# DESCRIPTION

## METHOD FOR PREVENTING FOULING OF HEAT EXCHANGER IN PETROLEUM PROCESS

### Technical Field

[0001] The present disclosure relates to a method for preventing fouling of a heat exchanger in a petroleum process.

### Background Art

[0002] In a distillation process of a petroleum refining plant for refining crude oil, after crude oil is heated in a heat exchanger and a heating furnace, the crude oil is fed to a distillation tower for distillation operation. Since the crude oil undergoes heat hysteresis in the heat exchanger and the heating furnace, a large amount of fouling adheres to the heat exchanger and the heating furnace. One form of fouling components is a form mixed with an organic polymeric component called asphaltene. Such adhesion of fouling reduces the heat exchanging effectiveness of the heat exchanger and the heating furnace, which increases the fuel use for maintaining an outlet temperature.

[0003] Patent Document 1 discloses an antifouling agent and a fouling prevention method for a heat exchanger and a heating furnace, which is added to a process fluid at an upstream of a desalter. Patent Document 2 discloses a method for preventing asphaltene fouling in a preheat exchanger in a petroleum process using a phosphate-based anticorrosive and a dispersant.

### Prior Art Documents

#### Patent Documents

[0004] Patent Document 1: JP 2010-163539 A

Patent Document 2: WO 2015/022979

### Disclosure

#### Problem to be Solved

[0005] The present inventors found that the phosphate-based anticorrosive is particularly useful for preventing asphaltene fouling of a preheat exchanger (Patent Document 2). However, the use of phosphate in place of conventional antifouling agents causes corrosion of carbon steel and stainless steel, which are used in general antifouling agent storage tanks and chemical feeders. Particularly, corrosivity of phosphate is notably exhibited as the temperature of phosphate rises. At a high temperature region in a feeding point, the temperature of phosphate climbs up to about 200°C. Since conventional chemical feeders cannot withstand the corrosion by phosphate, the material of the chemical feeders needs to be changed to a corrosion-resistant material.

[0006] In one example, the present disclosure provides a new method for preventing fouling of a heat exchanger in a petroleum process.

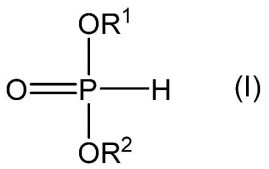
Means for Solving Problem

[0007] In one example, the present disclosure relates to a method for preventing fouling of a heat exchanger in a petroleum process, including adding a phosphite compound and a dispersant to a process fluid that passes through the heat exchanger.

[0008] In another example, the present disclosure relates to an antifouling agent for use in the fouling prevention method of the present disclosure, including a phosphite compound and a dispersant.

[0008a] In an aspect, there is provided a method for preventing asphaltene fouling of a heat exchanger in a petroleum process, comprising adding a phosphite compound and a dispersant to a process fluid that passes through the heat exchanger,

wherein the phosphite compound is a phosphite compound represented by Formula (I):

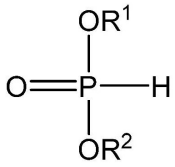



(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

[0008b] In another aspect, there is provided an anti-asphaltene fouling agent for use in the method as defined above, comprising a phosphite compound and a dispersant,

wherein the phosphite compound is a phosphite compound represented by Formula (I):

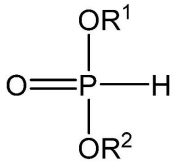


(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

[0008c] In yet another aspect, there is provided the use of a phosphite compound for preventing asphaltene fouling of a heat exchanger in a petroleum process through which a process fluid with an added dispersant passes,

wherein the phosphite compound is a phosphite compound represented by Formula (I):



(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

Effect

[0009] The present disclosure can reduce the fouling of the heat exchanger in the petroleum process. In one or more examples, the present disclosure can reduce the corrosion of the antifouling agent storage tank and chemical feeder.

Brief Description of Drawings

[0010] [FIG. 1] FIG. 1 is a block diagram illustrating an exemplary petroleum

refining process equipment equipped with an atmospheric distillation tower.

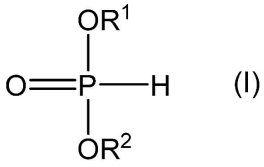
[FIG. 2] FIG. 2 is a cross-sectional view of a heat pipe used in a fouling prevention test.

[FIG. 3] FIG. 3 is a cross-sectional view illustrating a state in which the heat

# CLAIMS

1. A method for preventing asphaltene fouling of a heat exchanger in a petroleum process, comprising adding a phosphite compound and a dispersant to a process fluid that passes through the heat exchanger,

wherein the phosphite compound is a phosphite compound represented by Formula (I):



(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

2. The method according to claim 1, comprising adding the phosphite compound to the process fluid so that a concentration of the phosphite compound in the process fluid to be supplied to the heat exchanger is 1 to 100 ppm.

3. The method according to claim 1 or 2, comprising adding the dispersant to the process fluid so that a concentration of the dispersant in the process fluid to be supplied to the heat exchanger is 1 to 100 ppm.

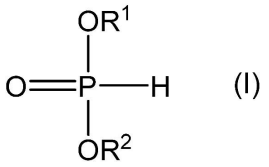
4. The method according to any of claims 1 to 3, comprising adding the phosphite compound and the dispersant to the process fluid so that a ratio of a content (ppm) of the phosphite compound and a content (ppm) of the dispersant in the process fluid to be supplied to the heat exchanger is 5:1 to 1:5.

5. The method according to any of claims 1 to 4, wherein the fouling prevention comprises restraining adhesion and/or accumulation of asphaltene inside the heat exchanger.

6. An anti-asphaltene fouling agent for use in the method according to any of

claims 1 to 5, comprising a phosphite compound and a dispersant,

wherein the phosphite compound is a phosphite compound represented by Formula (I):

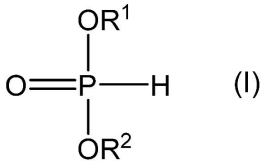


(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

7. Use of a phosphite compound for preventing asphaltene fouling of a heat exchanger in a petroleum process through which a process fluid with an added dispersant passes,

wherein the phosphite compound is a phosphite compound represented by Formula (I):



(I)

[In Formula (I), $R^1$ and $R^2$ are the same or different and represent a group having 1 to 30 carbon atoms.]

8. The method according to any of claims 1 to 5, wherein the phosphite compound is diethyl hydrogen phosphite, bis(2-ethylhexyl) hydrogen phosphite, dilauryl hydrogen phosphite, dioleyl hydrogen phosphite, diphenyl hydrogen phosphite, or a combinations of these.

9. The method according to any of claims 1 to 5 and 8, wherein the dispersant is polyolefin ester, polyalkenyl-substituted succinate, or a combination of these.