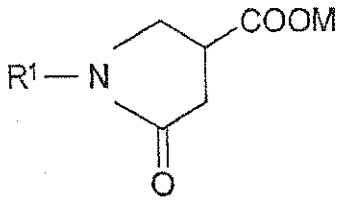
It has been found that, surprisingly, substituted pyrrolidonecarboxylic acids and salts thereof are excellent emulsifiers for inverse emulsions.

One aspect~~The invention~~ therefore provides inverse emulsions comprising

a) a hydrophobic liquid as a continuous phase

b) water as a disperse phase, and

c) a compound of the formula (1)



(1)

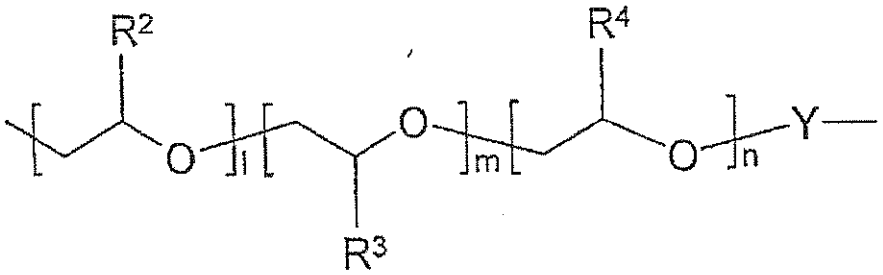
in which

R^1 is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group

M is hydrogen, alkali metal, alkaline earth metal or an ammonium group

R^5 is a hydrocarbyl group having 6 to 30 carbon atoms

X is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l is a number from 1 to 50,

m, n are independent of l and are each independently a number from 0 to 50,

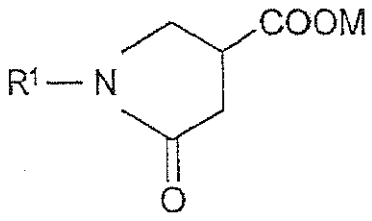
R^2, R^3, R^4 are each independently hydrogen, CH_3 or CH_2CH_3

Y is C_2-C_6-alkylene.

The ~~invention~~disclosure further provides a process for producing an inverse emulsion, by adding a compound of the formula (1) to a mixture of a hydrophobic

liquid and water. In another aspect, there is provided a process for producing an inverse emulsion, comprising the mixing

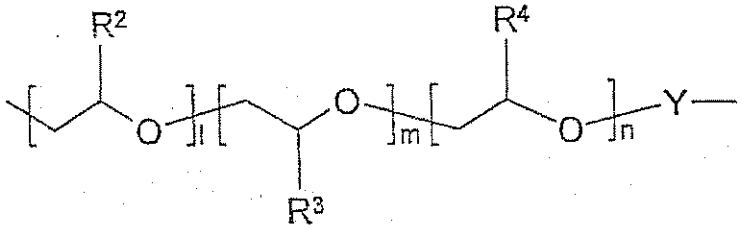
of a hydrophobic liquid, water and a compound of the formula (1)



(1)

in which

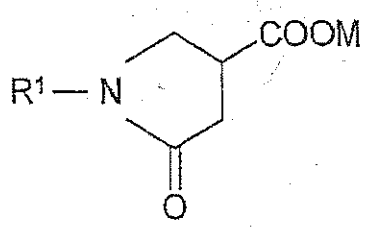
R^1	is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group
M	is hydrogen, alkali metal, alkaline earth metal or an ammonium group
R^5	is a hydrocarbyl group having 6 to 30 carbon atoms
X	is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l	is a number from 1 to 50,
m, n	are independent of l and are each independently a number from 0 to 50,
R^2, R^3, R^4	are each independently hydrogen, CH_3 or CH_2CH_3
Y	is C_2-C_6-alkylene.

The ~~invention~~disclosure further provides for the use of a compound of the formula (1) as an emulsifier in inverse emulsions which comprise a hydrophobic liquid as a continuous phase and water as a disperse phase. In yet another aspect, there is provided the use of a compound of the formula (1)



(1)

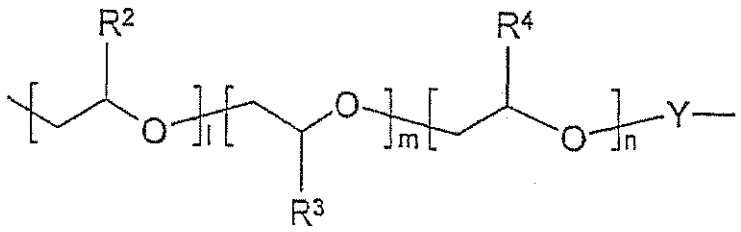
in which

R^1 is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group

M is hydrogen, alkali metal, alkaline earth metal or an ammonium group

R^5 is a hydrocarbyl group having 6 to 30 carbon atoms

X is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l is a number from 1 to 50,

m, n are independent of l and are each independently a number from 0 to 50,

R^2, R^3, R^4 are each independently hydrogen, CH_3 or CH_2CH_3

Y is C_2-C_6-alkylene,

as an emulsifier in inverse emulsions which comprise a hydrophobic liquid as a continuous phase and water as a disperse phase.

In still another aspect, there is provided a composition comprising 10-90% by weight of at least one

compound of the formula (1) and an oleophilic liquid selected from diesel oil, cleaned diesel oil with aromatics content below 0.5% by weight (clean oil), white oils, α-olefins, polyolefins, n-paraffins, isoparaffins, alkylbenzenes, alcohols, acetals, esters, ethers and triglycerides.

The compound of the formula (1) is also referred to hereinafter as inventive emulsifier.

In one embodiment, R^1 is a hydrocarbyl group, in which case R^1 does not contain any heteroatoms. R^1 is preferably C_8-C_{30}-alkyl, C_8-C_{30}-alkenyl, C_6-C_{30}-aryl or C_7-C_{30}-alkylaryl. More preferably, R^1 is a linear or branched C_8-C_{24}-alkyl or alkenyl chain, e.g. n- or isooctyl, n- or isononyl, n- or isodecyl, undecyl, dodecyl, tetradecyl, hexadecyl, octadecyl, eicosyl or longer radicals. Particular preference is given to cocoyl and oleyl radicals. R^1 may likewise be a C_6-C_{30}-aryl radical which is mono- or polycyclic and which may bear substituents, especially alkyl and/or alkenyl radicals. Additionally preferably, R^1 is a linear or branched, aliphatic C_{12}-C_{24} hydrocarbyl radical having one or more double bonds.

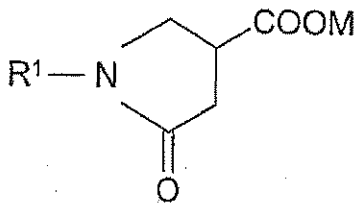
R^5 is preferably C_8-C_{30}-alkyl, C_8-C_{30}-alkenyl, C_6-C_{30}-aryl or C_7-C_{30}-alkylaryl. More preferably, R^5 is a linear or branched C_8-C_{24}-alkyl or alkenyl chain, e.g. n- or isooctyl, n- or isononyl, n- or isodecyl, undecyl, tetradecyl, hexadecyl, octadecyl, eicosyl or longer radicals. Particular preference is given to cocoyl and oleyl radicals. R^5 may likewise be a C_6-C_{30}-aryl radical which is mono- or polycyclic and which may bear substituents, especially alkyl and/or alkenyl radicals. Additionally preferably, R^5 is a linear or branched, aliphatic C_{12}-C_{24} hydrocarbyl radical having one or more double bonds.

X and Y are preferably each a group of the formula $-(CHR^{16})_k-$ in which R^{16} is H, CH_3 or CH_2CH_3 and k is a number from 2 to 6. R^{16} is preferably H. k is preferably a number from 2 to 4. More preferably, $-(CHR^{16})_k-$ represents groups of the formulae $-CH_2-CH_2-$, $-CH_2-CH(CH_3)-$, $-(CH_2)_3-$ or $-CH_2-CH(CH_2CH_3)-$. R^{16} may have the same definition in all $-(CH_2R^{16})-$ units, or different definitions.

l is preferably a number from 2 to 10.

Amended claims

1. An inverse emulsion comprising
   a) a hydrophobic liquid as a continuous phase
   b) water as a disperse phase, and
   c) a compound of the formula (1)



(1)

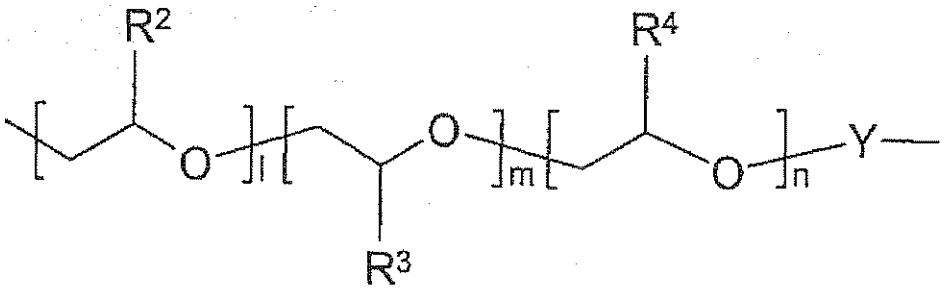
in which

R^1 is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group

M is hydrogen, alkali metal, alkaline earth metal or an ammonium group

R^5 is a hydrocarbyl group having 6 to 30 carbon atoms

X is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l is a number from 1 to 50,

m, n are independent of l and are each independently a number from 0 to 50,

R^2, R^3, R^4 are each independently hydrogen, CH_3 or CH_2CH_3

Y is C_2-C_6-alkylene.

2. The inverse emulsion as claimed in claim 1, in which the water phase comprises doubly or more than doubly charged positive ions.

3. The inverse emulsion as claimed in claim 2, in which the doubly or more than doubly charged positive ions are selected from magnesium and calcium ions, and from ions of diamines or higher amines which correspond to the formula (2)

$$NR^7R^8R^9 \qquad (2)$$

in which R^7, R^8 and R^9 are each independently radicals of the formula (4)

$$-[R^{14}-N(R^{15})]_b-(R^{15}) \quad (4)$$

in which

R^{14} is an alkylene group having 2 to 6 carbon atoms or mixtures thereof,

each R^{15} is independently hydrogen, an alkyl or hydroxyalkyl radical having up to 24 carbon atoms, a polyoxyalkylene radical $-(R^{10}-O)_p-R^{11}$ or a polyiminoalkylene radical $-[R^{14}-N(R^{15})]_q-(R^{15})$ where R^{14} and R^{15} are each as defined above, and

q and p are each independently from 1 to 50,

R^{10} is an alkylene group having 2 to 6 carbon atoms or mixtures thereof,

R^{11} is hydrogen, a hydrocarbyl radical having 1 to 24 carbon atoms or a group of the formula $-R^{10}-NR^{12}R^{13}$,

b is a number of from 1 to 20.

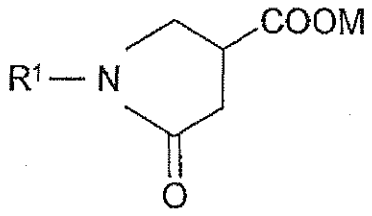
4. The inverse emulsion as claimed in one or more of claims 1 to 3, in which R^1 is a linear or branched, aliphatic C_{12}-C_{24} hydrocarbyl radical having one or more double bonds.

5. The inverse emulsion as claimed in one or more of claims 1 to 4, in which the continuous phase comprises at least one constituent selected from diesel oil, cleaned diesel oil with aromatics content below 0.5% by weight (clean oil), white oils, α-olefins, polyolefins, n-paraffins, isoparaffins, alkylbenzenes, alcohols, acetals, esters, ethers and triglycerides.

6. The inverse emulsion as claimed in one or more of claims 1 to 5,

which comprises 20 to 90% by weight of the hydrophobic liquid a), 5% to 70% by weight of water and 0.5 to 20% by weight of the compound of the formula (1), based on the weight of the inverse emulsion.

7. A process for producing an inverse emulsion, comprising the mixing of a hydrophobic liquid, water and a compound of the formula (1)



(1)

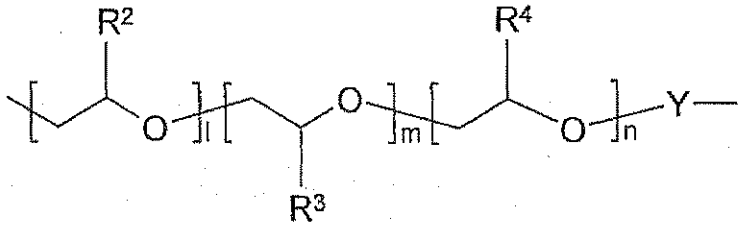
in which

R^1 is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group

M is hydrogen, alkali metal, alkaline earth metal or an ammonium group

R^5 is a hydrocarbyl group having 6 to 30 carbon atoms

X is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l is a number from 1 to 50,

m, n are independent of l and are each independently a number from 0 to 50,

R^2, R^3, R^4 are each independently hydrogen, CH_3 or CH_2CH_3

Y is C_2-C_6-alkylene.

8. The process as claimed in claim 7, wherein compounds containing doubly or more than doubly positively charged ions are added to the water phase.

9. The process as claimed in claim 8, in which the doubly or more than doubly charged positive ions are selected from magnesium and

calcium ions, and from ions of diamines or higher amines which correspond to the formula (2)

$$NR^7R^8R^9 \qquad (2)$$

in which R^7, R^8 and R^9 are each independently radicals of the formula (4)

$$-[R^{14}-N(R^{15})]_b-(R^{15}) \quad (4)$$

in which

R^{14} is an alkylene group having 2 to 6 carbon atoms or mixtures thereof,

each R^{15} is independently hydrogen, an alkyl or hydroxyalkyl radical having up to 24 carbon atoms, a polyoxyalkylene radical $-(R^{10}-O)_p-R^{11}$ or a polyiminoalkylene radical $-[R^{14}-N(R^{15})]_q-(R^{15})$ where R^{14} and R^{15} are each as defined above, and

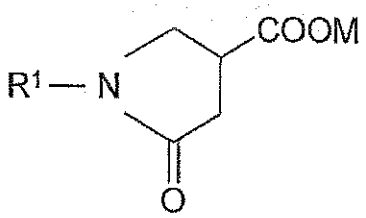
q and p are each independently from 1 to 50,

R^{10} is an alkylene group having 2 to 6 carbon atoms or mixtures thereof,

R^{11} is hydrogen, a hydrocarbyl radical having 1 to 24 carbon atoms or a group of the formula $-R^{10}-NR^{12}R^{13}$,

b is a number of from 1 to 20.

10. The use of a compound of the formula (1)



(1)

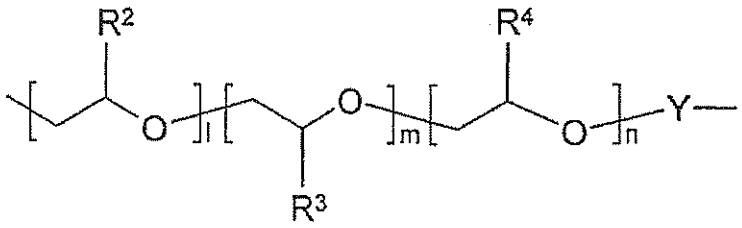
in which

R^1 is a hydrocarbyl group having 6 to 30 carbon atoms or an R^5-O-X- group

M is hydrogen, alkali metal, alkaline earth metal or an ammonium group

R^5 is a hydrocarbyl group having 6 to 30 carbon atoms

X is C_2-C_6-alkylene or a poly(oxyalkylene) group of the formula



in which

l is a number from 1 to 50,

m, n are independent of l and are each independently a number from 0 to 50,

R^2, R^3, R^4 are each independently hydrogen, CH_3 or CH_2CH_3

Y is C_2-C_6-alkylene,

as an emulsifier in inverse emulsions which comprise a hydrophobic liquid as a continuous phase and water as a disperse phase.

11. The use as claimed in claim 10, in which the inverse emulsion is an invert emulsion drilling fluid.

12. A composition comprising 10 – 90% by weight of at least one compound of the formula (1) and an oleophilic liquid selected from diesel oil, cleaned diesel oil with aromatics content below 0.5% by weight (clean oil), white oils, α-olefins, polyolefins, n-paraffins, isoparaffins, alkylbenzenes, alcohols, acetals, esters, ethers and triglycerides.