

PROCESS FOR PRODUCING 3-METHYLTHIOPROPANAL

BACKGROUND OF THE INVENTION

Field of the Invention

5 [0001]

The present application is filed, claiming the Paris Convention priorities of Japanese Patent Application No. 2009-91872 (filed on April 6, 2009), the entire content of which is incorporated herein by reference.

10 The present invention relates to a process for producing 3-methylthiopropenal by reacting acrolein with methylmercaptan. 3-methylthiopropenal is useful, for example, as a material for methionine.

15 Description of the Related Art

[0002]

It is widely known as a process for producing 3-methylthiopropenal by reacting acrolein with methylmercaptan that the reaction is performed in the
20 presence of pyridines (cf. JP-A-2004-115461, JP-A-11-511119, JP-A-9-501145 etc.).

SUMMARY OF THE INVENTION

[0003]

25 However, the above-mentioned conventional process is

not necessarily satisfactory in view of subgeneration of high-boiling impurities. Thus, an object of the present invention is to provide a process for producing 3-methylthiopropenal with subgeneration of high-boiling
 5 impurities being favorably inhibited.

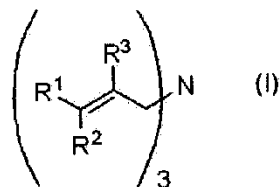
[0004]

The present inventors have intensively studied and found a process which can achieve the above object. Thus, the present invention has been completed.

10 [0005]

The present invention is intended to provide the following:

<1> A process for producing 3-methylthiopropenal, comprising reacting acrolein with methylmercaptan in the
 15 presence of a compound represented by the formula (I):



wherein each of R^1 to R^3 represents a hydrogen atom or an alkyl group having 1 to 4 carbon atoms.

[0006]

20 <2> The process according to the above item <1>, the reaction of acrolein with methylmercaptan is performed further in the presence of an organic acid.

[0007]

<3> The process according to the above item <2>, the compound represented by the formula (I) is used in an amount of from 0.01 to 1.0 mol based on one mole of the organic acid.

5 [0008]

<4> The process according to any one of the above items <1> to <3>, the compound represented by the formula (I) is used in an amount of from 0.1 to 2.0 mmoles based on one mole of methylmercaptan.

10 [0009]

<5> The process according to any one of the above items <1> to <4>, the reaction of acrolein with methylmercaptan is performed while each of acrolein, methylmercaptan, and a mixture of the compound represented by the formula (I) and the organic acid is fed into the reaction system.

[0010]

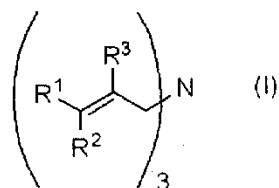
According to the present invention, 3-methylthiopropional can be produced with subgeneration of high-boiling impurities being favorably inhibited.

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DETAILED DESCRIPTION OF THE INVENTION

[0011]

In the present invention, a compound (hereinafter optionally referred to as a triallylamine (I)) represented
25 by the formula (I):



wherein each of R^1 to R^3 represents a hydrogen atom or an alkyl group having 1 to 4 carbon atoms is used. Subgeneration of high-boiling impurities can be favorably inhibited by using the triallylamine (I) as a catalyst. In the formula (I), examples of the alkyl group having 1 to 4 carbon atoms include a methyl group, an ethyl group, a n-propyl group, an iso-propyl group, a n-butyl group, a sec-butyl group, and a tert-butyl group. Examples of a triallylamine (I) include triallylamine, i.e. a compound of the formula (I) wherein all of R^1 to R^3 represent a hydrogen atom, tri(2-butenyl)amine, tri(3-methyl-2-butenyl)amine, tri(2-pentenyl)amine, and tri(2-hexenyl)amine. Two or more thereof may optionally be used. Among them, triallylamine is preferable.

[0012]

In the present invention, subgeneration of high-boiling impurities can be more favorably inhibited by using an organic acid in addition to the triallylamine (I). Examples of the organic acid include, for example, carboxylic acids; aliphatic monocarboxylic acids such as formic acid, acetic acid, propionic acid, octanoic acid, acrylic acid, trichloroacetic acid, and trifluoroacetic

acid, aromatic monocarboxylic acids such as phenylacetic acid, benzoic acid, cinnamic acid, furoic acid, and thiophenecarboxylic acid, aromatic polycarboxylic acids such as phthalic acid; sulfate monoesters; and sulfonic acid. Among them, carboxylic acids are preferable and acetic acid is more preferable.

[0013]

Conventionally, methylmercaptan is used nearly in an equimolar amount with acrolein. In view of odor reduction of resultant 3-methylthiopropional, it is preferable that acrolein is in slight excess and thus it is preferred to use from 0.95 to 0.99 mol of methylmercaptan based on one mole of acrolein.

[0014]

The amount of a triallylamine (I) used may be appropriately selected and is preferably from 0.1 to 2.0 mmoles based on one mole of methylmercaptan. In the case of coexistence of an organic acid, the amount is preferably from 0.01 to 1.0 mol and more preferably from 0.3 to 0.7 mol based on one mole of the organic acid.

[0015]

A mixing procedure for acrolein, methylmercaptan, a triallylamine (I) is not specifically limited and examples thereof may include a method in which a mixture of acrolein and a triallylamine (I) is admixed with methylmercaptan, a

method in which a mixture of methylmercaptan and a triallylamine (I) is admixed with acrolein, and a method in which each of acrolein, methylmercaptan, and a triallylamine (I) is fed respectively into a reaction system to admix with each other. Among them, a method in which each of acrolein, methylmercaptan, and a triallylamine (I) is fed respectively into a reaction system is preferred. In the case of using an organic acid, it is preferred that an organic acid is premixed with a triallylamine (I) and the mixture is admixed with acrolein and methylmercaptan, and it is particularly preferred that acrolein, methylmercaptan, a mixture of triallylamine (I) and an organic acid is fed respectively into a reaction system.

15 [0016]

The reaction system to be applied may be batch-wise or continuous, and a continuous system is preferably applied in view of productivity. The reaction temperature to be applied is usually from -10 to 100°C , and preferably from 0 to 80°C . The reaction time to be applied is usually from 10 minutes to 24 hours. The reaction may be conducted either under reduced pressure, under ordinary pressure, or under pressure. In addition, further components such as a solvent inactive against the reaction may be optionally fed in the reaction mentioned above.

[0017]

Any known methods may be appropriately applied to the post-processing operation for the resultant reaction mixture containing 3-methylthiopropenal. The examples
5 thereof include a method in which the reaction mixture is distilled and thus 3-methylthiopropenal is separated from the mixture and purified.

Examples

10 [0018]

Examples of the present invention will now be described, but are not limited thereto.

Example 1

15 To a reactor equipped with a supply port for acrolein, a supply port for methylmercaptan and a supply port for a mixture of triallylamine and acetic acid were charged 122 g (2.00 moles) of acrolein (with purity of 92% by weight), 93.4 g (1.94 moles) of methylmercaptan, and 0.231 g (0.94
20 mmol of triallylamine and 1.70 mmoles of acetic acid) of a mixture of triallylamine and acetic acid in a molar ratio of 1:1.8, and a batchwise reaction was performed at a reaction temperature of from 0 to 30°C for a reaction time of 30 minutes. The resultant reaction liquid was distilled
25 under 20 torr at 70 to 120°C to distil 3-methylthiopropenal

away and the residual concentrate (i.e. a high-boiling oligomer) was weighed. The amount of the residual concentrate obtained was 0.3% by weight with respect to the reaction liquid.

5 [0019]

Example 2

The same procedure as in Example 1 was carried out except that 0.0594 g (0.24 mmol of triallylamine and 0.44 mmol of acetic acid) of a mixture of triallylamine and
10 acetic acid in a molar ratio of 1:1.8 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 0.3% by weight.

[0020]

Example 3

15 The same procedure as in Example 1 was carried out except that the reaction was performed at a reaction temperature of from 40 to 70°C. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 1.7% by weight.

20 [0021]

Example 4

The same procedure as in Example 3 was carried out except that 0.119 g (0.48 mmol of triallylamine and 0.88 mmol of acetic acid) of a mixture of triallylamine and
25 acetic acid in a molar ratio of 1:1.8 was used. The amount

of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 1.4% by weight.

[0022]

Example 5

5 The same procedure as in Example 3 was carried out except that 1.02 g (1.38 mmoles of triallylamine and 13.8 mmoles of acetic acid) of a mixture of triallylamine and acetic acid in a molar ratio of 1:10 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer)
10 in the reaction liquid was 1.5% by weight.

[0023]

Example 6

 The same procedure as in Example 3 was carried out except that 0.314 g (1.38 mmoles of triallylamine and 2.07
15 mmoles of acetic acid) of a mixture of triallylamine and acetic acid in a molar ratio of 1:1.5 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 1.9% by weight.

[0024]

20 Comparative Example 1

 To a reactor equipped with a supply port for acrolein, a supply port for methylmercaptan and a supply port for a mixture of pyridine and acetic acid were charged 122 g (2.00 moles) of acrolein (with purity of 92% by weight),
25 93.4 g (1.94 moles) of methylmercaptan, and 0.938 g (1.38

mmoles of pyridine and 13.8 mmoles of acetic acid) of a mixture of pyridine and acetic acid in a molar ratio of 1:10, and a batchwise reaction was carried out at 0°C on trial but no reaction took place.

5 [0025]

Comparative Example 2

To a reactor equipped with a supply port for acrolein, a supply port for methylmercaptan and a supply port for a mixture of pyridine and acetic acid were charged 122 g
10 (2.00 moles) of acrolein (with purity of 92% by weight), 93.4 g (1.94 moles) of methylmercaptan, and 0.938 g (1.38 mmoles of pyridine and 13.8 mmoles of acetic acid) of a mixture of pyridine and acetic acid in a molar ratio of 1:10, and a batchwise reaction was performed at a reaction
15 temperature of from 40 to 70°C for a reaction time of 30 minutes. The resultant reaction liquid was distilled under 20 torr at 70 to 120°C to distil 3-methylthiopropional away and the residual concentrate (i.e. a high-boiling oligomer) was weighed. The amount of the residual concentrate
20 obtained was 2.6% by weight with respect to the reaction liquid.

[0026]

Comparative Example 3

The same procedure as in Comparative Example 2 was
25 carried out except that 0.911 g (1.06 mmoles of pyridine

and 13.8 mmoles of acetic acid) of a mixture of pyridine and acetic acid in a molar ratio of 1:13.0 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 5.2% by weight.

5 [0027]

Comparative Example 4

The same procedure as in Comparative Example 2 was carried out except that 0.233 g (1.38 mmoles of pyridine and 2.07 mmoles of acetic acid) of a mixture of pyridine
10 and acetic acid in a molar ratio of 1:1.5 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 8.3% by weight.

[0028]

Comparative Example 5

15 The same procedure as in Comparative Example 2 was carried out except that 1.08 g (1.38 mmoles of tributylamine and 13.8 mmoles of acetic acid) of a mixture of tributylamine and acetic acid in a molar ratio of 1:10 was used. The amount of the residual concentrate (i.e. a
20 high-boiling oligomer) in the reaction liquid was 3.5% by weight.

[0029]

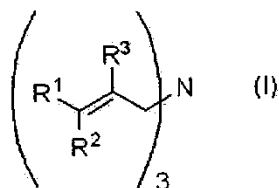
Comparative Example 6

The same procedure as in Comparative Example 2 was
25 carried out except that 0.455 g (1.38 mmoles of

tributylamine and 3.31 mmoles of acetic acid) of a mixture of tributylamine and acetic acid in a molar ratio of 1:2.4 was used. The amount of the residual concentrate (i.e. a high-boiling oligomer) in the reaction liquid was 5.6% by weight.

WHAT IS CLAIMED IS:

1. A process for producing 3-methylthiopropenal, comprising reacting acrolein with methylmercaptan in the presence of a compound represented by the formula (I):



wherein each of R¹ to R³ represents a hydrogen atom or an alkyl group having 1 to 4 carbon atoms.

2. The process according to claim 1, the reaction of acrolein with methylmercaptan is performed further in the presence of an organic acid.

3. The process according to claim 2, the compound represented by the formula (I) is used in an amount of from 0.01 to 1.0 mol based on one mole of the organic acid.

4. The process according to any one of claims 1 to 3, the compound represented by the formula (I) is used in an amount of from 0.1 to 2.0 mmoles based on one mole of methylmercaptan.

5. The process according to any one of claims 1 to 3,

the reaction of acrolein with methylmercaptan is performed while each of acrolein, methylmercaptan, and a mixture of the compound represented by the formula (I) and the organic acid is fed into the reaction system.