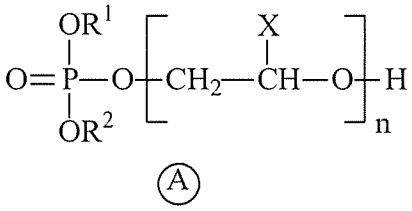
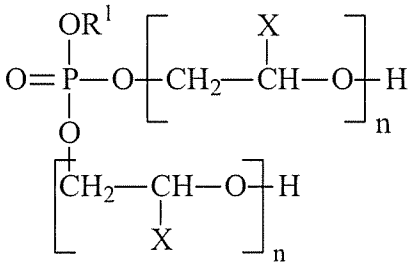
CLAIMS

1) An effective novel non – polymeric and non – fouling additive for inhibiting high – temperature naphthenic acid corrosion, comprising an effective corrosion – inhibiting amount of a oxide treated phosphate ester wherein said oxide treated phosphate ester is ~~obtained by a~~ reaction product of ~~reacting~~ a phosphate ester ~~with~~ and an oxirane compound selected from the group consisting of butylene oxide, ethylene oxide, propylene oxide or any other oxirane compound or a combination thereof ~~yielding said oxide treated phosphate ester having~~ and is a mixture of compounds of structural formulae A and B,



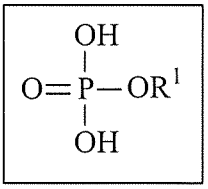
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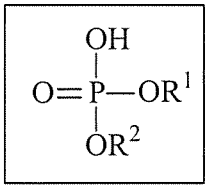
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wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other, X is H, CH_3 or C_2H_5; and n may vary from 1 to 20,

wherein said phosphate ester at least contains a mixture of compounds of structural formulae I and II,



I



II

wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other,

wherein said phosphate ester is ~~obtained as~~ a reaction mixture of reaction of an alcohol ~~with~~ and a phosphorous pentaoxide.

2) An effective additive, as claimed in claim 1, wherein said effective additive has acidity varying from 1 mg KOH/gm to 20 mg KOH/gm as determined by titration of samples against normal alcoholic KOH.

3) An effective additive, as claimed in claim 1 or 2, wherein said effective additive has phosphorus contents varying from 0.5 % to 9% of said effective additive.

4) An effective additive, as claimed in any one of preceding claims 1 to 3, wherein mole ratios of said phosphorus pentoxide and said alcohol are used, such that the mole ratio of said phosphorus pentoxide to said alcohol is 1 mole of said phosphorus pentoxide to 1 to 10 mole of said alcohol and 1 mole of said phosphorus pentoxide to 1 to 7 mole of said alcohol.

5) An effective additive as claimed in any one of preceding claims 1 to 4, wherein active dosage of said additive is from 1 to 2000 ppm.

6) A process of high temperature naphthenic acid corrosion inhibition of metallic surfaces of any of the hydrocarbon processing units of a petrochemical plant~~, used~~ for processing a stream containing naphthenic acid, with said processing units comprising distillation columns, strippers, trays, pump around piping and related equipments, and said process ~~using said oxide treated phosphate ester of any one of preceding claims 1 to 5, comprising~~ comprises the steps of:

a. heating said hydrocarbon containing naphthenic acid to vapourize a portion of said hydrocarbon;

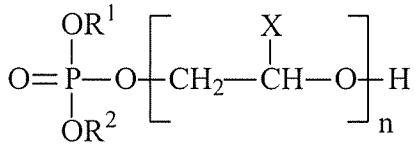
b. condensing a portion of the hydrocarbon vapors, passing through said hydrocarbon processing unit, to produce a condensed distillate;

c. adding to said distillate, before said condensed distillate is returned to said hydrocarbon processing unit or collected as a product, from 1 to 2000 ppm of an effective novel non-polymeric and non-fouling additive for inhibiting high temperature naphthenic acid corrosion, comprising an ~~said~~ oxide treated phosphate ester ~~of any one of preceding claims 1 to 5 in corrosion inhibition effective amount, capably forming~~ to form a reaction mixture;

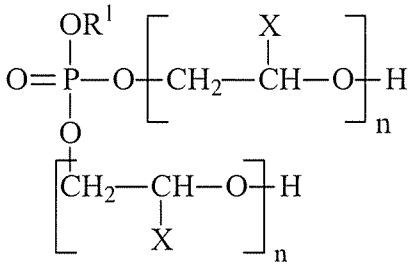
d. allowing said reaction mixture to contact said metallic surfaces of said hydrocarbon processing unit to form a protective film on said surfaces whereby each of said surfaces is inhibited against corrosion; and

e. allowing said condensed distillate to return to said hydrocarbon processing unit, or to be collected as said product;

wherein said oxide treated phosphate ester is obtained by reacting a phosphate ester with an oxirane compound selected from the group consisting of butylene oxide, ethylene oxide, propylene oxide or any other oxirane compound or a combination thereof yielding said oxide treated phosphate ester having a mixture of compounds of structural formulae A and B,



(A)



(B)

wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be

identical to or different from each other, X is H, CH_3 or C_2H_5; and n may vary from 1 to 20,

wherein said phosphate ester at least contains a mixture of compounds of structural formulae I and II,



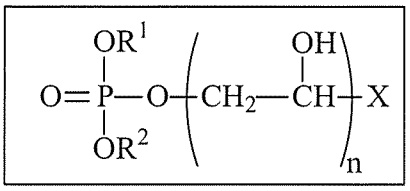
I II

wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other,

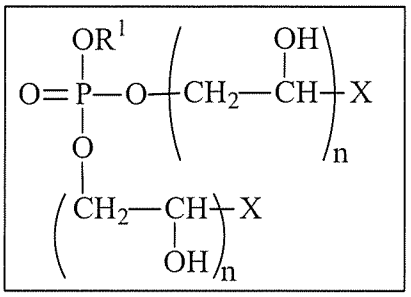
wherein said phosphate ester is obtained as a reaction mixture of reaction of an alcohol with a phosphorous pentaoxide..

7) A process as claimed in claim 6, wherein said stream includes crude oil, feedstock, and hydrocarbon stream and / or fractions thereof.

8) An effective novel non – polymeric and non – fouling additive for inhibiting high – temperature naphthenic acid corrosion, comprising an effective corrosion – inhibiting amount of a oxide treated phosphate ester wherein said oxide treated phosphate ester is ~~obtained by~~ a reaction product of ~~reacting~~ a phosphate ester ~~with~~ and an oxirane compound selected from the group consisting of butylene oxide, ethylene oxide, propylene oxide or any other oxirane compound or a combination thereof ~~yielding said oxide treated phosphate ester having~~ and is a mixture of compounds of structural formulae A and B,



A



B

wherein

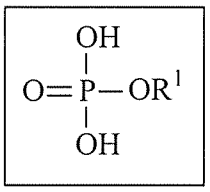
R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and

R^1 and R^2 may be identical to or different from each other,

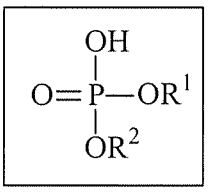
X is H, CH_3 or C_2H_5; and

n is 1,

said phosphate ester at least contains a mixture of compounds of structural formulae I and II,



I



II

wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other,

wherein said phosphate ester is ~~obtained as~~ a reaction mixture of reaction of an alcohol ~~with~~ and a phosphorous pentaoxide.

9) An effective additive, as claimed in claim 8, wherein said effective additive has acidity varying from 1 mg KOH/gm to 20 mg KOH/gm as determined by titration of samples against normal alcoholic KOH.

10) An effective additive, as claimed in claim 8 or 9, wherein said effective additive has phosphorus contents varying from 0.5 % to 9% of said effective additive.

11) An effective additive, as claimed in any one of preceding claims 8 to 10, wherein mole ratios of said phosphorus pentoxide and said alcohol are used, such that the mole ratio of said phosphorus pentoxide to said alcohol is 1 mole of said phosphorus pentoxide to 1 to 10 mole of said alcohol and 1 mole of said phosphorus pentoxide to 1 to 7 mole of said alcohol.

12) An effective additive as claimed in any one of preceding claims 8 to 11, wherein active dosage of said additive is from 1 to 2000 ppm.

13) A process of high temperature naphthenic acid corrosion inhibition of metallic surfaces of any of the hydrocarbon processing units of a petrochemical plant~~, used~~ for processing a stream containing naphthenic acid, with said processing units comprising distillation columns, strippers, trays, pump around piping and related equipments, ~~and~~ wherein said process ~~using said oxide treated phosphate ester of any one of preceding claims 8 to 12, comprising~~ comprises the steps of:

a. heating said hydrocarbon containing naphthenic acid to vapourize a portion of said hydrocarbon;

b. condensing a portion of the hydrocarbon vapors, passing through said hydrocarbon processing unit, to produce a condensed distillate;

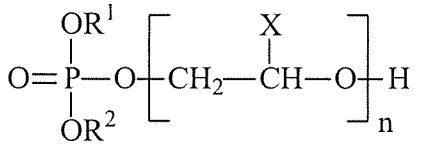
c. adding to said distillate, before said condensed distillate is returned to said hydrocarbon processing unit or collected as a product, from 1 to 2000 ppm of an effective novel non-polymeric and non-fouling additive for inhibiting high temperature naphthenic acid corrosion, comprising an ~~said~~ oxide treated phosphate ester ~~of any~~

~~one of preceding claims 8 to 12 in corrosion inhibition effective amount~~ to form a reaction mixture;

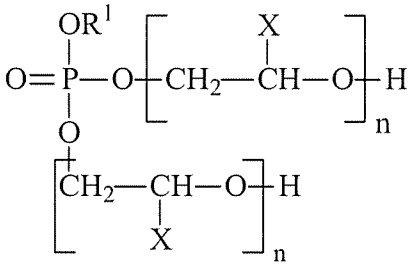
d. allowing said reaction mixture to contact said metallic surfaces of said hydrocarbon processing unit to form a protective film on said surfaces whereby each of said surfaces is inhibited against corrosion; and

e. allowing said condensed distillate to return to said hydrocarbon processing unit, or to be collected as said product

wherein said oxide treated phosphate ester– is obtained by reacting a phosphate ester with an oxirane compound selected from the group consisting of butylene oxide, ethylene oxide, propylene oxide or any other oxirane compound or a combination thereof yielding said oxide treated phosphate ester having a mixture of compounds of structural formulae A and B,

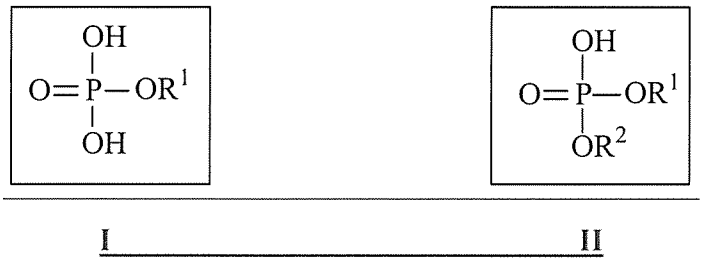


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wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other, X is H, CH_3 or C_2H_5; and n is 1, wherein said phosphate ester at least contains a mixture of compounds of structural formulae I and II,



I II

wherein R^1 and R^2 are each independently selected from the group consisting of moieties having 1 to 20 carbon atoms, and R^1 and R^2 may be identical to or different from each other,

wherein said phosphate ester is obtained as a reaction mixture of reaction of an alcohol with a phosphorous pentaoxide.

14) A process as claimed in claim 13, wherein said stream includes crude oil, feedstock, and hydrocarbon stream and / or fractions thereof.

15). Use of oxide treated phosphate ester additive as claimed in any one of preceding claims 1 to 5 or as prepared by process of any one of claims 6 or 7 for inhibiting high temperature naphthenic acid corrosion of metallic surfaces of any of the hydrocarbon processing units of a petrochemical plant, used for processing a stream containing naphthenic acid, wherein said processing units comprise distillation columns, strippers, trays, pump around piping and related equipments.

16). Use of oxide treated phosphate ester additive as claimed in any one of preceding claims 8 to 12 or as prepared by process of any one of claims 13 or 14 for inhibiting high temperature naphthenic acid corrosion of metallic surfaces of any of the hydrocarbon processing units of a petrochemical plant, used for processing a stream containing naphthenic acid, wherein said processing units comprise distillation columns, strippers, trays, pump around piping and related equipments.

~~17) An effective novel non polymeric and non fouling additive substantially as herein described with reference to the foregoing examples.~~

~~18) A process of high temperature naphthenic acid corrosion inhibition, substantially as herein described with reference to the foregoing examples.~~

~~19). Use of oxide treated phosphate ester additive substantially as herein described with reference to the foregoing examples.~~