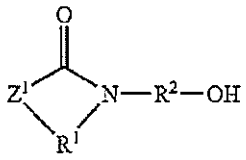
What is claimed is:

1. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which cyclic N-hydroxyalkylated amides (C)



where

Z^1 is oxygen, sulfur, or unsubstituted or substituted phosphorus,

R^1 and R^2 are each independently C_2-C_{20}-alkylene, C_5-C_{12}-cycloalkylene, C_6-C_{12}-arylene, or C_2-C_{20}-alkylene interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups and/or by one or more cycloalkyl, —(CO)—, —O(CO)O—, —(NH)(CO)O—, —O(CO)(NH)—, —O(CO)— or —(CO)O— groups, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles, or

R^2—OH is a group of the formula $—[X_i]_k—H$,

R^3 is hydrogen, C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl, C_2-C_{18}-alkenyl, C_6-C_{12}-aryl, C_5-C_{12}-cycloalkyl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, or a five- to six-membered heterocycle having oxygen, nitrogen and/or sulfur atoms, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles,

k is a number from 1 to 50 and

X_i, for each i=1 to k may independently be selected from the group of —CH_2—CH_2—O—, —CH_2—CH_2—N(H)—, —CH_2—CH_2—CH_2—N(H)—, —CH_2—CH(NH_2)—, —CH_2—CH(NHCHO)—, —CH_2—CH(CH_3)—O—, —CH(CH_3)—CH_2—O—, —CH_2—C(CH_3)$_2$—O—, —C(CH_3)$_2$—CH_2—O—, —CH_2—CH_2—CH_2—O—, —CH_2—CH_2—CH_2—CH_2—O—, —CH_2—CHVin-O—, —CHVin-CH_2—O—, —CH_2—CHPh-O— and —CHPh-CH_2—O— where Ph is phenyl and Vin is vinyl,

are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester (D) in the presence of at least one heterogeneous catalyst selected from the group consisting of inorganic salts (S) and enzymes (E),

wherein the inorganic salt (S) has at least one cation, with the proviso that the at least one cation is not lithium; and at least one anion selected from the group consisting of carbonate (CO_3^{2-}), hydrogencarbonate (HCO_3^-), phosphate (PO_4^{3-}), hydrogenphosphate (HPO_4^{2-}), dihydrogenphosphate ($H_2PO_4^-$), sulfate (SO_4^{2-}), sulfite (SO_3^{2-}) and carboxylate (R^6—COO^-), where R^6 is C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl or C_6-C_{12}-aryl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups.

2. The process according to claim **1**, wherein the at least one inorganic salt (S) has a pK_B of not more than 7.0 and not less than 1.0, and a solubility in the reaction medium at 25° C. of not more than 1 g/l.

3. The process according to claim **1**, wherein the inorganic salt has at least one cation selected from the group consisting of alkali metals, alkaline earth metals, ammonium, cerium, iron, manganese, chromium, molybdenum, cobalt, nickel and zinc, with the proviso that the at least one cation is not lithium.

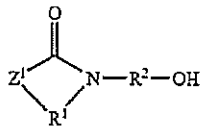
4. The process according to claim **1**, wherein the inorganic salt is selected from the group consisting of K_3PO_4, Na_3PO_4, K_2CO_3 and Na_2CO_3 and hydrates thereof.

5. The process according to claim **1**, wherein the enzyme is selected from the group consisting of esterases (E.C.3.1.-.-), lipases (E.C.3.1.1.3), glycosylases (E.C. 3.2.-.-) and proteases (E.C.3.4.-.-).

6. The process according to claim **5**, wherein the enzyme is selected from the group consisting of Novozyme® 435 (lipase from *Candida antarctica* B), lipase from *Alcaligenes* sp., *Aspergillus* sp., *Mucor* sp., *Penicilium* sp., *Geotricum* sp., *Rhizopus* sp., *Burkholderia* sp., *Candida* sp., *Pseudomonas* sp., *Thermomyces* sp. or porcine pancreas.

7. The process according to claim **1**, wherein the reaction is carried out in such a way that the product (C) is obtained on completion of the reaction as an about 10-80% by weight solution in the (meth)acrylic ester used as the reactant.

8. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which cyclic N-hydroxyalkylated amides (C)



where

Z^1 is N—R^3,

R^1 and R^2 are each independently C_2-C_{20}-alkylene, C_5-C_{12}-cycloalkylene, C_6-C_{12}-arylene, or C_2-C_{20}-alkylene interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups and/or by one or more cycloalkyl, —(CO)—, —O(CO)O—, —(NH)(CO)O—, —O(CO)(NH)—, —O(CO)— or —(CO)O— groups, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles, or

R^2—OH is a group of the formula —$[X_i]_k$—H,

R^3 is C_1-C_{18}-alkyl, C_2-C_{18}-alkyl, C_2-C_{18}-alkenyl, C_6-C_{12}-aryl, C_5-C_{12}-cycloalkyl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, or a five- to six-membered heterocycle having oxygen, nitrogen and/or sulfur atoms, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles,

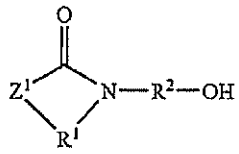
k is a number from 1 to 50 and

X_i, for each i=1 to k may independently be selected from the group of —CH_2—CH_2—O—, —CH_2—CH_2—N(H)—, —CH_2—CH_2—CH_2—N(H)—, —CH_2—CH(NH_2)—, —CH_2—CH(NHCHO)—, —CH_2—CH(CH_3)—O—, —CH(CH_3)—CH_2—O—, —CH_2—C(CH_3)$_2$—O—, —C(CH_3)$_2$—CH_2—O—, —CH_2—CH_2—CH_2—O—, —CH_2—CH_2—CH_2—CH_2—O—, —CH_2—CHVin-O—, —CHVin-CH_2—O—, —CH_2—CHPh-O— and —CHPh-CH_2—O— where Ph is phenyl and Vin is vinyl,

are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester (D) in the presence of at least one heterogeneous catalyst selected from the group consisting of inorganic salts (S) and enzymes (E),

wherein the inorganic salt (S) has at least one cation, with the proviso that the at least one cation is not lithium; and at least one anion selected from the group consisting of carbonate (CO_3^{2-}), hydrogencarbonate (HCO_3^-), phosphate (PO_4^{3-}), hydrogenphosphate (HPO_4^{2-}), dihydrogenphosphate ($H_2PO_4^-$), sulfate (SO_4^{2-}), sulfite (SO_3^{2-}) and carboxylate (R^6—COO^-), where R^6 is C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl or C_6-C_{12}-aryl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups.

9. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which cyclic N-hydroxyalkylated amides (C)



where

Z^1 is N—R^3,

R^1 is C_3-C_{20}-alkylene, C_5-C_{12}-cycloalkylene, C_6-C_{12}-arylene, or C_2-C_{20}-alkylene interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups and/or by one or more cycloalkyl, —(CO)—, —O(CO)O—, —(NH)(CO)O—, —O(CO)(NH)—, —O(CO)— or —(CO)O— groups, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles,

R^2 is C_2-C_{20}-alkylene, C_5-C_{12}-cycloalkylene, C_6-C_{12}-arylene, or C_2-C_{20}-alkylene interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups and/or by one or more cycloalkyl, —(CO)—, —O(CO)O—, —(NH)(CO)O—, —O(CO)(NH)—, —O(CO)— or —(CO)O— groups, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles, or

R^2—OH is a group of the formula —$[X_i]_k$—H,

R^3 is hydrogen,

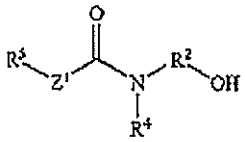
k is a number from 1 to 50 and

X_i, for each i=1 to k may independently be selected from the group of —CH_2—CH_2—O—, —CH_2—CH_2—N(H)—, —CH_2—CH_2—CH_2—N(H)—, —CH_2—CH(NH_2)—, —CH_2—CH(NHCHO)—, —CH_2—CH(CH_3)—O—, —CH(CH_3)—CH_2—O—, —CH_2—C(CH_3)$_2$—O—, —C(CH_3)$_2$—CH_2—O—, —CH_2—CH_2—CH_2—O—, —CH_2—CH_2—CH_2—CH_2—O—, —CH_2—CHVin-O—, —CHVin-CH_2—O—, —CH_2—CHPh-O— and —CHPh-CH_2—O— where Ph is phenyl and Vin is vinyl,

are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester (D) in the presence of at least one heterogeneous catalyst selected from the group consisting of inorganic salts (S) and enzymes (E),

wherein the inorganic salt (S) has at least one cation, with the proviso that the at least one cation is not lithium; and at least one anion selected from the group consisting of carbonate (CO_3^{2-}), hydrogencarbonate (HCO_3^-), phosphate (PO_4^{3-}), hydrogenphosphate (HPO_4^{2-}), dihydrogenphosphate ($H_2PO_4^-$), sulfate (SO_4^{2-}), sulfite (SO_3^{2-}) and carboxylate (R^6—COO^-), where R^6 is C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl or C_6-C_{12}-aryl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups.

10. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which open-chain N-hydroxyalkylated amides



are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester in the presence of at least one heterogeneous catalyst selected from the group consisting of an inorganic salt and an enzyme,

wherein

Z' is sulfur, unsubstituted or substituted phosphorus or mono- or unsubstituted nitrogen (N—R^3),

R^2 is C_2-C_{20}-alkylene, C_5-C_{12}-cycloalkylene, C_6-C_{12}-arylene, or C_2-C_{20}-alkylene interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups and/or by one or more cycloalkyl, —(CO)—, —O(CO)O—, —(NH)(CO)O—, —O(CO)(NH)—, —O(CO)— or —(CO)O— groups, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles, or

R^2 —OH is a group of the formula —$[X_i]_k$—H,

R^3, R^4 and R^5 are each independently hydrogen, C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl, C_2-C_{18} alkenyl, C_6-C_{12}-aryl, C_5-C_{12}-cycloalkyl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, or a five- to six-membered heterocycle having oxygen, nitrogen and/or sulfur atoms, where the radicals mentioned may each be substituted by aryl, alkyl, aryloxy, alkyloxy, heteroatoms and/or heterocycles, and R^3 and R^5 may also together form a five- to twelve-membered ring,

with the proviso that, in the case that Z^1=O, R^5 is only unsubstituted C_1-C_{18}-alkyl, C_6-C_{12}-aryl or C_5-C_{12}-cycloalkyl,

k is a number from 1 to 50,

X_i for each i=1 to k may independently be selected from the group of —CH_2—CH_2—O—, —CH_2—CH_2—N(H)—, —CH_2—CH_2—CH_2—N(H)—, —CH_2—CH(NH_2)—, —CH_2—CH(NHCHO)—, —CH_2—CH(CH_3)—O—, —CH(CH_3)—CH_2—O—, —CH_2—C(CH_3)$_2$—O—, —C(CH_3)$_2$—CH_2—O—, —CH_2—CH_2—CH_2—O—, —CH_2—CH_2—CH_2—CH_2—O—, —CH_2—CHVin-O—, —CHVin-CH_2—O—, —CH_2—CHPh-O— and —CHPh-CH_2—O— where Ph is phenyl and Vin is vinyl,

the inorganic salt has at least one anion selected from the group consisting of carbonate (CO_3^{2-}), hydrogencarbonate (HCO_3^-), phosphate (PO_4^{3-}), hydrogenphosphate (HPO_4^{2-}), dihydrogenphosphate (HPO_4^-), sulfate (SO_4^{2-}), sulfite (SO_3^{2-}) and carboxylate (R^6—COO^-), where R^6 is C_1-C_{18}-alkyl, or C_2-C_{18}-alkyl or C_6-C_{12}-aryl which are each optionally interrupted by one or more oxygen and/or sulfur atoms and/or one or more substituted or unsubstituted imino groups, and

the inorganic salt has at least one cation selected from the group consisting of potassium, sodium, alkaline earth metals, ammonium, cerium, iron, manganese, chromium, molybdenum, cobalt, nickel and zinc.

11. The process according to claim 10, wherein Z^1 is unsubstituted or monosubstituted nitrogen (N—R^3).

12. The process according to claim 10, wherein the inorganic salt has a pK_B of not more than 7.0 and not less than 1.0, and a solubility in the reaction medium at 25° C. of not more than 1 g/l.

13. The process according to claim 10, wherein the inorganic salt is selected from the group consisting of K_3PO_4, Na_3PO_4, K_2CO_3 and Na_2CO_3 and hydrates thereof.

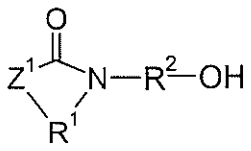
14. The process according to claim 10, wherein the enzyme is selected from the group consisting of esterases, lipases, glycosylases and proteases.

15. The process according to claim 14, wherein the enzyme is selected from the group consisting of Novozyme® 435 (lipase from *Candida antarctica* B), lipase from *Alcaligenes* sp., *Aspergillus* sp., *Mucor* sp., *Penicilium* sp., *Geotricum* sp., *Rhizopus* sp., *Burkholderia* sp., *Candida* sp., *Pseudomonas* sp., *Thermomyces* sp. or porcine pancreas.

16. The process according to claim 10, wherein the reaction is carried out in such a way that the open-chain N-hydroxyalkylated amides are obtained on completion of the reaction as an about 10-80% by weight solution in the (meth)acrylic ester used as the reactant.

Claims:

1. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which cyclic N-hydroxyalkylated amides (C)



where

Z^1 is oxygen or N-R^3,

R^1 and R^2 are each independently C_2-C_{20}-alkylene, or

R^2-OH is a group of the formula -$[X_i]_k$-H,

R^3 is hydrogen or C_1-C_{18}-alkyl,

k is a number from 1 to 50 and

X_i, for each i=1 to k may independently be selected from the group of -CH_2-CH_2-O-, -CH_2-$CH(CH_3)$-O-, -$CH(CH_3)$-CH_2-O-, -CH_2-$C(CH_3)_2$-O-, -$C(CH_3)_2$-CH_2-O-, -CH_2-CH_2-CH_2-O- and -CH_2-CH_2-CH_2-CH_2-O-,

are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester (D) in the presence of at least one heterogeneous catalyst selected from the group consisting of inorganic salts (S) and enzymes (E),

wherein the inorganic salt (S) has at least one cation selected from the group consisting of lithium, sodium and potassium; and at least one anion which is phosphate (PO_4^{3-}),

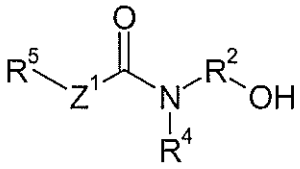
and wherein the enzymes (E) is selected from the group consisting of lipases from *Candida antarctica B*, *Alcaligenes sp.*, *Aspergillus sp.*, *Mucor sp.*, *Penicilium sp.*, *Geotricum sp.*, *Rhizopus sp.*, *Burkholderia sp.*, *Candida sp.*, *Pseudomonas sp.*, *Thermomyces sp.* and porcine pancreas.

2. The process according to claim 1, wherein the at least one inorganic salt (S) has a pK_B of not more than 7.0 and not less than 1.0, and a solubility in the reaction medium at 25° C. of not more than 1 g/l.

3. The process according to claim 1, wherein the reaction is carried out in such a way that the product (C) is obtained on completion of the reaction as an about 10-80%

by weight solution in the (meth)acrylic ester used as the reactant.

4. A process for preparing (meth)acrylates of N-hydroxyalkylated amides, in which open-chain N-hydroxyalkylated amides (O)



are esterified with (meth)acrylic acid or transesterified with at least one (meth)acrylic ester in the presence of at least one heterogeneous catalyst selected from the group consisting of an inorganic salt and an enzyme,

wherein

Z^1 is mono- or unsubstituted nitrogen (N-R^3),

R^2 is C_2-C_{20}-alkylene, or

R^2-OH is a group of the formula -$[X_i]_k$-H,

R^3, R^4 and R^5 are each independently hydrogen or C_1-C_{18}-alkyl,

k is a number from 1 to 50,

X_i for each i=1 to k may independently be selected from the group of -CH_2-CH_2-O-, -CH_2-$CH(CH_3)$-O-, -$CH(CH_3)$-CH_2-O-, -CH_2-$C(CH_3)_2$-O-, -$C(CH_3)_2$-CH_2-O-, -CH_2-CH_2-CH_2-O- and -CH_2-CH_2-CH_2-CH_2-O-,

the inorganic salt has at least one anion which is phosphate (PO_4^{3-}), and

the inorganic salt has at least one cation selected from the group consisting of lithium, potassium and sodium,

and the enzyme is selected from the group consisting of lipases from *Candida antarctica B*, *Alcaligenes sp.*, *Aspergillus sp.*, *Mucor sp.*, *Penicilium sp.*, *Geotricum sp.*, *Rhizopus sp.*, *Burkholderia sp.*, *Candida sp.*, *Pseudomonas sp.*, *Thermomyces sp.* and porcine pancreas.

5. The process according to claim 4, wherein the inorganic salt has a pK_B of not more than 7.0 and not less than 1.0, and a solubility in the reaction medium at 25° C. of not more than 1 g/l.

6. The process according to claim 4, wherein the reaction is carried out in such a way that the open-chain N-hydroxyalkylated amides are obtained on completion of the reaction as an about 10-80% by weight solution in the (meth)acrylic ester used as the reactant.