a chloro methane such as chloroform to be reused. But an electrolytic treatment is needed to recover hydrogen chloride, since when a base is used, a salt is generated from hydrogen chloride.

Accordingly, the objective of the present disclosure is to

provide a method for producing a polycarbonate safely and efficiently even without using a base.

MEANS FOR SOLVING THE PROBLEMS

[0009]

The inventor of the present disclosure repeated intensive studies in order to solve the above-described problems. As a result, the inventor completed the present disclosure by finding that a carbonate derivative can be amazingly produced without using a base in a safe and efficient manner by subjecting a halogenated methane and the specific amount of a hydroxy group-containing compound to a photoreaction in the presence of oxygen. A halogenated hydrocarbon has been conventionally considered not to be decomposed by increasing a ratio of a hydroxy group-containing compound to the halogenated hydrocarbon, since a hydroxy group-containing compound is known as a stabilizer to prevent a halogenated hydrocarbon from being decomposed. On the one hand, it was very surprising that even when a base is not used, a reaction proceeds from a halogenated formate ester and a carbonate derivative is efficiently generated.

The present disclosure is hereinafter described.

[0009a]

In an aspect, there is provided a method for producing a carbonate derivative,

the method comprising the step of irradiating a high energy light to a composition comprising a halogenated methane and a hydroxy group-containing compound in the presence of oxygen,

wherein the composition does not contain a base or a catalyst;

wherein a molar ratio of a total usage amount of the hydroxy group-containing compound to 1 mole of the halogenated methane is 0.05 or more and 10 or less,

wherein the hydroxy group-containing compound is represented by the following formula (i) and the carbonate derivative is a linear carbonate derivative represented by the following formula (I), or

the hydroxy group-containing compound is represented by the following formula (ii) and the carbonate derivative is a carbonate derivative comprising a unit represented by the following formula (II-1) or a cyclic carbonate derivative represented by the following formula (II-2):

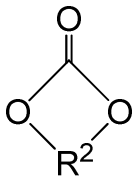
(i) R^1-OH

(ii) $HO-R^2-OH$

(I) $R^1-O-C(=O)-O-R^1$

(II-1) $[-O-R^2-O-C(=O)-]$

(II-2)



wherein

R^1 is a monovalent C_{1-200} organic group optionally comprising a hetero atom,

R^2 is a divalent C_{1-200} organic group optionally comprising a hetero atom.

[0010]

[1] A method for producing a carbonate derivative,

the method comprising the step of irradiating a high energy light to a composition comprising a halogenated methane and a hydroxy group-containing compound in the presence of oxygen,

wherein a molar ratio of a total usage amount of the hydroxy group-containing compound to 1 mole of the halogenated methane is 0.05 or more,

wherein the high energy light comprises a light having a wavelength of 180 nm or more and 280 nm or less.

[0014]

The method according to any one of the above [1] to [4], wherein two or more kinds of the hydroxy group-containing compound are used.

EFFECT

[0015]

It is not needed in the presently disclosed method that an expensive catalyst and a highly toxic compound such as phosgene and carbon monoxide are used as a raw material compound. In addition, a high quality carbonate derivative can be obtained, since a base is not needed to be used and does not remain in the carbonate derivative as a target compound. The presently disclosed method is, therefore, industrially very useful as a technology to safely and efficiently produce a useful high quality polycarbonate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a schematic diagram to demonstrate one example of the constitution of a reaction apparatus usable in the present invention method.

Fig. 2 is a graph to demonstrate a time-dependent change of a ratio of a cyclic carbonate/ethylene glycol in the reaction mixture in the case where ethylene glycol was used as a hydroxy group-containing compound.

MODE FOR CARRYING OUT THE INVENTION

CLAIMS

1. A method for producing a carbonate derivative,

the method comprising the step of irradiating a high energy light to a composition comprising a halogenated methane and a hydroxy group-containing compound in the presence of oxygen,

wherein the composition does not contain a base or a catalyst;

wherein a molar ratio of a total usage amount of the hydroxy group-containing compound to 1 mole of the halogenated methane is 0.05 or more and 10 or less,

wherein the hydroxy group-containing compound is represented by the following formula (i) and the carbonate derivative is a linear carbonate derivative represented by the following formula (I), or

the hydroxy group-containing compound is represented by the following formula (ii) and the carbonate derivative is a carbonate derivative comprising a unit represented by the following formula (II-1) or a cyclic carbonate derivative represented by the following formula (II-2):

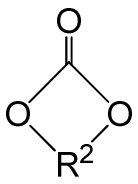
(i) R^1-OH

(ii) $HO-R^2-OH$

(I) $R^1-O-C(=O)-O-R^1$

(II-1) $[-O-R^2-O-C(=O)-]$

(II-2)



wherein

R^1 is a monovalent C_{1-200} organic group optionally comprising a hetero atom,

R^2 is a divalent C_{1-200} organic group optionally comprising a hetero atom.

2. The method according to claim 1, wherein the halogenated methane is chloroform.

3. The method according to claim 1 or 2, further comprising the step of stirring the composition without irradiating the high energy light.

4. The method according to any one of claims 1 to 3, wherein the high energy light comprises a light having a wavelength of 180 nm or more and 280 nm or less.

5. The method according to any one of claims 1 to 4, wherein two or more kinds of the hydroxy group-containing compound are used.