

The present invention relates to polyolefinic compositions containing a stabilizer or mixture of stabilizers from the group of the phenolic antioxidants, the sterically hindered amines, the ultraviolet light absorbers, the organic phosphorus compounds, the metal salts of fatty acids and the thiosynergists, and further containing N,N-dibenzylhydroxylamine or other selected hydroxylamine derivatives.

Although phenolic antioxidants have long been known to be very effective stabilizers for polyolefin and have been used commercially, polyolefins stabilized in this manner have a marked tendency to discolour upon heating at elevated temperatures or upon exposure to the combustion products of natural gas.

By the simultaneous use of organic phosphites the discolouration of polyolefinic compositions is reduced, but it remains a serious practical problem.

Polyolefinic compositions containing phenolic antioxidants and sterically hindered amines as light stabilizers behave similarly. They tend to discolour upon storage for extended periods even at ambient temperature.

Organic hydroxylamine derivatives, such as N,N-dibenzylhydroxylamine, are known and commercially available.

U.S. Patent Specifications 3,644,278 and 3,778,464 describe the use of substituted hydroxylamines of varying structures as antioxidant stabilizers for hydrocarbons and in particular for polyolefins. The use of such hydroxylamines in combination with phenolic antioxidants or in combination with organic phosphorus compounds, ultraviolet light absorbers, thiosynergists or sterically hindered amines has not, however, been proposed.

U.S. Patent Specification 3,408,422 suggests the use of selected hydroxylamine derivatives in unsaturated polyesters to prevent premature gelation on storage.

U.S. Patent Specification 3,926,909 describes the use of substituted hydroxylamines in polyurethanes (Spandex) to prevent discoloration by light, smoke or gas fumes.

U.S. Patent Specification 4,242,224 discloses the use of dialkylhydroxylamines or mercaptans as stabilizers in amine-containing antioxidant or antiozone emulsions to prevent the pink discoloration which occurs in such emulsions at high pH values.

U.S. Patent Specification 4,316,996 describes a process of preparing phenolic antioxidants in the presence of a hydroxylamine derivative and of a substituted oxime to yield a phenolic antioxidant which gives rise to good colour and colour stability of the treated substrates. It is stated that, when such antioxidants are incorporated into rubber, the discolouration is reduced. The compositions according to the invention are not described.

U.S. Patent Specification 3,432,578 relates to compositions containing conjugated diene polymers and diaryl- or diaralkylhydroxylamines as stabilizers against the effects of ultraviolet light. The use of N,N-dibenzylhydroxylamine is proposed. It is also noted that the dialkylhydroxylamines are completely ineffective as stabilizers in such polymers. This patent suggests that other types of stabilizer may be used in conjunction with hydroxylamines and Table I describes a stabilized composition containing a conjugated diene polymer, phenolic antioxidants and N,N-dibenzylhydroxylamine. Such a composition is stabilized against the effects of ultraviolet light.

U.S. Patent Specification 4,386,224 describes the use of N,N-diethylhydroxylamine as a colour stabilizer for monoalkylphenols such as nonyl- or dodecylphenol.

The object of the present invention are polyolefinic compositions which comprise a stabilizer or a mixture of stabilizers from the group of the phenolic antioxidants, the sterically hindered amines, the ultraviolet light absorbers, the organic phosphorus compounds, the metal salts of

fatty acids or the thiosynergists, and comprising at least one hydroxylamine derivative; the compositions according to the invention are stabilized in particular against discoloration resulting, for example, from high temperature processing, from storage for prolonged periods (at ambient temperature) or from contact with combustion products.

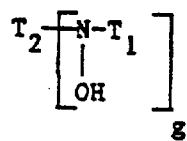
Stabilizer combinations that may be used advantageously, are the following:

- a phenolic antioxidant and a hydroxylamine derivative
- a phenolic antioxidant, a sterically hindered amine and a hydroxylamine derivative
- a phenolic antioxidant, an organic phosphorus compound and a hydroxylamine derivative
- a phenolic antioxidant, an ultraviolet light absorber and a hydroxylamine derivative
- a phenolic antioxidant, an ultraviolet light absorber, an organic phosphorus compound and a hydroxylamine derivative
- a phenolic antioxidant, a sterically hindered amine, an organic phosphorus compound and a hydroxylamine derivative
- a phenolic antioxidant, a sterically hindered amine, an ultraviolet light absorber and a hydroxylamine derivative
- a phenolic antioxidant, a sterically hindered amine, an organic phosphorus compound, a thiosynergist and a hydroxylamine derivative
- a sterically hindered amine and a hydroxylamine derivative
- a phenolic antioxidant, a thiosynergist and a hydroxylamine derivative
- a metal salt of a fatty acid and a hydroxylamine derivative
- a phenolic antioxidant, a metal salt of a fatty acid and a hydroxylamine derivative.

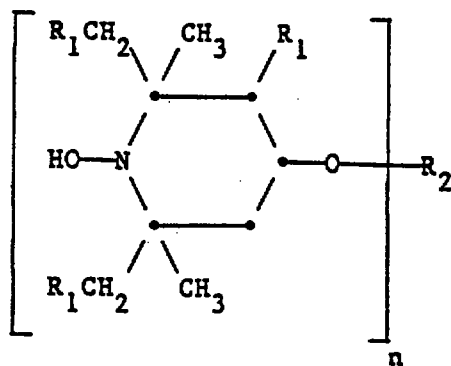
The present invention relates to stabilized compositions which comprise

- (a) a saturated polyolefin or a mixture of such polyolefins,
- (b) at least one stabilizer or a mixture of stabilizers from the group of the phenolic antioxidants, the sterically hindered amines, the ultraviolet light absorbers, the organic phosphorus compounds, the metal salts of fatty acids or the thiosynergists, and
- (c) at least one hydroxylamine derivative of the formulae I to XIV, or a

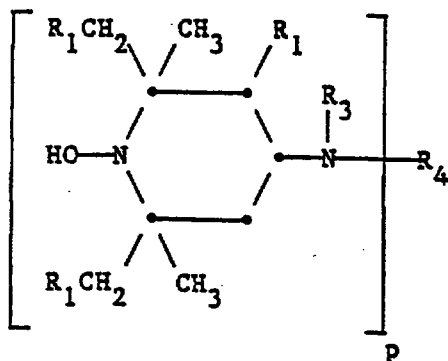
mixture of such derivatives



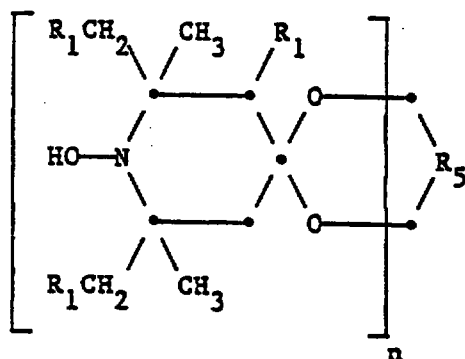
(I),



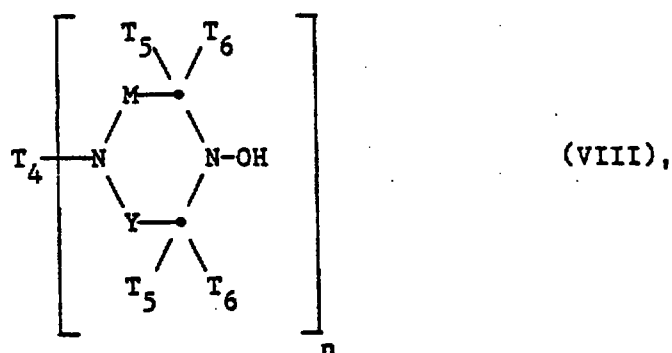
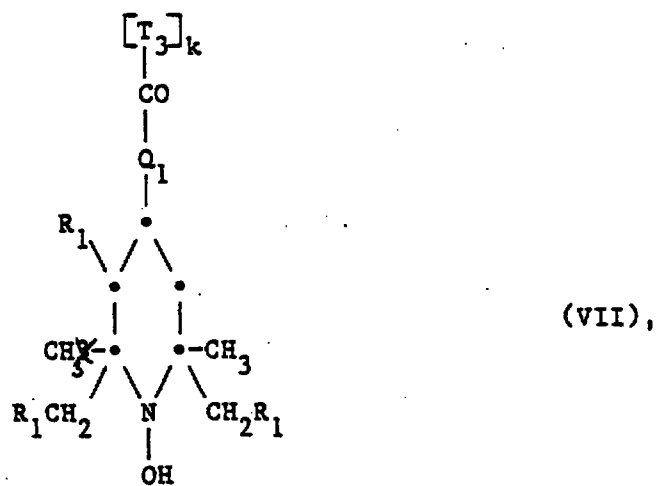
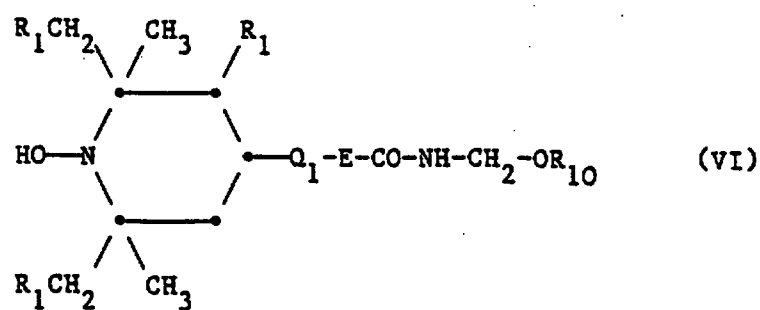
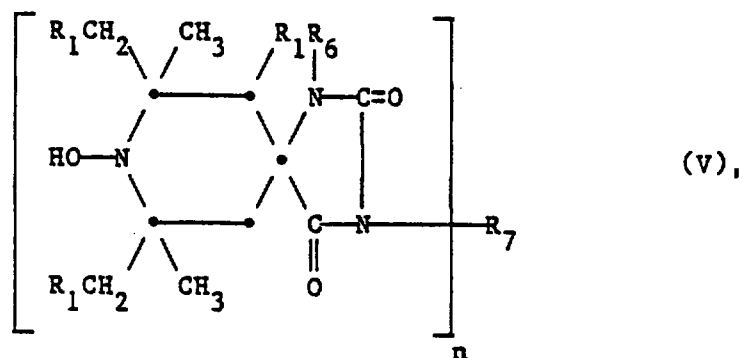
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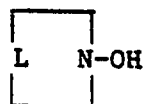


(III),

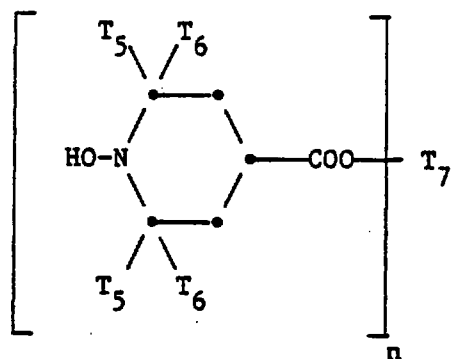


(IV),

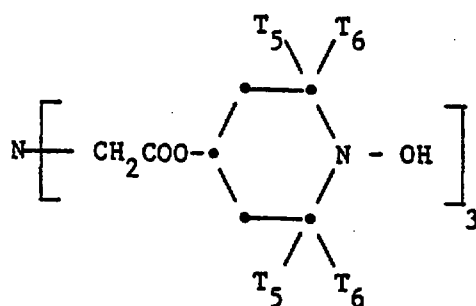




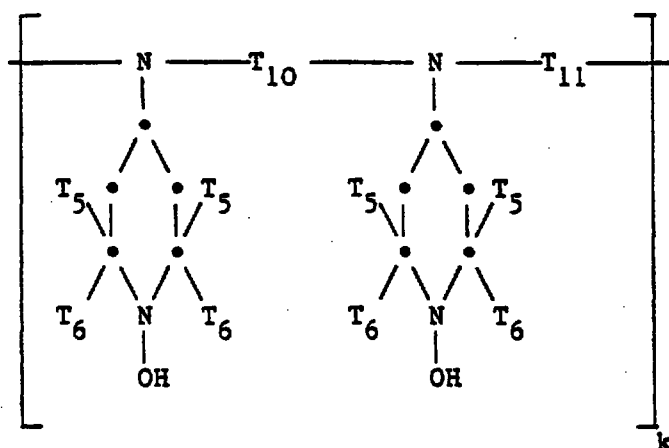
(IX),



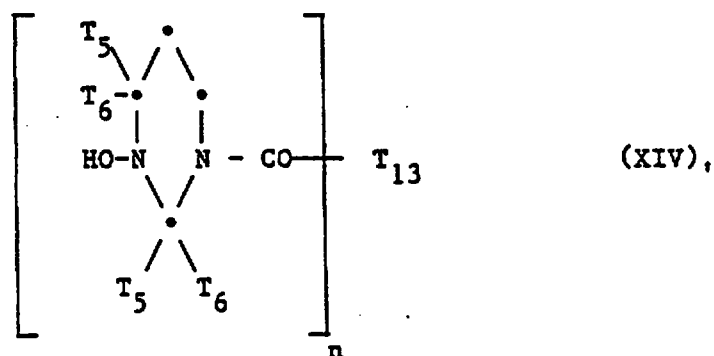
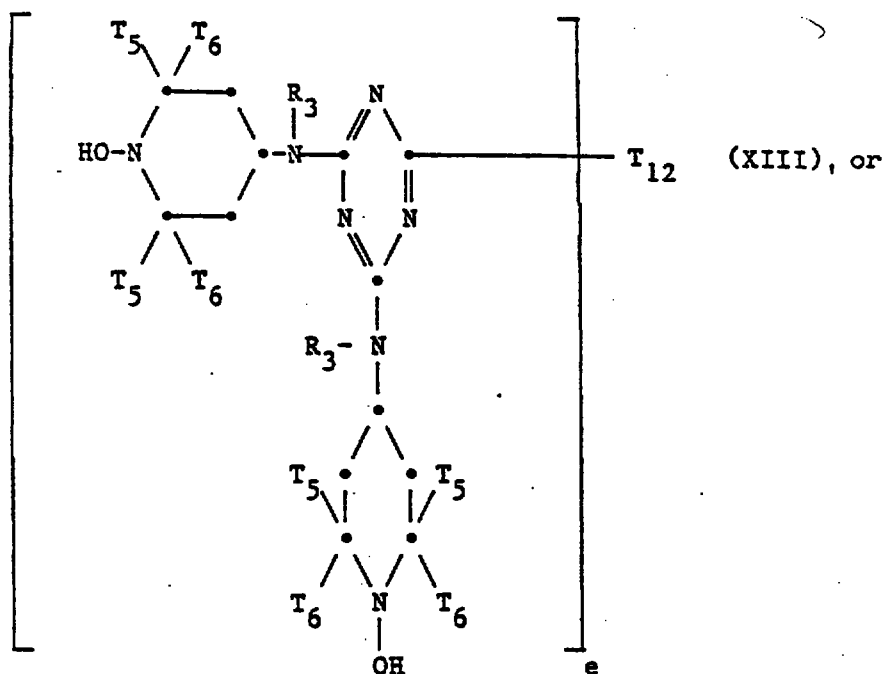
(X)



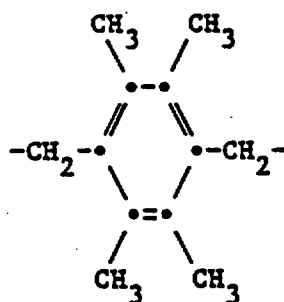
(XI),



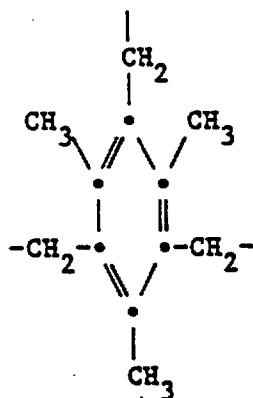
(XII),



provided that components b) and c) are not identical, in which formulae T_1 is $\text{C}_1\text{-C}_{36}$ alkyl, $\text{C}_5\text{-C}_{12}$ cycloalkyl, $\text{C}_7\text{-C}_9$ aralkyl, which is unsubstituted or substituted by $\text{C}_1\text{-C}_4$ alkyl or by one or two halogen atoms, or wherein g is 1, 2, 3 or 4; wherein, when g is 1, T_2 is hydrogen, or has one of the meanings given for R_1 ; wherein, when g is 2, T_2 is $\text{C}_2\text{-C}_{12}$ alkylene, $\text{C}_6\text{-C}_{10}$ cycloalkylene, $\text{C}_6\text{-C}_{10}$ arylene, $\text{C}_8\text{-C}_{10}$ alkylenearylenealkylene, or a radical

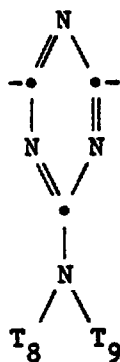


wherein, when g is 3, T₂ is C₃-C₆alkanetriyl, or a radical

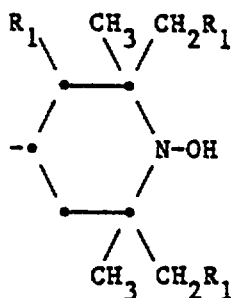


wherein, when g is 4, T₂ is C₄-C₆alkanetetrayl; wherein R₁ is hydrogen or methyl, n is 1 or 2; when n is 1, R₂ is hydrogen or C₁-C₁₈alkyl which can be optionally interrupted by one or more oxygen atoms, however, where there are several oxygen atoms they are not in direct contact, or cyanoethyl, benzyl, glycidyl, a monovalent aliphatic, cycloaliphatic, araliphatic or aromatic acyl radical, a monovalent acyl radical of a carbamic acid, a monovalent radical of a phosphorus-containing acid, or a monovalent silyl radical, a monovalent aliphatic C₂-C₁₈acyl radical, a cycloaliphatic C₅-C₁₂acyl radical or an aromatic C₇-C₁₅acyl radical being particularly preferred; or wherein, when n is 2, R₂ is C₁-C₁₂alkylene, C₄-C₁₂alkenylene, xylylene, an aliphatic, cycloaliphatic, araliphatic or aromatic diacyl radical or dicarbamoyl radical, or a divalent radical of a phosphorus-containing acid, or a divalent silyl radical, an aliphatic C₂-C₃₆diacyl radical, a cycloaliphatic or aromatic C₈-C₁₄diacyl radical, or an aliphatic, cycloaliphatic or aromatic C₈-C₁₄dicarbamoyl radical being particularly preferred; and wherein p is 1, 2 or 3, R₃ is hydrogen, C₁-C₁₂alkyl, C₅-C₇cycloalkyl, C₇-C₈aralkyl, C₂-C₁₈alkanoyl, C₃-C₅alkenoyl or benzoyl; and wherein, when p is 1, R₄ is hydrogen, C₁-C₁₈alkyl, C₅-C₇cycloalkyl or C₂-C₈alkenyl which is unsubstituted or substituted by cyano or contains a carbonyl-containing group or an acylamino group, or R₄ is glycidyl, a group of the formula -CH₂-CH(OH)-Z or a group of the formula -CONH-Z wherein Z is hydrogen, methyl or phenyl; or wherein, when p is 2, R₄ is C₂-C₁₂alkylene, C₆-C₁₂arylene, xylylene, a group -CH₂CH(OH)-CH₂-, or a group -CH₂-CH(OH)-CH₂-O-X-O-CH₂-CH(OH)-CH₂- wherein X is C₂-C₁₀alkylene, C₆-C₁₅arylene or C₆-C₁₂cycloalkylene; or, provided that R₃ is not alkanoyl, alkenoyl or benzoyl, R₄ is a

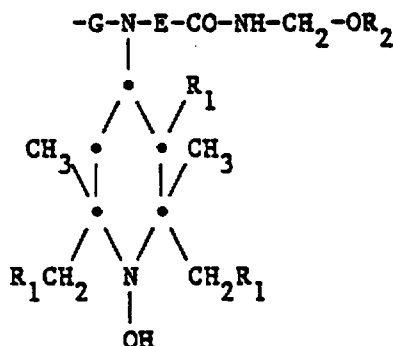
divalent aliphatic, cycloaliphatic or aromatic diacyl radical or dicarbonyl radical, or a keto group; or when p is 1, R₃ and R₄ form a cyclic aliphatic or aromatic 1,2- or 1,3-diacyl radical or together form a divalent aliphatic monoacyl radical; or R₄ is a radical



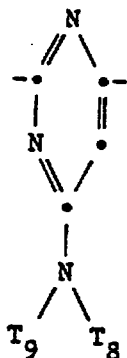
where T₈ and T₉ are independently of one another hydrogen, or C₁-C₁₈-alkyl, or wherein T₈ and T₉ together are C₄-C₆alkylene, or 3-oxapentamethylene, 3-oxapentamethylene being preferred; and where, when p is 3, R₄ is 2,4,6-triazinyl; wherein, when n is 1, R₅ is C₂-C₈alkylene or hydroxyalkylene or C₄-C₂₂acyloxyalkylene; or wherein, when n is 2, R₅ is a group $(-CH_2)_2C(CH_2-)_2$; and wherein R₆ is hydrogen, C₁-C₁₂alkyl, allyl, benzyl, glycidyl or C₂-C₆alkoxyalkyl; and wherein, when n is 1, R₇ is hydrogen, C₁-C₁₂alkyl, C₃-C₅alkenyl, C₇-C₉aralkyl, C₅-C₇cycloalkyl, C₂-C₄hydroxyalkyl, C₂-C₆alkoxyalkyl, C₆-C₁₀aryl, glycidyl, a group of the formula $-(CH_2)_m-O-CO-Q$ or of the formula $-(CH_2)_m-O-COO-Q$ wherein m is 1 or 2, and Q is C₁-C₄alkyl or phenyl; or wherein, when n is 2, R₇ is C₂-C₁₂alkylene, C₆-C₁₂arylene, a group $-CH_2CH(OH)-CH_2-O-X-O-CH_2-CH(OH)-CH_2-$ wherein X is C₂-C₁₀alkylene, C₆-C₁₅arylene or C₆-C₁₂cycloalkylene, or a group $-CH_2CH(OZ')-CH_2-(OCH_2-CH(OZ')CH_2)_2-$ wherein Z' is hydrogen, C₁-C₁₈alkyl, allyl, benzyl, C₂-C₁₂alkanoyl or benzoyl; or wherein Q₁ is $-N(R_8)-$ or $-O-$, E is C₁-C₃alkylene, or a group $-CH_2-CH(R_9)-O-$ wherein R₉ is hydrogen, methyl or phenyl or wherein E is the group $-(CH_2)_3-NH-$ or a direct bond; and wherein R₁₀ is hydrogen or C₁-C₁₈alkyl, R₈ is hydrogen, C₁-C₁₈alkyl, C₅-C₇cycloalkyl, C₇-C₁₂aralkyl, cyanoethyl, C₆-C₁₀aryl, or the group $-CH_2-CH(R_9)-OH$ wherein R₉ has the meaning defined above, or wherein R₈ finally is a group of the formula



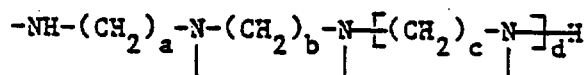
or of the formula



wherein G is C₂-C₈alkylene or C₆-C₁₂arylene, or wherein R₈ is also a group -E-CO-NH-CH₂-OR₁₀; wherein formula VII denotes the recurring structural unit of a polymer where T₃ is ethylene or 1,2-propylene, or T₃ is the recurring structural unit in a copolymer of an α-olefinic radical with an alkyl acrylate or methacrylate; preferably a copolymer of ethylene and ethyl acrylate, where k is from 2 to 100; T₄ has the same meaning as R₄ when p is 1 or 2, T₅ is methyl; T₆ is methyl or ethyl, or T₅ and T₆ together form tetramethylene or pentamethylene or a mixture of said hydroxylamine derivatives, T₅ and T₆ preferably being methyl; M and Y are independently of one another methylene or carbonyl, M preferably being methylene and Y carbonyl; with the proviso that compounds of the formula VIII wherein M and Y are a carbonyl group, T₅ is methyl and T₆ is methyl or ethyl, or T₅ and T₆ together are tetramethylene or pentamethylene and T₄ is hydrogen, C₁-C₁₈alkyl, C₂-C₁₂alkylene or xylylene are excluded; L denotes straight-chain or branched C₄-C₇alkylene, 3-oxapentamethylene or 3-hydroxyazapentamethylene; T₇ has the same meaning as R₇ and is preferably octamethylene where n is 2; T₁₀ and T₁₁ are independently of one another C₂-C₁₂alkylene or T₁₁ is a group of formula



and T_{12} is a group of the formula



where a, b and c are independently of one another 2 or 3, and d is 0 or 1, preferably a and c are each 3, b is 2 and d is 1; wherein e is 3 or 4, preferably 4; and T_{13} has the same meaning as R_2 with the proviso that T_{13} is not hydrogen when n is 1.

The composition according to the invention is stabilized against degradation and/or discoloration due to elevated temperatures or to contact with combustion products of natural gas or to prolonged storage or to the action of gamma radiation.

In particular, the present invention relates to stabilized compositions as defined above, wherein the component b is

1. a phenolic antioxidant or a mixture of phenolic antioxidants; or
2. a phenolic antioxidant or mixture of phenolic antioxidants in combination with
 - (i) an organic phosphorus compound or mixture of organic phosphorus compounds
 - (ii) a sterically hindered amine or mixture of sterically hindered amines
 - (iii) a thiosynergist or mixture of thiosynergists
 - (iv) an ultraviolet light absorber or mixture of ultraviolet light absorbers
 - (v) a sterically hindered amine and an organic phosphorus compound or

- mixture of these classes of compounds
- (vi) a sterically hindered amine, a thiosynergist and an organic phosphorus compound or mixture of these classes of compounds
 - (vii) an ultraviolet light absorber and a sterically hindered amine or mixture of these classes of compounds or
 - (viii) an ultraviolet light absorber and an organic phosphorus compound or mixture of these classes of compounds
 - (ix) a metal salt of a fatty acid or mixture of these metal salts, or
3. a sterically hindered amine or mixture of sterically hindered amines, or
4. a metal salt of a fatty acid or mixture of these metal salts.

The hydroxylamine derivatives which can preferably be used in the compositions according to the invention, are characterized by the structural formulae I to XIV. Some of these compounds are known and are commercially available. In other cases the amine intermediates required for the hydroxylamine synthesis, are commercially available.

The hydroxylamines are prepared by reacting hydroxylamine or a substituted hydroxylamine with a compound containing active halogen in the presence of an acid acceptor; or by oxidizing an amine with a peroxy compound such as e.g. hydrogen peroxide, followed by reduction of the oxyl intermediate formed to the desired hydroxylamine; hydroxylamines can also be obtained by reducing the oximes of a cyclic ketone.

When the hydroxylamine derivative possesses a structure of the formula I, T_1 is C_1-C_{36} alkyl, e.g. methyl, ethyl, propyl, butyl, isobutyl, tert-butyl, n-hexyl, n-octyl, n-dodecyl, n-octadecyl, eicosyl or triacontyl. T_1 as C_4-C_{18} alkyl is preferred.

T_1 may also be C_5-C_{12} cycloalkyl, such as e.g. cyclopentyl, cyclohexyl, cyclooctyl or cyclododecyl. T_1 as cyclohexyl or cyclododecyl is preferred.

T_1 as C_7-C_9 aralkyl is e.g. benzyl, α -methylbenzyl, or α, α -dimethylbenzyl where the benzyl group may additionally be substituted by alkyl,

preferably methyl, or where the benzyl group may be substituted by one or two halogen atoms, preferably chlorine or bromine.

T₁ as benzyl is preferred.

In formula I, the index g is preferably 1 or 2, in particular 1.

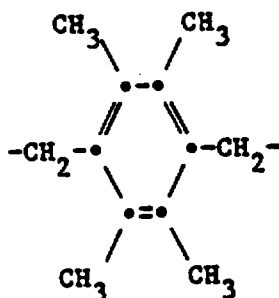
Preferably T₁ and T₂ together have from 6 to 36 carbon atoms. It is particularly preferred when T₂ is hydrogen and T₁ is C₆-C₁₂cycloalkyl, or T₁ and T₂ are independently of one another C₄-C₁₈alkyl, cyclohexyl or benzyl.

Particularly preferred compounds of the formula I are N,N-di-tertbutylhydroxylamine, N,N-di-n-octylhydroxylamine, N-cyclohexylhydroxylamine, N-cyclododecylhydroxylamine, N,N-dicyclohexylhydroxylamine and N,N-di-benzylhydroxylamine, or mixtures of these compounds.

When g is 2, T₂ is C₂-C₁₂alkylene, e.g. ethylene, 1,2-propylene, trimethylene, tetramethylene, hexamethylene, octamethylene or dodecamethylene. T₂ as C₂-C₈alkylene is preferred.

When g is 2, T₂ is also C₆-C₁₀cycloalkylene, e.g. cyclohexylene, preferably 1,4-cyclohexylene, or decahydronaphthylene.

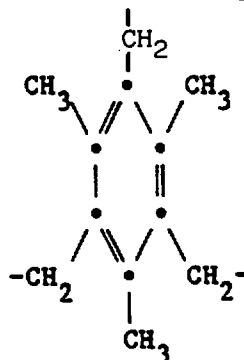
T₂ is also C₈-C₁₀alkylenearylenealkylene, e.g. p-xylylene or ethylene-p-phenylene-ethylene. T₂ as p-xylylene or a radical of the formula



is preferred.

If T_2 is C_6 - C_{10} arylene, it is o-, m- or p-phenylene, preferably m- or p-phenylene, or 1,4-naphthylene.

When g is 3, T_2 is C_3 - C_6 alkanetriyl, e.g. glyceryl, 1,2,3-propanetriyl or preferably a radical of the formula



When g is 4, T_2 is C_4 - C_6 alkanetetrayl, e.g. 1,2,3,4-butanetetrayl or $(-CH_2)_2C(CH_2-)_2$.

When the hydroxylamine has a structure of the formulae II to VII, R_1 is hydrogen or methyl, preferably hydrogen.

If any substituents are C_1 - C_{12} alkyl, they are for example methyl, ethyl, n-propyl, sec-propyl, n-butyl, sec-butyl, tert-butyl, n-hexyl, n-octyl, 2-ethylhexyl, n-nonyl, n-decyl, n-undecyl or n-dodecyl.

As C_1 - C_{18} alkyl, R_2 is in addition to the groups given above n-tridecyl, n-tetradecyl, n-hexadecyl or n-octadecyl.

If R_2 is alkyl optionally interrupted by one or more oxygen atoms, it is for example 3-oxabutyl, 3,6-dioxaheptyl, 3,6,9-trioxadecyl, 3,6,9,12-tetraoxatridecyl or 3,6,9,12,15-pentaoxahexadecyl.

If R_2 is a monovalent acyl radical, it is derived, e.g., from acetic acid, stearic acid, salicylic acid, methacrylic acid, benzoic acid or β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid.

R_2 as a monovalent acyl radical of a carbamic acid is for example

carbamoyl or 2-carbamoyl-propionyl.

As a monovalent or a divalent radical of a phosphorus-containing acid, R_2 is derived for example from phosphorous acid, phosphonic acid, phosphinic acid or phosphoric acid or from the esters or partial esters of these acids.

As C_1 - C_{12} alkylene, R_2 is for example methylene, ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

As C_4 - C_{12} alkenylene, R_2 is for example 1,4-but-2-enylene, 1,6-hex-3-enylene, 1,8-oct-4-enylene, 1,10-dec-5-enylene or 1,12-dodec-6-enylene; preferably 1,4-but-2-enylene.

If R_2 is a divalent acyl radical, it is derived, for example, from adipic acid, suberic acid, sebacic acid, maleic acid, phthalic acid, dibutylmalonic acid, dibenzylmalonic acid, butyl-(3,5-di-tert-butyl-4-hydroxybenzyl)malonic acid, or bicycloheptenedicarboxylic acid.

If R_2 is a divalent carbamoyl radical, it is derived, for example, from hexamethylenedicarbamic acid or from 2,4-toluylenedicarbamic acid.

The following polyalkylpiperidine compounds can be particularly preferably used as starting materials in the preparation of hydroxylamines of the formula II:

4-hydroxy-2,2,6,6-tetramethylpiperidine,
4-stearoyloxy-2,2,6,6-tetramethylpiperidine,
di(2,2,6,6-tetramethylpiperidin-4-yl) adipate,
di(2,2,6,6-tetramethylpiperidin-4-yl) sebacate,
dimethyl-bis(2,2,6,6-tetramethylpiperidine-4-oxy)silane.

If any substituents are C_5 - C_7 cycloalkyl, they are for example cyclopentyl, cyclohexyl or cycloheptyl, preferably cyclohexyl.

As C_7 - C_8 aralkyl, R_3 is particularly phenethyl or benzyl.

As C_2 - C_{18} alkanoyl, R_3 is for example propionyl, butyryl, octanoyl, dodecanoyl, hexadecanoyl, octadecanoyl, but in particular acetyl; and as C_3 - C_5 alkenoyl, R_3 is preferably acryloyl.

As C_2 - C_8 alkenyl unsubstituted or substituted by a cyano, a carbonyl-containing group or an acylamino group, R_4 is for example 1-propenyl, allyl, methallyl, 2-butenyl, 2-pentenyl, 2-hexenyl, 2-octenyl, 2,2-dicyanovinyl, 1-methyl-2-cyano-2-methoxycarbonylvinyl or 2,2-diacetylaminovinyl.

If any substituents are C_2 - C_{12} alkylene, they are for example ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

If any substituents are C_6 - C_{12} arylene, they are, for example o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

X as C_6 - C_{15} arylene can also be 4,4'-(2,2-propylidenediphenylene).

X as C_6 - C_{12} cycloalkylene is preferably cyclohexylene.

As a divalent aliphatic, cycloaliphatic (sic) or aromatic diacyl radical, R_4 is derived for example from adipic acid, suberic acid, sebacic acid, maleic acid, phthalic acid, dibutylmalonic acid, dibenzylmalonic acid, butyl-(3,5-di-tert-butyl-4-hydroxybenzyl)malonic acid or cyclohexanedicarboxylic acid.

As a dicarbamoyl radical, R_4 is for example a radical of hexamethylenedicarbamic acid or of 2,4-toluylenedicarbamic acid.

If R_3 and R_4 form a cyclic aliphatic or aromatic 1,2- or 1,3-diacyl radical when p is 1, this radical is derived from m-phthalic acid, o-phthalic acid, 1,2-cyclohexanedicarboxylic acid or 1,3-cyclohexanedicarboxylic acid.

As a divalent aliphatic monoacyl radical R_3 and R_4 form together with the common nitrogen atom of a lactam, preferably an ϵ -caprolactam.

The following polyalkylpiperidines are particularly suitable as starting materials for the preparation of hydroxylamine derivatives of the formula III:

N,N-bis(2,2,6,6-tetramethylpiperidin-4-yl)-hexamethylene-1,6-diamine,
N,N-bis(2,2,6,6-tetramethylpiperidin-4-yl)hexamethylene-1,6-diacetamide,
4-benzylamino-2,2,6,6-tetramethylpiperidine,
N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)-N,N'-dibutyladipamide,
N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)-p-xylylenediamine,
N,N'-bis(2,2,6,6-tetramethylpiperidin-4-yl)-N,N'-dicyclohexyl-(2-hydroxypropylene)diamine,
4-(3-methyl-4-hydroxy-5-tert-butylphenylacetamido)-2,2,6,6-tetramethylpiperidine,
methyl α -cyano- β -methyl- β -[N-(2,2,6,6-tetramethylpiperidin-4-yl)aminoacrylate.

If R_5 is C_2 - C_8 alkylene or hydroxyalkylene, it is for example ethylene, 1-methylethylene, propylene, 2-ethylpropylene or 2-ethyl-2-hydroxymethylpropylene.

As C_4 - C_{22} acyloxyalkylene, R_5 is for example 2-ethyl-2-acetoxymethylpropylene.

The following polyalkylpiperidines are particularly suitable as starting materials in the preparation of hydroxylamine derivatives of the formula IV:

9-aza-8,8,10,10-tetramethyl-1,5-dioxaspiro[5.5]undecane,
9-aza-8,8,10,10-tetramethyl-3-ethyl-1,5-dioxaspiro[5.5]undecane,
2,2,6,6-tetramethylpiperidine-4-spiro-2'-(1',3'-dioxane)-5'-spiro-5''-(1'',3''-dioxane)-2''-spiro-4'''-(2'''',2'''',6'''',6'''-tetramethylpiperidine).

If any substituents are C_2 - C_6 alkoxyalkyl, they are for example methoxymethyl, ethoxymethyl, propoxymethyl, tert-butoxymethyl, ethoxyethyl, ethoxypropyl, n-butoxyethyl, tert-butoxyethyl, isopropoxyethyl or propoxypropyl.

As C₃-C₅alkenyl, R₇ is for example 1-propenyl, allyl, methallyl, 2-butenyl or 2-pentenyl.

As C₇-C₉aralkyl, R₇ is in particular phenethyl or particularly preferably benzyl; and as C₅-C₇cycloalkyl, R₇ is in particular cyclohexyl.

If R₇ is C₂-C₄hydroxyalkyl, it is for example 2-hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl, 2-hydroxybutyl or 4-hydroxybutyl.

As C₆-C₁₀aryl, R₇ is in particular phenyl, or α - or β -naphthyl which is unsubstituted or substituted by halogen or C₁-C₄alkyl.

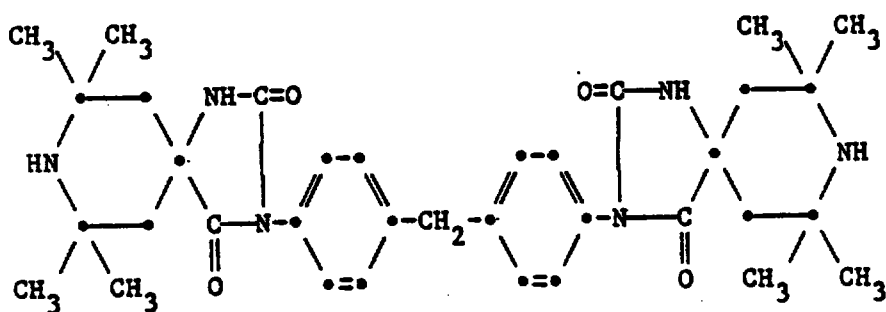
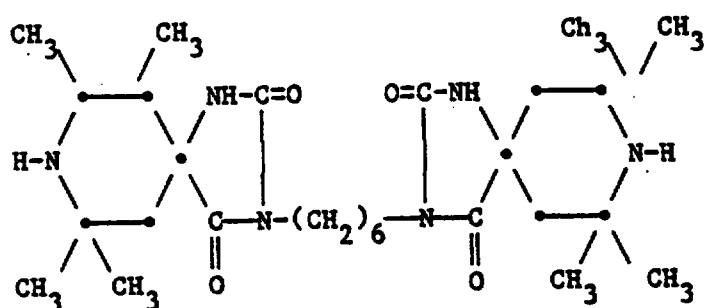
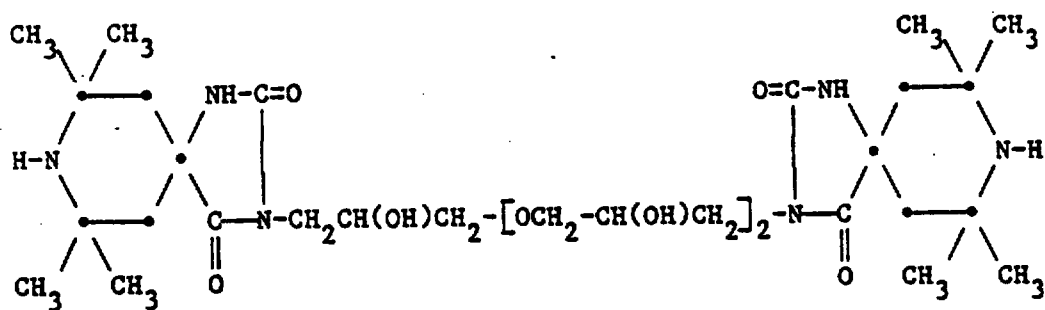
If R₇ is C₂-C₁₂alkylene, it is for example ethylene, propylene, 2,2-dimethylpropylene, tetramethylene, hexamethylene, octamethylene, decamethylene or dodecamethylene.

If R₇ is C₆-C₁₂arylene, it is for example o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

If Z' is C₂-C₁₂alkanoyl, it is for example propionyl, butyryl, octanoyl, dodecanoyl or particularly preferably acetyl.

The following polyalkylpiperidines are suitable as starting materials preferably for the preparation of hydroxylamine derivatives of the formula V:

3-benzyl-1,3,8-triaza-7,7,9,9-tetramethylspiro[4.5]decane-2,4-dione,
3-n-octyl-1,3,8-triaza-7,7,9,9-tetramethylspiro[4.5]decane-2,4-dione,
3-allyl-1,3,8-triaza-1,7,7,9,9-pentamethylspiro[4.5]decane-2,4-dione,
or the compounds of the following structural formulae:



As C₅-C₇cycloalkyl, R₈ is in particular cyclohexyl.

As C₆-C₁₀aryl, R₈ is particularly phenyl, or α- or β-naphthyl which is unsubstituted or substituted by halogen or C₁-C₄alkyl.

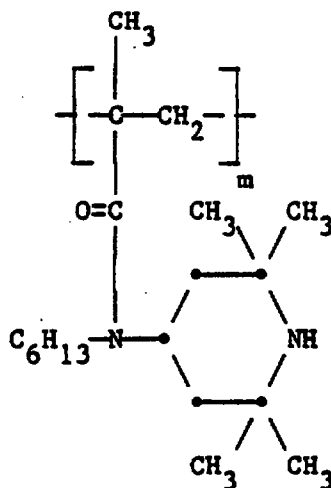
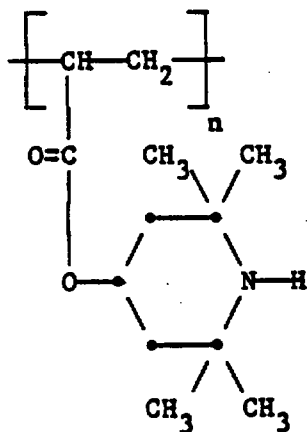
As C₁-C₃alkylene, E is for example methylene, ethylene or propylene.

As C₂-C₆alkylene, G is for example ethylene, propylene, 2,2-dimethylpropylene, tetramethylene or hexamethylene; and as C₆-C₁₂arylene, G is for example o-, m- or p-phenylene, 1,4-naphthylene or 4,4'-diphenylene.

The following polyalkylpiperidines are preferably suitable in the preparation of the hydroxyl derivatives of the formula VI:

N-hydroxymethyl-N'-(2,2,6,6-tetramethylpiperidin-4-yl)urea,
N-methoxymethyl-N'-(2,2,6,6-tetramethylpiperidin-4-yl)urea,
N-methoxymethyl-N'-n-dodecyl-N'-(2,2,6,6-tetramethylpiperidin-4-yl)urea and O-(2,2,6,6-tetramethylpiperidin-4-yl)-N-methoxymethylurethane.

The following polymeric compounds are preferably suitable as starting materials in the preparation of the hydroxylamine derivatives of the formula VII:



In hydroxylamine derivatives of the formula IX, L is for example tetramethylene, pentamethylene, hexamethylene, heptamethylene, 2,6-heptanediyl, 2,4-dimethyl-1,5-pentanediyl, 3-oxapentamethylene or 3-hydroxyazapentamethylene. Particularly preferably L is pentamethylene or 3-oxapentamethylene.

Hydroxylamine derivatives of the formula I are particularly preferred.

Of the saturated polyolefins used in the compositions according to the invention, those are particularly preferred which are derived from monoolefins, especially α -olefins, such as, for example, polyethylene, which can optionally be crosslinked, polypropylene, polyisobutylene, polybutene-1, poly-3-methylbutene-1 or polymethylpentene-1.

The polyethylene used may be of low, medium or high density. Mixtures of the polymers cited above, for example mixtures of polyethylene and polypropylene, polypropylene and polybutene-1; or polyisopropylene and polypropylene and other combinations may also be used.

Copolymers of the monoolefins cited above, especially α -olefins, may also be used in the compositions according to the invention. Thus for example ethylene/propylene copolymers, propylene/butene-1 copolymers, propylene/octene-1 copolymers, ethylene/butene-1 copolymers, ethylene/octane-1(sic) copolymers as well as ethylene/vinyl acetate copolymers may be used.

Compositions containing as the polyolefin component polyethylene, polypropylene, polyisobutylene, poly(butene-1), poly(pentene-1), poly(3-methylbutene-1), poly(4-methylpentene-1) and various ethylene or propylene copolymers, are particularly preferred.

Very particularly preferred are compositions whose polyolefin substrates are polypropylene, low density polyethylene, medium density polyethylene, high density polyethylene, linear low density polyethylene, poly(butene-1), ethylene/vinyl acetate copolymer, ethylene/propylene copolymer or copolymers of ethylene or of propylene with other α -olefins.

Polypropylene, high density polyethylene, ethylene/propylene copolymers or copolymers of ethylene or of propylene with another α -olefins, are particularly preferred as the polyolefinic substrates.

Phenolic antioxidants which can be used in the compositions according to the invention, originate from various classes of materials. A few examples are given in the list below:

Simple 2,6-dialkylphenols, such as, for example, 2,6-di-tert-butyl-4-methylphenol, 2-tert-butyl-4,6-dimethylphenol, 2,6-di-tert-butyl-4-methoxymethylphenol, 2,6-dioctadecyl-4-methylphenol and 2,6-di-tert-butylphenol.

Derivatives of alkylated hydroquinones, such as for example, 2,5-di-tert-butylhydroquinone, 2,5-di-tert-amylhydroquinone, 2,6-di-tert-butylhydroquinone, 2,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyanisole, tris(3,5-di-tert-butyl-4-hydroxyphenyl) phosphite, 3,5-di-tert-butyl-4-hydroxyphenyl stearate and bis(3,5-di-tert-butyl-4-hydroxyphenyl) adipate.

Hydroxylated thiodiphenyl ethers, such as, for example, 2,2'-thio-bis(6-tert-butyl-4-methylphenol), 2,2'-thio-bis(4-octylphenol), 4,4'-thio-bis(6-tert-butyl-3-methylphenol), 4,4'-thio-bis(3,6-di-sec-amylphenol), 4,4'-thio-bis(6-tert-butyl-2-methylphenol) and 4,4'-bis(2,6-dimethyl-4-hydroxyphenyl) disulfide.

Alkylidene-bisphenols, such as, for example, 2,2'-methylene-bis(6-tert-butyl-4-methylphenol), 2,2'-methylene-bis(6-tert-butyl-4-ethylphenol), 4,4'-methylene-bis(6-tert-butyl-2-methylphenol), 4,4'-methylene-bis(2,6-di-tert-butylphenol), 2,6-di(3-tert-butyl-5-methyl-2-hydroxybenzyl)-4-methylphenol, 2,2'-methylene-bis[4-methyl-6-(α -methylcyclohexyl)phenol], 1,1-bis(3,5-dimethyl-2-hydroxyphenyl)butane, 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 2,2-bis(3,5-di-tert-butyl-4-hydroxyphenyl)propane, 1,1,3-tris(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 2,2-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)-4-n-dodecylmercaptobutane, 1,1,5,5-tetra(5-tert-butyl-4-hydroxy-2-methylphenyl)pentane and

ethylene glycol bis[3,3-bis(3-tert-butyl-4-hydroxyphenyl)butyrate].

O-, N- and S-benzyl compounds, such as, for example, 3,5,3',5'-tetra-tert-butyl-4,4'-dihydroxydibenzyl ether, octadecyl 4-hydroxy-3,5-dimethylbenzylmercaptoacetate, tris(3,5-di-tert-butyl-4-hydroxybenzyl)amine and bis(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl) dithioterephthalate.

Hydroxybenzylated malonates, such as for example, dioctadecyl 2,2-bis-(3,5-di-tert-butyl-2-hydroxybenzyl)malonate, dioctadecyl 2-(3-tert-butyl-4-hydroxy-5-methylbenzyl)malonate, didodecylmercaptoethyl 2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate and di[4-(1,1,3,3-tetramethylbutyl)-phenyl] 2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate.

Aromatically substituted hydroxybenzyl compounds, such as, for example, 1,3,5-tri(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene, 1,4-di(3,5-di-tert-butyl-4-hydroxybenzyl)-2,3,5,6-tetramethylbenzene and 2,4,6-tri(3,5-di-tert-butyl-4-hydroxybenzyl)phenol.

s-Triazine compounds, such as, for example, 2,4-bis-octylmercapto-6-(3,5-di-tert-butyl-4-hydroxyanilino)-s-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyanilino)-s-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyphenoxy)-s-triazine, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenoxy)-s-triazine, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenylethyl)-s-triazine, 1,3,5-tris(2,6-dimethyl-3-hydroxy-4-tert-butylbenzyl)isocyanurate and 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-isocyanurate.

Amides of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid, such as, for example, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hexahydro-s-triazine and N,N'-di(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)-hexamethylenediamine or N,N'-bis- β -(3,5-di-t-butyl-4-hydroxyphenyl)propionylhydrazine.

Esters of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid with monohydric or polyhydric alcohols, such as, for example, with methanol, ethanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol,

1,2-propanediol, diethylene glycol, thiodiethylene glycol, triethylene glycol, neopentylglycol, pentaerythritol (sic), 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolethane, trimethylolpropane, trishydroxyethyl isocyanurate and 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane.

Esters of β -(5-tert-butyl-4-hydroxy-3-methylphenyl)propionic acid with monohydric or polyhydric alcohols, such as, for example, with methanol, ethanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, diethylene glycol, triethylene glycol, thiodiethylene glycol, neopentylglycol, pentaerythritol (sic), 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolethane, trimethylolpropane, trishydroxyethyl isocyanurate and 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane.

Esters of 3,5-di-tert-butyl-4-hydroxyphenylacetic acid with monohydric or polyhydric alcohols, such as for example, with methanol, ethanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, diethylene glycol, thiodiethylene glycol, neopentylglycol, pentaerythritol (sic), 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolethane, trimethylolpropane, trishydroxyethyl isocyanurate and 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane, the tetrakis ester of pentaerythritol (sic) being particularly preferred.

Benzylphosphonates, such as, for example, dimethyl 3,5-di-tert-butyl-4-hydroxybenzylphosphonate, diethyl 3,5-di-tert-butyl-4-hydroxybenzylphosphonate, dioctadecyl 3,5-di-tert-butyl-4-hydroxybenzylphosphonate and dioctadecyl 5-tert-butyl-4-hydroxy-3-methylbenzylphosphonate.

Preferred phenolic antioxidants are n-octadecyl 3,5-di-tert-butyl-4-hydroxyhydrocinnamate, neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), di-n-octadecyl 3,5-di-tert-butyl-4-hydroxybenzylphosphonate, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate, thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate, 1,3,5-trimethyl-2,4,6-tris-(3,5-di-tert-butyl-4-hydroxybenzyl)benzene, 3,6-dioxaoctamethylene bis(3-methyl-5-tert-butyl-4-hydroxyhydrocinnamate),

2,6-di-tert-butyl-p-cresol, 2,2'-ethylidene-bis(4,6-di-tert-butylphenol), 1,3,5-(2,6-dimethyl-4-tert-butyl-3-hydroxybenzyl)isocyanurate, 1,1,3-tris(2-methyl-4-hydroxy-5-tert-butylphenyl)butane, 1,3,5-tris[2-(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyloxy)ethyl]isocyanurate, 3,5-di(3,5-di-tert-butyl-4-hydroxybenzyl)mesitol, hexamethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), 1-(3,5-di-tert-butyl-4-hydroxyanilino)-3,5-di(octylthio)-s-triazine, N,N'-hexamethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamamide), calcium bis(ethyl-3,5-di-tert-butyl-4-hydroxybenzylphosphonate), ethylene bis[3,3-di(3-tert-butyl-4-hydroxyphenyl)butyrate], octyl 3,5-di-tert-butyl-4-hydroxybenzylmercaptoacetate, bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl)hydrazide, and N,N'-bis[2-(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyloxy)ethyl]oxamide.

In a particularly preferred embodiment, the compositions according to the invention comprise as the phenolic antioxidant neopentanetetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate), n-octadecyl 3,5-di-tert-butyl-4-hydroxyhydrocinnamate, 1,3,5-trimethyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl)benzene, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate, 2,6-di-tert-butyl-p-cresol or 2,2'-ethylidene-bis(4,6-di-tert-butylphenol).

When the compositions according to the invention contain organic phosphorus compounds, these substances are, for example, triphenyl phosphite, diphenylalkyl phosphites, phenyldialkyl phosphites, tri(nonylphenyl)-phosphite, trilauryl phosphite, trioctadecyl phosphite, di(isodecyloxy)-2,4,8,10-tetra-oxa-3,9-diphospha[5.5]undecane and tri(4-hydroxy-3,5-di-tert-butylphenyl) phosphite or similar phosphonites.

The preferred organic phosphorus compounds are tris(2,4-di-tert-butylphenyl) phosphite, 3,9-di(2,4-di-tert-butylphenoxy)-2,4,8,10-tetraoxa-3,9-diphospha-[5.5]undecane, tris(p-nonylphenyl) phosphite, 3,9-di-stearyloxy-2,4,8,10-tetraoxa-3,9-diphospha[5.5]undecane, dilauryl phosphite, 3,9-di[2,6-di-tert-butyl-4-(2-(n-octadecyloxycarbonyl)-ethyl)-phenoxy]-2,4,8,10-tetraoxa-3,9-diphospha[5.5]undecane and tetrakis(2,4-di-tert-butylphenyl)-4,4'-bis-(diphenylene) phosphonite. Tris(2,4-di-tert-butylphenyl) phosphite is particularly preferred.

When the compositions according to the invention contain thiosynergists, these compounds are, for example, dilauryl thiodipropionate, distearyl thiodipropionate or neopentametetracyl tetrakis(3-dodecylthiopropionate). Distearyl thiodipropionate or dilauryl thiodipropionate are preferred.

When the compositions according to the invention contain a metal salt of a fatty acid, these are, for example, alkali metal, alkaline earth metal, zinc, cadmium or aluminium salts of the higher fatty acids, such as, for example calcium stearate, zinc stearate, magnesium behenate, sodium ricinoleate or potassium palmitate. Calcium stearate is particularly preferred.

When the compositions according to the invention contain sterically hindered amines, these compounds are for example 4-benzoyl-2,2,6,6-tetramethylpiperidine, 4-stearyloxy-2,2,6,6-tetramethylpiperidine, bis-(2,2,6,6-tetramethylpiperidyl) sebacate or 3-n-octyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decane-2,4-dione.

Preferred sterically hindered amines are bis-(2,2,6,6-tetramethylpiperidin-4-yl) sebacate, bis(1,2,2,6,6-pentamethylpiperidin-4-yl) sebacate, di(1,2,2,6,6-pentamethylpiperidin-4-yl) (3,5-di-tert-butyl-4-hydroxybenzyl) butylmalonate, tris(2,2,6,6-tetramethylpiperidin-4-yl) nitri-
lotriacetate, 1,2-bis(2,2,6,6-tetramethyl-3-oxopiperazin-4-yl) ethane, 2,2,4,4-tetramethyl-7-oxa-3,20-diaza-21-oxodispiro[5.1.11.2]heneicosane, the polycondensation product of 2,4-dichloro-6-tert-octylamino-s-triazine and 4,4'-hexamethylene-N,N'-bis(amino-2,2,6,6-tetramethylpiperidine), the polycondensation product of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid, the polycondensation product of 4,4'-hexamethylenebis(2,2,6,6-tetramethylpiperidine)- and 1,2-dibromoethane, the polycondensation product of 2,4-dichloro-6-morpholino-s-triazine and 4,4'-hexamethylenebisamino(2,2,6,6-tetramethylpiperidine), N,N',N'',N'''-tetrakis[(4,6-bis(butyl-(2,2,6,6-tetramethylpiperidin-4-yl)-amino-s-triazin-2-yl)-1,10-diamino-4,7-diazadecane, octamethylene bis(2,2,6,6-tetramethylpiperidine-4-carboxylate) and 4,4'-ethylene bis(2,2,6,6-tetramethylpiperazin-3-one).

Particularly preferred sterically hindered amines are bis(2,2,6,6-tetramethylpiperidin-4-yl) sebacate, the polycondensation product of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid, the polycondensation product of 2,4-dichloro-6-tert-octylamino-s-triazine and 4,4'-hexamethylenebis(amino-2,2,6,6-tetramethylpiperidine) or N,N',-N'',N'''-tetrakis-[(4,6-bis-(butyl-(2,2,6,6-tetramethylpiperidin-4-yl)-amino)-s-triazin-2-yl]-1,10-diamino-4,7-diazadecane.

When the compositions according to the invention contain ultraviolet light absorbers, these compounds are, for example, 2H-benzotriazoles, benzophenones, oxanilides, α -cyanocinnamates, substituted benzoic esters or nickel salts of the o-alkylated sterically hindered phenolic benzylphosphonates.

Examples of ultraviolet light absorbers are listed below:

2-(2'-Hydroxyphenyl)benzotriazoles, such as, for example, 5'-methyl, 3',5'-di-tert-butyl, 5'-tert-butyl, 5'-(1,1,3,3-tetramethylbutyl), 5-chloro-3',5'-di-tert-butyl, 5-chloro-3'-tert-butyl-5'-methyl, 3'-sec-butyl-5'-tert-butyl, 3'- α -methylbenzyl-5'-methyl, 3'- α -methylbenzyl-5'-methyl-5-chloro, 4'-hydroxy, 4'-methoxy, 4'-octoxy, 3',5'-di-tert-amyl, 3'-methyl-5'-carbomethoxyethyl and 5-chloro-3',5'-di-tert-amyl derivatives.

2,4-bis-(2'-Hydroxyphenyl)-6-alkyl-2-triazines, such as, for example, the 6-ethyl, 6-heptadecyl or 6-undecyl derivatives.

2-Hydroxybenzophenones, such as, for example, 4-hydroxy, 4-methoxy, 4-octoxy, 4-decyloxy, 4-dodecyloxy, 4-benzyloxy, 4,2',4'-trihydroxy, 2,2',-4,4'-tetrahydroxy or 2'-hydroxy-4,4'-dimethoxy derivatives.

1,3-bis-(2'-Hydroxybenzoyl)benzenes, such as, for example, 1,3-bis(2'-hydroxy-4'-hexyloxybenzoyl)benzene, 1,3-bis(2'-hydroxy-4'-octyloxybenzoyl)benzene or 1,3-bis(2'-hydroxy-4'-dodecyloxybenzoyl)benzene (sic).

Esters of optionally substituted benzoic acids, such as, for example, phenylsalicylate, octylphenylsalicylate, dibenzoylresorcinol, bis-(4-tert-butylbenzoyl)-resorcinol, benzoylresorcinol, or the 2,4-di-tert-butylphenyl ester, the octadecyl ester or the 2-methyl-4,6-di-tert-butyl ester of 3,5-di-tert-butyl-4-hydroxybenzoic acid.

Acrylates, such as, for example, ethyl or isooctyl α -cyano- β , β -diphenylacrylate, methyl α -carbomethoxycinnamate, methyl or butyl α -cyano- β -methyl-p-methoxycinnamate, or N(β -carbomethoxyvinyl)-2-methylindoline.

Oxalic acid diamides, such as, for example, 4,4'-dioctyloxyoxanilides, 2,2'-dioctyloxy-5,5'-di-tert-butyloxanilide, 2,2'-didodecyloxy-5,5'-di-tert-butyloxanilide, 2-ethoxy-2'-ethyloxanilide, N,N'-bis(3-dimethylaminopropyl)oxalamide, 2-ethoxy-5-tert-butyl-2'-ethyloxanilide and mixtures with 2-ethoxy-2'-ethyl-5,4'-di-tert-butyloxanilide, or mixtures with ortho- and paramethoxy as well with o- and p-ethoxy-disubstituted oxanilides.

The ultraviolet light absorbers which preferably find application in the compositions according to the invention are 2-(2-hydroxy-5-methylphenyl)-2H-benzotriazole, 2-(2-hydroxy-3,5-di-tert-amylphenyl)-2H-benzotriazole, 2-[2-hydroxy-3,5-di(α , α -dimethylbenzyl)phenyl]-2H-benzotriazole, 2-(2-hydroxy-5-tert-octylphenyl)-2H-benzotriazole, 2-hydroxy-4-octyloxybenzophenone, nickel bis(0-ethyl 3,5-di-tert-butyl-4-hydroxybenzylphosphonate), 2,4-dihydroxybenzophenone, 2-(2-hydroxy-3-tert-butyl-5-methylphenyl)-2H-benzotriazole, or nickel butylamine complex with 2,2'-thio-bis(4-tert-butylphenol), 2-ethoxy-2'-ethyloxanilide or 2-ethoxy-2'-ethyl-5,5'-di-tert-butyloxanilide.

The stabilized polyolefinic compositions of the present invention can also contain, if appropriate, other additives. These include, for example, stearates, pigments, dyes, light stabilizers such as metal deactivators, talc and other fillers, etc.

The invention further relates to a method of stabilizing saturated poly-

olefins or mixtures thereof against oxidative, thermal or radiation-induced degradation, which comprises adding to the substrate (a),
b) a stabilizer or a mixture of stabilizers selected from the group of the phenolic antioxidants, the sterically hindered amines, the ultra-violet light absorbers, the organic phosphorus compounds, the metal salts of fatty acid and the thiosynergists, and
c) a hydroxylamine derivative or a mixture thereof, provided that components b) and c) are not identical.

The invention further relates to the use of the stabilized polyolefinic compositions described above.

The hydroxylamine stabilizers are added to the compositions according to the invention in an amount from 0.01 to 5% by weight. The actual amount to be used will depend in each case on the substrate to be stabilized and on application. The preferred amounts are from 0.025 to 2% by weight of the hydroxylamine derivative, 0.05 to 1% by weight being particularly preferred.

The hydroxylamine derivatives stabilize the compositions according to the invention especially during high temperature processing. The stabilized substrate discolours relatively little even though the polymer may undergo a number of extrusions.

The stabilizers are incorporated into the organic polymers by methods known per se. The incorporation can be made during any processing stage prior to the shaping. For example, the stabilizer may be mixed with a polymer in powder form, or an emulsion or suspension of the stabilizer may be mixed with a solution, suspension, or emulsion of the polymer. The stabilized polyolefinic compositions may optionally also contain, in addition to the above stabilizers, further additives. Their proportion by weight is between 0.01 and 5% by weight, preferably between 0.025 and 2% by weight and particularly preferably between 0.1 and 0.5% by weight.

The material thus stabilized can be used in a very wide variety of forms, for example as sheets, fibres, tapes or mouldings, or as binders for

paints, adhesives or cements.

In addition to incorporating the stabilizer substances prior to shaping, it is also possible to apply the compositions according to the invention by a surface treatment to the finished articles. This is particularly useful in the treatment of fibres, where the stabilizers present are applied to the surface, for example, in the form of a spin finishing, after extrusion of the fibre material.

Examples of further additives are the following substances:

Metal deactivators, such as, for example, oxanilides, isophthalic acid dihydrazides, sebacic acid bisphenylhydrazides, bisbenzylidene oxalic acid di-hydrazides, N,N'-diacetal adipic acid dihydrazides, N,N'-bissalicyloyl oxalic acid dihydrazides, N,N'-bissalicyloyl hydrazine, N,N'-bis-(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazine, N-salicyloyl-N'-salicylalhydrazine, 3-salicyloylamino-1,2,4-triazole or N,N'-bissalicyloylthiopropionic acid dihydrazide.

Nucleation agents, such as, for example, 4-tert-butylbenzoic acid, adipic acid, diphenylacetic acid or substituted sorbitols such as 1,3- or 2,4-dibenzylidenesorbitol.

Other additives that can be incorporated in the compositions according to the invention are clarifiers, antiozonants, lubricants such as stearyl alcohol, fillers, carbon black, asbestos, kaolin, talc, glass fibres, pigments, optical brighteners, flameproofing agents or antistatic agents.

Example 1: Processing stability of polypropylene at 260°C

The basic formulation comprises 100 parts by weight of unstabilized polypropylene (Hercules, Profax® 6501) with 0.1 parts by weight of calcium stearate. The stabilizers to be tested are dissolved in methylene chloride and incorporated in the basic formulation. After removal of the solvent under reduced pressure, the stabilizer-containing polymer compound is extruded. An extruder having an internal space 2.54 cm in diameter is used, its screw conveyor rotating one hundred times per

minute. The temperatures of the individual extruder parts are listed in the table below:

<u>Extruder part</u>	<u>Temperature °C</u>
Cylinder 1	232
Cylinder 2	246
Cylinder 3	260
Screw conveyor 1	260
Screw conveyor 2	260

During extrusion, the internal extruder pressure is monitored using a pressure sensor. After each of the first, third or fifth extrusions, a few resin pellets are removed and compression-moulded into 3.2 mm thick plates. The yellowness index of these specimens is determined according to ASTM D 1925. Low yellowness index values indicate slight yellowing of the specimens.

If the internal pressure in the extruder during the fifth extrusion is at the same level as during the first extrusion, the polypropylene is considered to be adequately stabilized. Results are given in Table I. It is clear from Table I that the presence of N,N-dibenzylhydroxylamine in the polypropylene composition which additionally contains a phenolic antioxidant, prevents discoloration during processing at high temperatures. This discoloration is due to the phenolic antioxidant, the purpose of which is to stabilize the polymer during processing.

Table I: Processing stability of polypropylene at 260°C

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extrusion pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	44.1	38.9	33.6	3.6	3.9	4.4
Antioxidant A	0.1						
+							
Hydroxyl-amine 1	0.05	51.5	48.3	43.0	2.3	2.8	4.4

*) Antioxidant A = neopentetetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Example 2: Processing stability of polypropylene at 260°C

The procedure of Example 1 is repeated using a polyolefinic composition containing additionally an organic phosphorus compound. The results are seen in Table II:

Table II: Processing stability of polypropylene at 260°C

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extrusion pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	44.1	38.9	33.6	3.6	3.9	4.4
Antioxidant A	0.05						
+							
Phosphite I	0.05	52.5	48.3	45.2	3.7	4.5	5.4
+							
Hydroxyl-amine 1	0.05						

*) Antioxidant A = neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Phosphite I = tris(2,4-di-tert-butylphenyl) phosphite

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

The results in Table II show that the presence of N,N-dibenzylhydroxylamine in a polypropylene composition containing both a phenolic antioxidant and an organic phosphorus compound reduces to a minimum discoloration during processing at high temperatures, the phenol and the phosphorus compound performing the functions assigned to them.

Example 3: Processing stability of polypropylene at 260°C

Using the same procedure as in Example 2, additional polypropylene compositions containing both a phenolic antioxidant and an organic phosphite and a hydroxylamine derivative are examined. The results are given in Table III.

Table III:

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extrusion pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	44.1	38.9	37.8	3.3	3.4	3.6
Antioxidant A	0.05						
Phosphite I	0.05	51.5	52.2	50.0	3.5	3.9	4.4
Hydroxylamine 1	0.05						
Antioxidant I	0.05						
Phosphite I	0.05	51.5	52.5	51.1	5.7	7.0	8.5
Hydroxylamine 2	0.05						

- *) Antioxidant A = neopentanetetrayl-tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)
 Phosphite I = tris(2,4-di-tert-butylphenyl) phosphite
 Hydroxylamine 1 = N,N-dibenzylhydroxylamine
 Hydroxylamine 2 = N,N'-dicyclohexyl-N,N'-dihydroxy-p-xylylenediamine

Example 4: Processing stability of polypropylene at 260°C

Using the procedure of Example 1, additional polypropylene compositions containing a phenolic antioxidant and a hydroxylamine derivative are examined. The results are given in Table IV.

Table IV:

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extrusion pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1		5	1		5
Basic formulation	-	41.0		36.3	5.0		6.2
	0.1 0.05	50.4		39.2	6.2		7.5

- *) Antioxidant A = neopentanetetrayl tetrakis(3,5-di-tert-butyl-4-hydroxy-cinnamate)
 Hydroxylamine 4 = di(1-hydroxy-2,2,6,6-tetramethylpiperidin-4-yl) sebacate

Example 5: Resistance to gas fading of polypropylene compositions

The basic formulation comprises 100 parts of unstabilized polypropylene (Profax[®] 6501, Hercules) and 0.1 parts of calcium stearate. Various stabilizers to be tested are admixed to the polypropylene as described in

stabilizers to be tested are admixed to the polypropylene as described in Example 1. This mix is extruded once and then granulated. The granules are compression moulded into 3.2 mm thick plates at 193°C and the yellowness index of the specimens is determined according to ASTM D 1925. The specimen is then subjected for a given period (compare the table below) at 60°C to a gas fading test according to AATCC Test Method 23. The test is carried out in a gas fume chamber (Drum Model No. 8727). The results are given in Table V below:

Table V:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index of the specimen after days exposure to gas fading at 60°C				
		0	4	14	21	32
Basic formulation	-	4.3	4.8	5.1	4.9	5.7
Light stabilizer . a + Hydroxylamine I	0.25 0.05	3.5	0.1	0.1	0.1	2.6
Antioxidant A + Light stabilizer a + Hydroxylamine I	0.1 0.25 0.05	2.2	-0.4	-0.4	0.2	0.9
Antioxidant A + Light stabilizer b + Hydroxylamine I	0.1 0.25 0.05	2.8	2.5	3.2	3.5	4.0
Antioxidant A + Light stabilizer c + Hydroxylamine I	0.1 0.25 0.05	4.1	3.6	3.3	3.1	4.0

Table V (continued)

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index of the specimen after days exposure to gas fading at 60°C				
		0	4	14	21	32
Antioxidant A + Light stabilizer d + Hydroxylamine I	0.1 0.25 0.05					
		3.4	2.5	2.7	2.3	5.2
Antioxidant A + Hydroxylamine I	0.1 0.05					
		2.1	1.0	2.1	2.2	2.3
Antioxidant B + Light stabilizer a + Hydroxylamine I	0.1 0.25 0.05					
		2.1	-1.2	-0.5	-0.2	1.2
Antioxidant B + Light stabilizer b + Hydroxylamine I	0.1 0.25 0.05					
		2.1	2.0	2.4	2.5	4.0
Antioxidant B + Light stabilizer c + Hydroxylamine I	0.1 0.25 0.05					
		3.6	2.1	2.0	1.7	3.8
Antioxidant B + Light stabilizer d + Hydroxylamine I	0.1 0.25 0.05					
		3.1	1.8	1.9	2.0	1.8
Antioxidant B + Hydroxylamine I	0.1 0.05					
		1.8	1.0	0.6	1.7	1.9

Table V (continued)

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index of the specimen after days exposure to gas fading at 60°C				
		0	4	14	21	32
Antioxidant A	0.05					
+ Phosphorus cpd. 1	0.05					
+ Light stabilizer a	0.25	2.4	-0.1	0.1	1.1	6.5
+ Hydroxylamine 1	0.05					

*)

Light stabilizer a = bis(2,2,6,6-tetramethylpiperidin-4-yl) sebacate

Light stabilizer b = polycondensation product of 1(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid

Light stabilizer c = polycondensation product of 2,4-dichloro-6-tert-octyl-amino-s-triazine and 4,4'-hexamethylene-bis-(amino-2,2,6,6-tetramethylpiperidine)

Light stabilizer d = N,N',N'',N'''-tetrakis-[4,6-bis-(butyl-(2,2,6,6-tetramethylpiperidin-4-yl)-amino)-s-triazin-2-yl]-1,10-diamino-4,7-diazadecane

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Antioxidant A = neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxycinnamate)

Antioxidant B = 3,5-di-tert-butyl-4-hydroxytoluene

Phosphorus cpd. I = tris(2,4-di-tert-butylphenyl)phosphite.

From the results given in Table V, it is seen that N,N-dibenzylhydroxylamine prevents the discoloration of polypropylene compositions when other stabilizers are additionally present and when discoloration due to gas fading is induced. The additional stabilizers are sterically hindered light stabilizers which can be present in combination with phenolic antioxidants or in combination with phenolic antioxidants and organic

phosphites.

Example 6: Oven ageing of polypropylene compositions at 60°C

The additives are admixed to the polypropylene in solution by the procedure described in Example 1. The stabilized composition is then extruded once and then granulated.

Approximately 100 g of the resultant pellets are enclosed in a 120 ml vessel and exposed in a circulating air oven for the indicated number of days at 60°C. The colour of the pellets is measured by the yellowness index. Results are given in Table VI.

Table VI:

Stabilizer*)	Amount of stabilizer (% by weight)	Yellowness index of the specimen after days exposure to oven ageing at 60°C					
		0	4	10	14	24	39
Basic formulation	-	0.7	8.2	10.3	13.8	17.7	19.9
Light stabilizer a	0.25	-3.0	-1.1	-2.3	-1.2	4.2	5.8
+ Hydroxylamine I	0.05						
Antioxidant A	0.1						
+ Light stabilizer a	0.25	-1.9	-0.5	-1.4	0.3	1.5	3.0
+ Hydroxylamine I	0.05						
Antioxidant A	0.1						
+ Light stabilizer b	0.25	-1.6	4.8	7.2	9.1	12.3	13.8
+ Hydroxylamine I	0.05						
Antioxidant A	0.1						
+ Light stabilizer c	0.25	0.5	1.3	0.0	2.3	3.5	6.5
+ Hydroxylamine I	0.05						

Table VI (continued) :

Stabilizer*)	Amount of stabilizer (% by weight)	Yellowness index of the specimen after days exposure to oven ageing at 60°C					
		0	4	10	14	24	39
Antioxidant A + Light stabilizer d + Hydroxylamine I	0.1 0.25 0.05						
		-0.4	1.7	0.0	2.1	2.4	3.7
Antioxidant A + Hydroxylamine I	0.1 0.05						
		-1.4	2.8	2.6	4.5	5.2	5.5
Antioxidant B + Light stabilizer a + Hydroxylamine I	0.1 0.25 0.05						
		-2.0	-0.6	-1.2	-0.1	2.3	36.4
Antioxidant B + Light stabilizer b + Hydroxylamine I	0.1 0.25 0.05						
		-2.7	3.3	5.6	7.7	10.1	14.1
Antioxidant B + Light stabilizer c + Hydroxylamine I	0.1 0.25 0.05						
		-0.7	-0.1	-0.7	0.9	2.7	8.6
Antioxidant B + Light stabilizer d + Hydroxylamine I	0.1 0.25 0.05						
		-0.5	-0.1	-0.6	1.4	1.8	12.0
Antioxidant B + Hydroxylamine I	0.1 0.05						
		-1.0	1.9	2.3	4.7	5.6	6.3

Table VI (continued):

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index of the specimen after days exposure to oven ageing at 60°C					
		0	4	10	14	24	39
Antioxidant A	0.05						
+ Phosphite I	0.05						
+ Light stabilizer a	0.25	-2.3	-1.2	-2.7	-0.5	-0.7	1.0
+ Hydroxylamine 1	0.05						

*)

Light stabilizer a = bis-(2,2,6,6-tetramethylpiperidin-4-yl) sebacate

Light stabilizer b = polycondensation product of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid

Light stabilizer c = polycondensation product of 2,4-dichloro-6-tert-octyl-amino-s-triazine and 4,4'-hexamethylene-bis-(amino-2,2,6,6-tetramethylpiperidine)

Light stabilizer d = N,N',N'',N'''-tetrakis-[(4,6-bis-(butyl-2,2,6,6-tetramethylpiperidin-4-yl)amino)-s-triazin-2-yl]-1,10-diamino-4,7-diazadecane

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Antioxidant A = neopentantetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Antioxidant B = 3,5-di-tert-butyl-4-hydroxytoluene

Phosphite I = tris(2,4-di-tert-butylphenyl)phosphite

From Table VI it is seen that the discoloration of polyolefinic compositions in the oven ageing test is reduced when these compositions contain hydroxylamine and various other stabilizers. Suitable additional stabilizers are sterically hindered amines or combinations of sterically hindered amines with phenolic antioxidants, or with phenolic antioxidants and organic phosphites.

Example 7: Resistance to gas fading of polypropylene compositions
Polypropylene compositions are prepared and subjected to a gas fading test, as described in Example 5. For this purpose, 4 g of pellets to be tested are placed in an open 20 ml vessel and then left in a gas fume chamber at 60°C. The results are given in Table VII:

Table VII:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after days exposure to gas fading at 60°C			
		0	15	30	45
Basic formulation	-	-7.3	-3.2	-0.4	-0.7
Antioxidant A + Hydroxylamine I	0.15 0.05	-10.9	-8.1	-2.6	5.4
Antioxidant A + Phosphite I + Hydroxylamine I	0.05 0.05 0.05	-7.0	-6.2	-4.7	-3.5

Antioxidant A = neopentanedetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Hydroxylamine I = N,N-dibenzylhydroxylamine

Phosphite I = tris(2,4-di-tert-butylphenyl) phosphite

From Table VII it is seen that N,N-dibenzylhydroxylamine inhibits the gas fading discolouration of polyolefinic compositions containing a phenolic antioxidant or a combination of a phenolic antioxidant and an organic phosphite.

Example 8: Processing stability of polypropylene at 260°C

Using the procedure described in Example 1, a variety of stabilized polypropylene compositions are prepared. Various phenolic antioxidants are

used in combination with N,N-dibenzylhydroxylamine. The yellowness index of the specimens, determined after the first, third or fifth extrusion, is given in Table VIII.

Table VIII:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Basic formulation	-	5.2	5.7	6.5
Antioxidant A + Hydroxylamine I	0.1 0.05	4.3	5.2	10.8
Antioxidant B + Hydroxylamine I	0.1 0.05	4.8	4.9	5.9
Antioxidant C + Hydroxylamine I	0.1 0.05	4.4	5.5	9.1
Antioxidant D + Hydroxylamine I	0.1 0.05	4.1	5.0	6.7
Antioxidant E + Hydroxylamine I	0.1 0.05	4.5	5.2	6.8
Antioxidant F + Hydroxylamine I	0.1 0.05	4.5	5.5	8.3
Antioxidant G + Hydroxylamine I	0.1 0.05	5.7	8.4	14.2

Table VIII: (continued)

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Antioxidant H + Hydroxylamine I	0.1 0.05	5.8	7.1	17.3
Antioxidant I + Hydroxylamine I	0.1 0.05	8.3	9.0	11.6
Antioxidant J + Hydroxylamine I	0.1 0.05	3.8	4.6	5.5
Antioxidant K + Hydroxylamine I	0.1 0.05	3.7	4.2	5.6
Antioxidant L + Hydroxylamine I	0.1 0.05	4.4	5.4	9.1

*)

- Antioxidant A = neopentanetetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)
- Antioxidant B = 3,5-di-tert-butyl-4-hydroxytoluene
- Antioxidant C = n-octadecyl 3,5-di-tert-butyl-4-hydroxyhydrocinnamate
- Antioxidant D = 1,2,3-trimethyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl) benzene
- Antioxidant E = thiodiethylene bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)
- Antioxidant F = 3,6-dioxaoctamethylene bis(3-methyl-5-tert-butyl-4-hydroxyhydrocinnamate)
- Antioxidant G = bis(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyl)hydrazide
- Antioxidant H = 1,1,3-tris(2-methyl-4-hydroxy-5-tert-butylphenyl)-

	butane
Antioxidant I	= 2,2'-ethylidene-bis(4,5-di-tert-butylphenol)
Antioxidant J	= 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl) isocyanurate
Antioxidant K	= 1,3,5-tris[2-(3,5-di-tert-butyl-4-hydroxycinnamoyloxy)-ethyl] isocyanurate
Antioxidant L	= 3,5-di(3,5-di-tert-butyl-4-hydroxybenzyl)mesitol.
Hydroxylamine 1	= N,N-dibenzylhydroxylamine

Example 9: Processing stability of polypropylene at 260°C

Using the procedure described in Example 2, a variety of stabilized polypropylene compositions are prepared. Mixtures of phenolic antioxidants and organic phosphites in the presence of hydroxylamine as stabilizers are employed. The yellowness index of the specimens, determined after the first, third and fifth extrusion, is given in Table IX.

Table IX:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Basic formulation	0.1	5.2	5.7	6.5
Antioxidant A + Phosphite II + Hydroxylamine 1	0.1 0.05 0.05	4.0	4.0	6.4
Antioxidant A + Phosphite III + Hydroxylamine 1	0.1 0.05 0.05	4.6	4.7	6.5

Table IX:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Antioxidant A + Phosphite IV + Hydroxylamine I	0.1 0.05 0.05	4.3	4.6	4.6
Antioxidant A + Phosphite V + Hydroxylamine I	0.1 0.05 0.05	4.5	4.8	6.0
Antioxidant A + Phosphite VI + Hydroxylamine I	0.1 0.05 0.05	4.5	5.6	7.5

Antioxidant A = neopentanetetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Antioxidant C = n-octadecyl 3,5-di-tert-butyl-4-hydroxyhydrocinnamate

Phosphite I = tris(2,4-di-tert-butylphenyl) phosphite

Phosphite II = 3,9-distearoyloxy-2,4,8,10-tetraoxa-3,9-diphosphat[5.5]undecane

Phosphite III = tris(p-nonylphenyl) phosphite

Phosphite IV = 3,9-di[2,6-di-tert-butyl-4-(2-n-octadecyloxycarbonylethyl)phenoxy]2,4,8,10-tetraoxa-3,9-diphosphat[5.5]undecane

Phosphite V = tetrakis(2,4-di-tert-butylphenyl)-4,4'-bis(diphenyl-
ene) phosphonite
Phosphite VI = dilauryl phosphite
Hydroxylamine I = N,N-dibenzylhydroxylamine

Example 10: Processing stability of polypropylene at 260°C

Using the procedure described in Example 1, polypropylene compositions containing a phenolic antioxidant and N,N-dibenzylhydroxylamine are prepared. These compositions are tested for their yellowing characteristics at high temperature extrusion. A variety of polypropylene substrates are examined.

Table X:

Stabilizer and/or substrate*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Substrate V	-	5.2	5.7	6.5
Substrate V + Antioxidant A + Hydroxylamine I	0.1 0.05	4.3	5.2	10.8
Substrate W	-	4.8	8.1	7.8
Substrate W + Antioxidant A + Hydroxylamine I	0.1 0.05	5.8	7.2	9.9
Substrate X	-	3.8	4.2	4.7
Substrate X + Antioxidant A + Hydroxylamine I	0.1 0.05	3.8	3.7	7.4

Table X:

Stabilizer and/or substrate*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Substrate Y	-	4.9	5.8	6.6
Substrate Y + Antioxidant A + Hydroxylamine 1	0.1 0.05	4.6	5.6	11.1
Substrate Z	-	1.8	2.7	2.4
Substrate Z + Antioxidant A + Hydroxylamine 1	0.1 0.05	1.8	3.0	6.8

*)

Antioxidant A = neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Substrate used: Each substrate contains polypropylene resin plus 0.1 % by weight calcium stearate.

Substrate V = Profax[®] 6501, Hercules

Substrate W = Fortilene[®], Soltex

Substrate X = RMO[®], Gulf

Substrate Y = 8600, Arco

Substrate Z = Marlex[®] GP, Phillips

Example 11: Processing stability of polypropylene at 260°C

The preparation and test procedures described in Example 1 are carried out except that other hydroxylamine derivatives are substituted for N,N-di-benzylhydroxylamine (compare Table XI). The results in Table XI show that the hydroxylamine derivatives produce an additional stabilizing effect, particularly N,N-di-n-octylhydroxylamine.

Table XI:

Stabilizer *)	Amount of stabilizer (% by wt.)	Internal extruder pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	43.0	39.9	35.7	4.3	6.1	7.4
Antioxidant A + Hydroxylamine1	0.1 0.05	49.4	48.3	45.2	1.7	2.7	4.1
Antioxidant A + Hydroxylamine2	0.1 0.05	50.4	48.3	45.2	5.7	8.0	10.0
Antioxidant A + Hydroxylamine4	0.1 0.05	51.5	50.4	47.3	5.0	7.9	11.1
Antioxidant A + Hydroxylamine5	0.1 0.05	48.3	47.2	43.0	2.9	5.3	10.8
Antioxidant A + Hydroxylamine6	0.1 0.05	49.4	47.3	44.1	1.5	3.0	3.7
Antioxidant A + Hydroxylamine7	0.1 0.05	52.5	51.5	49.0	7.1	9.5	11.7
Antioxidant A + Hydroxylamine8	0.1 0.05	52.5	51.1	48.3	6.7	9.0	11.1
Antioxidant A + Hydroxylamine9	0.1 0.05	50.4	51.5	49.4	7.0	9.2	11.2

*)

Antioxidant A	= neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)
Hydroxylamine 1	= N,N-dibenzylhydroxylamine
Hydroxylamine 2	= N,N'-dicyclohexyl-N,N'-dihydroxy-p-xylylenediamine
Hydroxylamine 4	= di(1-hydroxy-2,2,6,6-tetramethylpiperidin-4-yl) sebacate
Hydroxylamine 5	= N-cyclohexylhydroxylamine
Hydroxylamine 6	= N,N-di-n-octylhydroxylamine
Hydroxylamine 7	= 1-hydroxy-2,2,6,6-tetramethyl-benzoxypiperidine
Hydroxylamine 8	= 1-hydroxy-2,2,6,6-tetramethyl-4-(3,5-di-tert-butyl-4-hydroxyhydrocinnamoyloxy)piperidine
Hydroxylamine 9	= N-(1-hydroxy-2,2,6,6-tetramethylpiperidin-4-yl) ϵ -caprolactam

Example 12: Processing stability of polyethylene at 274°C

Using the procedure described in Example 1, a basic formulation comprising high density polyethylene (HDM[®]-4903, Phillips) is compounded with the indicated stabilizers and extruded. The yellowness index and the melt flow index according to ASTM D-1238 (Condition N) are measured. The results are given in Table XII below.

Table XII:

Stabilizer*)	Amount of stabilizer (% by wt.)	Melt flow index after extrusion No. (g/10 min.)		Yellowness index after extrusion No.		
		1	5	1	3	5
Basic formulation	-	2.9	1.7	-10.7	-10.9	-10.9
Antioxidant A + Hydroxylamine I	0.04	4.5	4.1	-3.8	3.9	7.1
	0.02					
Antioxidant A + Hydroxylamine I	0.04	4.8	4.7	5.0	3.4	7.6
	0.04					
Antioxidant A + Hydroxylamine I	0.04	4.9	5.2	-7.3	-1.5	4.1
	0.08					
Antioxidant A + Phosphite I + Hydroxylamine I	0.02	5.1	4.7	-5.9	0.4	4.1
	0.02					
	0.04					
Antioxidant I + Phosphite I + Hydroxylamine I	0.02	4.8	4.5	-5.2	2.0	5.5
	0.02					
	0.04					

*)

Antioxidant A = neopentane tetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Antioxidant I = 2,2'-ethylene-bis(4,6-di-tert-butylphenol)

Phosphite I = tris(2,4-di-tert-butylphenyl) phosphite

Hydroxylamine I = N,N-dibenzylhydroxylamine

Example 13: Processing stability of polyethylene at 274°C

Using the procedure described in Example 12, various polyethylene compositions containing a phenolic antioxidant with or without N,N-dibenzylhydroxylamine are tested for processing stability. The yellowness index and the melt flow index of the specimens are measured. The results are given in Table XIII below.

Table XIII:

Stabilizer*	Amount of stabilizer (% by wt.)	Melt flow index after extrusion no. (g/10 min.)		Yellowness index after extrusion no.		
		1	5	1	3	5
Substrate R	-	2.9	2.1	-9.6	-8.7	-7.7
Substrate R + Antioxidant C + Hydroxylamine I	0.01 0.01	4.0	3.1	-8.1	-4.5	-3.5
Substrate R + Antioxidant C + Hydroxylamine I	0.02 0.02	3.1	2.5	-9.9	-9.7	-9.3
Substrate S	-	3.1	2.0	-8.7	-8.8	-7.2
Substrate S + Antioxidant A + Hydroxylamine I	0.02 0.02	4.6	3.6	-7.3	-4.2	-1.0
Substrate T	-	52.0	47.8	-7.9	-8.1	-7.4
Substrate T + Antioxidant A + Hydroxylamine I	0.02 0.02	58.9	57.0	-7.4	-5.8	-4.2

Table XIII (continued):

Stabilizer*)	Amount of stabilizer (% by wt.)	Melt flow index after extrusion no. (g/10 min.)		Yellowness index after extrusion No.		
		1	5	1	3	5
Substrate U	-	32.0	23.5	-6.1	-5.2	-2.9
Substrate U + Antioxidant A	0.02	34.0	35.6	-5.7	1.8	11.1
Substrate U + Antioxidant A + Hydroxylamine I	0.02					

*)

- Antioxidant A = neopentanetetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)
- Antioxidant C = n-octadecyl 3,5-di-tert-butyl-4-hydroxyhydrocinnamate
- Hydroxylamine I = N,N-dibenzylhydroxylamine
- Substrate R = HMM[®] 4903, Phillips, high density polyethylene
- Substrate S = Chemplex[®] 5602, Chemplex, high density polyethylene
- Substrate T = DNDU[®] 1062, Union Carbide, low density polyethylene
- Substrate U = Exxon polyethylene, linear low density polyethylene (Unipol process)

Example 14: Following the general procedure of Example 6, polypropylene formulations (Profax[®] 6501, Hercules) containing 0.1 % by weight of calcium stearate, a phenolic antioxidant and N,N-dibenzylhydroxylamine are prepared. One portion of these formulations is extruded once and then compression moulded into 3.2 mm thick plates as described in Example 5. Another portion of the polypropylene formulations is extruded five times before being moulded into plates.

The yellowness index of the test plates is determined. The specimens are then exposed to ageing in a circulating air oven at 150°C. The yellowness index of the specimens is measured at defined intervals until decomposition sets in.

A specimen is considered to be decomposed when cracking or browning of the corners occurs. The test results are given in the table below.

Table XIV

Stabilizer	Amount of stabilizer (% by wt.)	Yellowness index after hours (one extrusion)					Yellowness index after hours (5 extrusions)					Hours to decomposition	
		0	100	325	485	1000	0	100	325	485	1000	1 extrusion	5 extrusions
Basic formulation	-	3.6	-	-	-	-	4.4	-	-	-	-	20	20
Antioxidant A + Hydroxyl-amine 1	0.1 0.05	2.3	10.7	28	36	45	4.4	14	30	39	47	1105	1040

*)

Antioxidant A = neopentetetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Example 15: Processing stability of polypropylene at 260°C

Following the procedure of Example 11, N,N-di-tert-butylhydroxylamine is substituted for N,N-dibenzylhydroxylamine in the stabilized polypropylene composition. The results are given in Table XV below.

Table XV:

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extruder pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	37.8	35.7	-	3.6	4.3	4.8
Antioxidant A + Hydroxylamine 10	0.1 0.05	50.4	48.3	52.2	1.9	4.9	7.1

*)

Antioxidant A = neopentantetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Hydroxylamine 10 = N,N-di-tert-butylhydroxylamine

Example 16: Processing stability of polypropylene at 260°C

Using the procedure of Example 1, polypropylene compositions containing, in addition to the phenolic antioxidant, a thiosynergist, are prepared. The processing stability of these compositions is tested by measuring the internal extruder pressure and the yellowness index values of the individual specimens during several successive extrusions. The results are seen in Table XIV below:

Table XVI:

Stabilizer*)	Amount of stabilizer (% by wt.)	Internal extruder pressure during extrusion No. (kg/cm ²)			Yellowness index after extrusion No.		
		1	3	5	1	3	5
Basic formulation	-	37.8	35.2	-	3.6	4.3	4.8
Antioxidant A	0.1						
+ Thio-synergist p	0.05	52.5	50.4	49.4	2.2	3.2	4.2
+ Hydroxyl-amine 1	0.05						

*)

Antioxidant A = neopentanetetrayl tetrakis(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Thiosynergist p = distearylthiodipropionate

Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Examples 17-20: Following the procedure described in Examples 5 and 6, polypropylene specimens are prepared and tested for resistance to gas fading and oven ageing. The specimens under test contain the following stabilizer combinations:

Example 17: an ultraviolet light absorber;

Example 18: an ultraviolet light absorber and an organic phosphite

Example 19: an ultraviolet light absorber and a sterically hindered amine

Example 20: a sterically hindered amine, an organic phosphite and a thio-synergist

All these specimens exhibit reduced yellowing when a hydroxylamine derivative is additionally used.

Example 21: Effect of calcium stearate on the discoloration of polypropylene processed at 260°C

Using the procedure described in Example 1, polypropylene (Profax® 6501, Hercules) is extruded and the yellowness index determined in each case after the first, third and fifth extrusion. The basic formulation contains no calcium stearate in contrast to Example 1. The test plates are moulded at 232°C.

Results are seen in Table XVII below:

Table XVII:

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Basic formulation	-	1.6	2.5	2.9
Antioxidant A + Hydroxylamine 1	0.1 0.05	2.2	8.0	12.8
Calcium stearate + Hydroxylamine 1	0.1 0.05	1.0	1.8	3.3
Calcium stearate + Antioxidant A + Hydroxylamine 1	0.1 0.1 0.05	1.0	1.5	4.0

*) Hydroxylamine 1 = N,N-dibenzylhydroxylamine

Antioxidant A = neopentanedetrayl tetrakis(3,5-tert-butyl-4-hydroxyhydrocinnamate

Example 22: Effect of calcium stearate on the discolouration of high density polyethylene processed at 274°C

Using the procedure of Example 12, high density polyethylene (HM®-4903, Phillips) is extruded and the yellowness index of the specimens is then measured in order to determine the discoloration. The basic formulation

contains no calcium stearate. The test plates are moulded at 193°C. The results are listed in Table XVIII below:

Table XVIII

Stabilizer*)	Amount of stabilizer (% by wt.)	Yellowness index after extrusion No.		
		1	3	5
Basic formulation	-	-2.2	-2.9	-2.8
Antioxidant A + Hydroxylamine I	0.1 0.05	-1.0	3.1	5.6
Calcium stearate + Hydroxylamine I	0.1 0.05	-3.9	-2.3	-1.3
Calcium stearate + Antioxidant A + Hydroxylamine I	0.1 0.1 0.05	-2.6	-0.6	0.8

*) Hydroxylamine I = N,N-dibenzylhydroxylamine
 Antioxidant A = neopentanetetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Example 23: Effect of calcium stearate on processing stability of high density polyethylene at 274°C

Using the procedure of Examples 12 and 22, melt flow indices of high density polyethylene (HMM[®] 4903, Phillips) are determined after one, three or five extrusions. The basic formulation contains no calcium stearate. The results are seen in Table XIX below.

Table XIX:

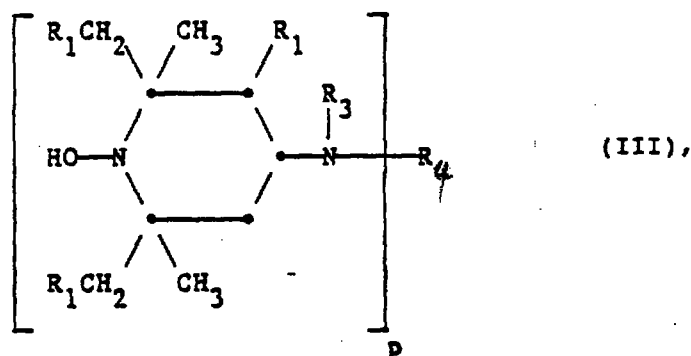
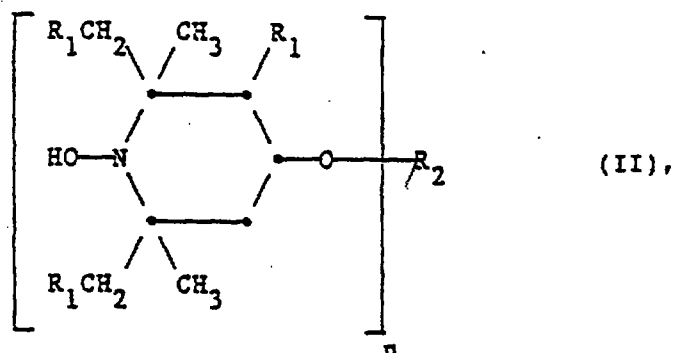
Stabilizer*)	Amount of stabilizer (% by wt.)	Melt flow index after extrusion No. (g/10 min)		
		1	3	5
Basic formulation	-	4.5	3.5	2.5
Antioxidant A + Hydroxylamine 1	0.1 0.05	5.8	5.75	5.75
Calcium stearate + Antioxidant A + Hydroxylamine 1	0.1 0.1 0.05	5.8	5.75	5.75

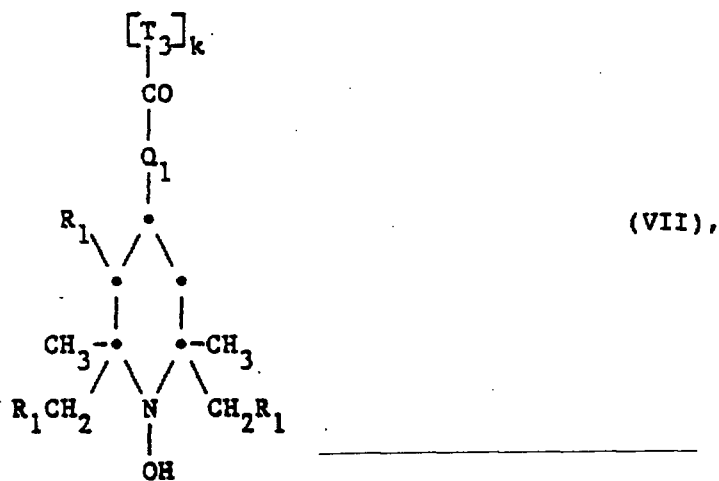
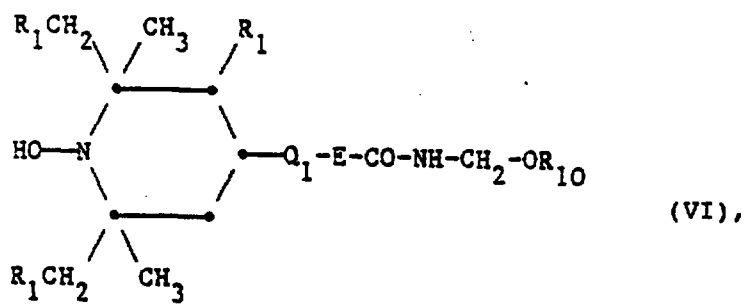
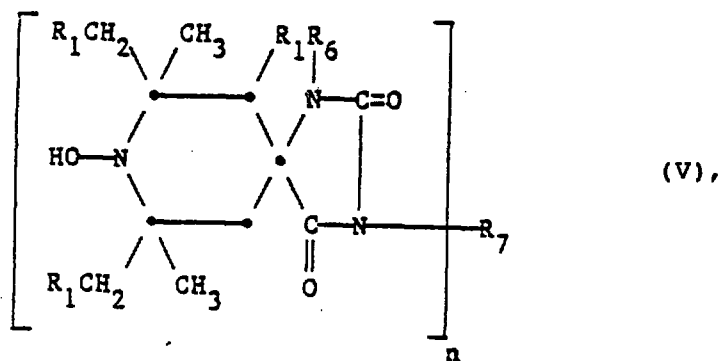
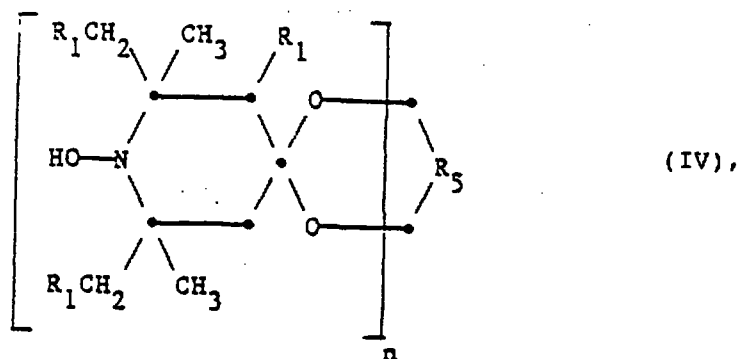
*) Hydroxylamine 1 = N,N-dibenzylhydroxylamine

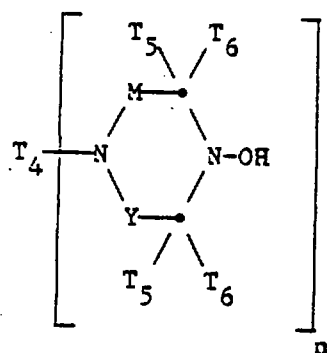
Antioxidant A = neopentanetetrayl tetrakis-(3,5-di-tert-butyl-4-hydroxyhydrocinnamate)

Patent Claims

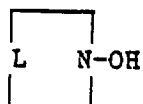
1. A stabilized composition, which comprises a) a saturated polyolefin or a mixture of such polyolefins, b) at least one stabilizer or a mixture of stabilizers from the group of the phenolic antioxidants, the sterically hindered amines, the ultraviolet light absorbers, the organic phosphorus compounds, the metal salts of fatty acids or the thiosynergists, and c) at least one hydroxylamine derivative of the formulae I to XIV, or a mixture of such derivatives



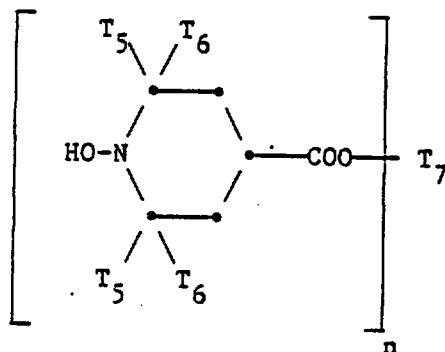




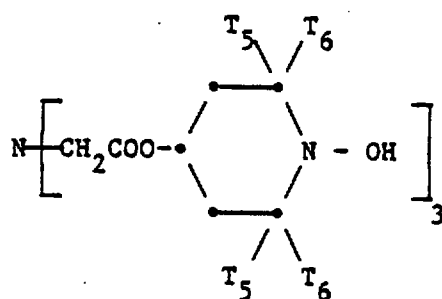
(VIII),



(IX),

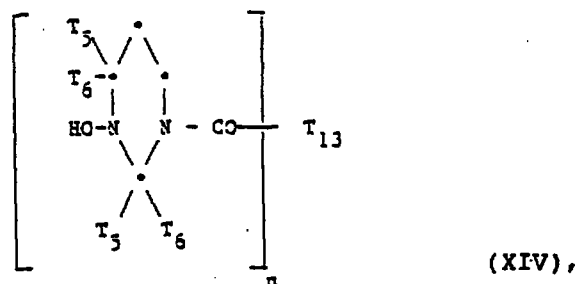
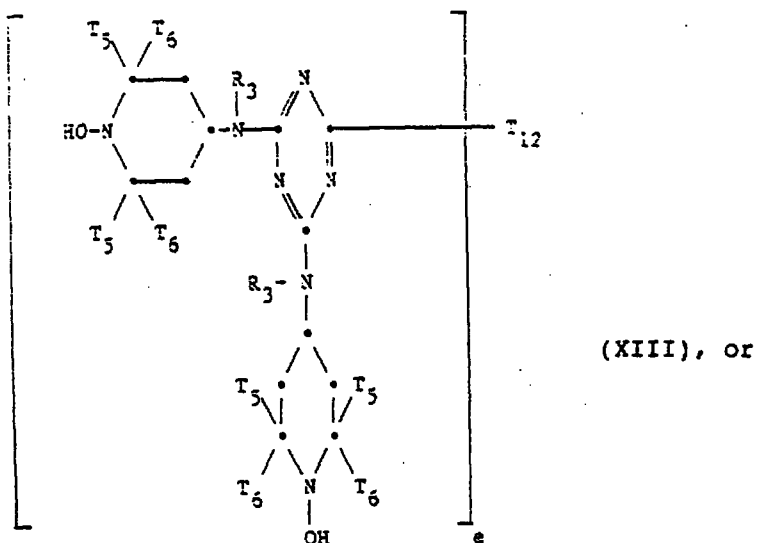
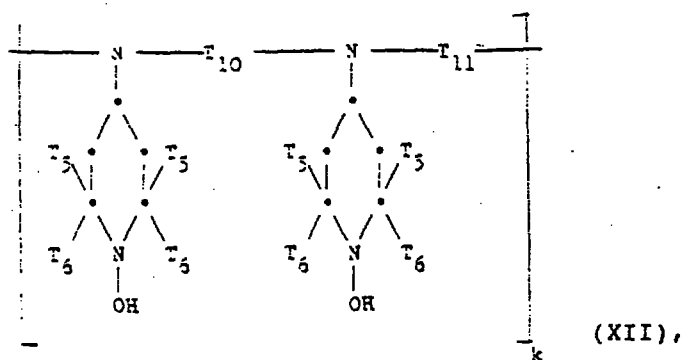


(X),



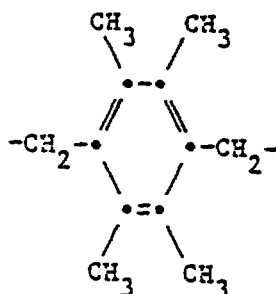
(XI),



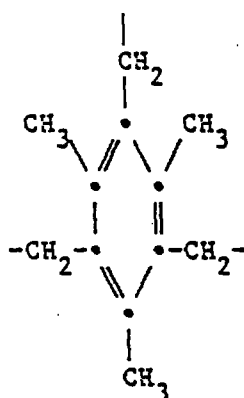


provided that components b) and c) are not identical, in which formulae T_1 is C_1 - C_{36} alkyl, C_5 - C_{12} cycloalkyl, C_7 - C_9 aralkyl, which is unsubstituted or substituted by C_1 - C_4 alkyl or by one or two halogen atoms, or wherein g is 1, 2, 3 or 4; wherein, when g is 1, T_2 is hydrogen, or has one of the meanings given for T_1 ; wherein, when g is 2, T_2 is C_2 - C_{12} alkylene, C_6 - C_{10} cycloalkylene, C_6 - C_{10} arylene, C_8 - C_{10} alkylenearylenealkylene, or a radical





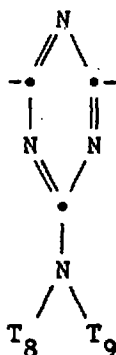
wherein, when g is 3, T_2 is C_3 - C_6 alkanetriyl, or a radical



wherein, when g is 4, T_2 is C_4 - C_6 alkanetetrayl; wherein R_1 is hydrogen or methyl, n is 1 or 2; when n is 1, R_2 is hydrogen or C_1 - C_{18} alkyl which can be optionally interrupted by one or more oxygen atoms, however, where there are several oxygen atoms they are not in direct contact, or cyanoethyl, benzyl, glycidyl, a monovalent aliphatic, cycloaliphatic, araliphatic or aromatic acyl radical, a monovalent acyl radical of a carbamic acid, a monovalent radical of a phosphorus-containing acid, or a monovalent silyl radical; or wherein, when n is 2, R_2 is C_1 - C_{12} alkylene, C_4 - C_{12} alkenylene, xylylene, an aliphatic, cycloaliphatic, araliphatic or aromatic diacyl radical or dicarbamoyl radical, or a divalent radical of a phosphorus-containing acid, or a divalent silyl radical; and wherein p is 1, 2 or 3, R_3 is hydrogen, C_1 - C_{12} alkyl, C_5 - C_7 cycloalkyl, C_7 - C_8 -aralkyl, C_2 - C_{18} alkanoyl, C_3 - C_5 alkenoyl or benzoyl; and wherein, when p is 1, R_4 is hydrogen, C_1 - C_{18} alkyl, C_5 - C_7 cycloalkyl or C_2 - C_8 alkenyl which is unsubstituted or substituted by cyano or contains a carbonyl-containing group or an acylamino group, or R_4 is glycidyl, a group of the formula $-\text{CH}_2-\text{CH}(\text{OH})-\text{Z}$ or a group of the formula $-\text{CONH}-\text{Z}$ wherein Z is hydrogen, methyl or phenyl; or wherein, when p is 2, R_4 is C_2 - C_{12} alkylene,

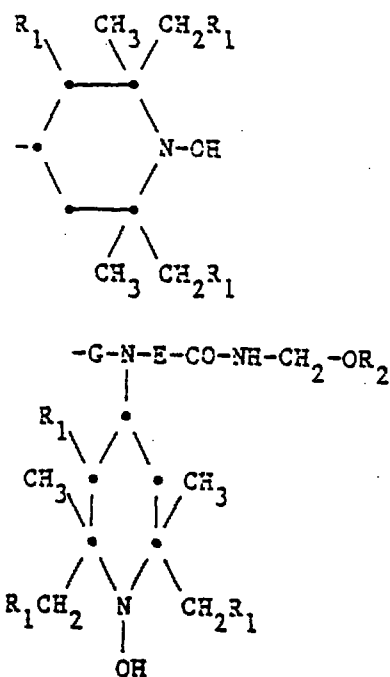


C₆-C₁₂arylene, xylylene, a group -CH₂CH(OH)-CH₂-, or a group -CH₂-CH(OH)-CH₂-O-X-O-CH₂-CH(OH)-CH₂- wherein X is C₂-C₁₀alkylene, C₆-C₁₅arylene or C₆-C₁₂cycloalkylene; or, provided that R₃ is not alkanoyl, alkenoyl or benzoyl, R₄ is an aliphatic, cycloaliphatic or aromatic diacyl radical or dicarbamoyl radical, or a keto group; or when p is 1, R₃ and R₄ form a cyclic aliphatic or aromatic 1,2-or 1,3-diacyl radical or together form a divalent aliphatic monoacyl radical; or R₄ is a radical

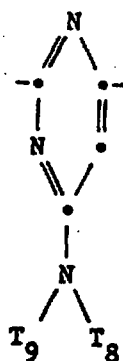


where T₈ and T₉ are independently of one another hydrogen, or C₁-C₁₈-alkyl, or wherein, T₈ and T₉ together are C₄-C₆alkylene, or 3-oxapentamethylene; and where, when p is 3, R₄ is 2,4,6-triazinyl; wherein when n is 1, R₅ is C₂-C₈alkylene or hydroxyalkylene or C₄-C₂₂acyloxyalkylene; or wherein, when n is 2, R₅ is a group (-CH₂)₂-C(CH₂-)₂; and wherein R₆ is hydrogen, C₁-C₁₂alkyl, allyl, benzyl, glycidyl or C₂-C₆alkoxyalkyl; and wherein, when n is 1, R₇ is hydrogen, C₁-C₁₂alkyl, C₃-C₅alkenyl, C₇-C₉aralkyl, C₅-C₇cycloalkyl, C₂-C₄hydroxyalkyl, C₂-C₆alkoxyalkyl, C₆-C₁₀aryl, glycidyl, a group of the formula -(CH₂)_m-O-CO-Q or of the formula -(CH₂)_m-COO-Q wherein m is 1 or 2, and Q is C₁-C₄alkyl or phenyl; or wherein, when n is 2, R₇ is C₂-C₁₂alkylene, C₆-C₁₂arylene, a group -CH₂-CH(OH)-CH₂-O-X-O-CH₂-CH(OH)-CH₂- wherein X is C₂-C₁₀alkylene, C₆-C₁₅arylene or C₆-C₁₂cycloalkylene, or a group -CH₂-CH(OZ')-CH₂-(OCH₂-CH(OZ')-CH₂)₂- wherein Z' is hydrogen, C₁-C₁₈alkyl, allyl, benzyl, C₂-C₁₂alkanoyl or benzoyl; or wherein Q₁ is -N(R₈)-or -O-, E is C₁-C₃-alkylene, or a group -CH₂-CHR₉-O- wherein R₉ is hydrogen, methyl or phenyl or wherein E is the group -(CH₂)₃-NH- or a direct bond; and wherein R₁₀ is hydrogen or C₁-C₁₈alkyl, R₈ is hydrogen, C₁-C₁₈alkyl, C₅-C₇cycloalkyl, C₇-C₁₂aralkyl, cyanoethyl, C₆-C₁₀aryl, or the group -CH₂-CH(R₉)-OH wherein R₉ has the meaning defined above, or wherein R₈ finally is a group of the formula

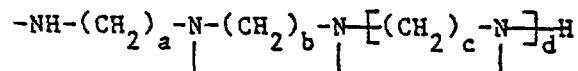




wherein G is C₂-C₆alkylene or C₆-C₁₂arylene, or wherein R₈ is also a group -E-CO-NH-CH₂-OR₁₀; Formula VII denotes the recurring structural unit of a polymer where T₃ is ethylene or 1,2-propylene, or T₃ is the recurring structural unit in a copolymer of an -olefinic radical with an alkyl acrylate or methacrylate, where k is from 2 to 100; T₄ has the same meaning as R₄ when p is 1 or 2, with the proviso that compounds of the formula VIII wherein M and Y are a carbonyl group, T₅ is methyl and T₆ is methyl or ethyl, or T₅ and T₆ together are tetramethylene or pentamethylene and T₄ is hydrogen, C₁-C₁₈alkyl, C₂-C₁₂alkylene or xylylene are excluded; T₅ is methyl; T₆ is methyl or ethyl, or T₅ and T₆ together form tetramethylene or pentamethylene or a mixture of said hydroxylamine derivatives; M and Y are independently of one another methylene or carbonyl; L denotes straight-chain or branched C₄-C₇alkylene, 3-oxapentamethylene or 3-hydroxyazapentamethylene; T₇ has the same meaning as R₇; T₁₀ and T₁₁ are independently of one another C₂-C₁₂alkylene or T₁₁ is a group of the formula



and T₁₂ is a group of the formula



where a, b and c are independently of one another 2 or 3, and d is 0 or 1; wherein e is 3 or 4; and T₁₃ has the same meaning as R₂ with the proviso that T₁₃ is not hydrogen when n is 1.

2. A composition according to Claim 1, wherein the hydroxylamine is a compound of the formula I, where g is 1 and the radicals T₁ and T₂ together have from 6 to 36 carbon atoms.

3. A composition according to Claim 2, wherein T₂ is hydrogen and T₁ is C₆-C₁₂cycloalkyl; or wherein T₁ and T₂ have the same meaning and are C₄-C₁₈alkyl, cyclohexyl or benzyl.

4. A composition according to Claim 3 wherein the hydroxylamine of the formula I is N,N-di-tert-butylhydroxylamine, N,N-di-n-octylhydroxylamine, N-cyclohexylhydroxylamine, N-cyclododecylhydroxylamine, N,N-dicyclohexylhydroxylamine, or N,N-dibenzylhydroxylamine, or a mixture of the abovementioned hydroxylamines.

5. A composition according to Claim 1, wherein the hydroxylamine derivative is a compound of the formula I, wherein g is 2, T₁ is cyclohexyl and T₂ is p-xylylene; or wherein the hydroxylamine derivative is a compound of the formula II, where n is 2, R₁ is hydrogen, and R₂ is sebacoyl.

6. A composition according to Claim 1, wherein component b) is a phenolic antioxidant.

7. A composition according to Claim 6, wherein component b) additionally contains an organic phosphorus compound.

8. A composition according to Claim 6, wherein component b) additionally



contains a sterically hindered amine as light stabilizer.

9. A composition according to Claim 6, wherein component b) additionally contains a thiosynergist.

10. A composition according to Claim 6, wherein component b) additionally contains an ultraviolet light absorber.

11. A composition according to Claim 8, wherein component b) additionally contains an organic phosphorus compound.

12. A composition according to Claim 11, wherein component b) additionally contains a thiosynergist.

13. A composition according to Claim 8, wherein component b) additionally contains an ultraviolet light absorber.

14. A composition according to Claim 10, wherein component b) additionally contains an organic phosphorus compound.

15. A composition according to Claim 1, wherein component b) contains a sterically hindered amine as light stabilizer.

16. A composition according to Claim 1, wherein component b) is the metal salt of a fatty acid.

17. A composition according to Claim 16, additionally containing a phenolic antioxidant as component b).

18. A method of stabilizing a saturated polyolefin or a mixture thereof against oxidative, thermal or radiation-induced degradation which comprises adding to the substrate (a), b) a stabilizer or a mixture of stabilizers selected from the group of the phenolic antioxidants, the sterically hindered amines, the ultraviolet light absorbers, the organic phosphorus compounds, the metal salts of fatty acids and the thiosynergists, and c) at least one hydroxylamine derivative or a mixture



of hydroxylamine derivatives according to Claim 1, provided that components b) and c) are not identical.

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