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Agricultural Articles

The present invention relates to agricultural articles which keep their properties during the use and degrade later on, until total disintegration and disappearance of the plastic. The invention further relates to a method for controlling the weathering resistance and the degradation of agricultural articles. The desired effect is obtained with specific combinations of degradant metal salts and stabilizers.

The agricultural article of the present invention comprises an organic polymer, an organic salt of Fe, Ce, Co, Mn, Cu or Vd and one or more sterically hindered amine compounds.

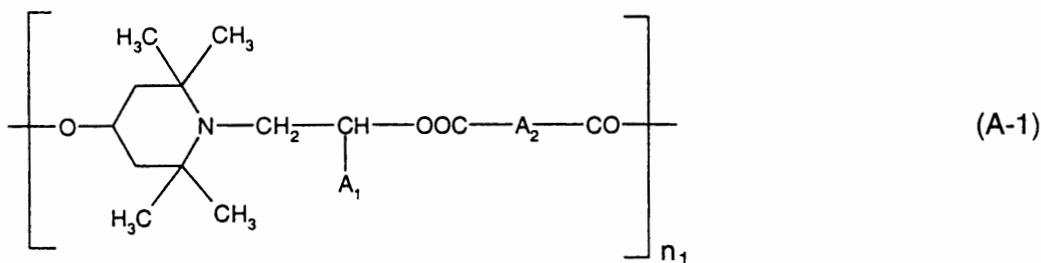
Shelf stable nonwoven fabrics and films are disclosed in US-A-5,393,831. A method for controlling the degradation start time is further disclosed in JP-A-05/043749. Chemically degradable polyolefin films are also described in US-A-5,565,503.

Stabilized plastics are for example described in EP-A-226,453, GB-A-1,582,280, US-A-3,909,333, US-A-5,859,098, DE-A-4,003,129 and EP-A-172,691.

The present invention relates in particular to an agricultural article comprising the components

- (I) an organic polymer,
- (II) an organic salt of Fe, Ce, Co, Mn, Cu or Vd, and
- (III) one or more sterically hindered amine compounds selected from the group consisting of

a compound of the formula (A-1)



wherein

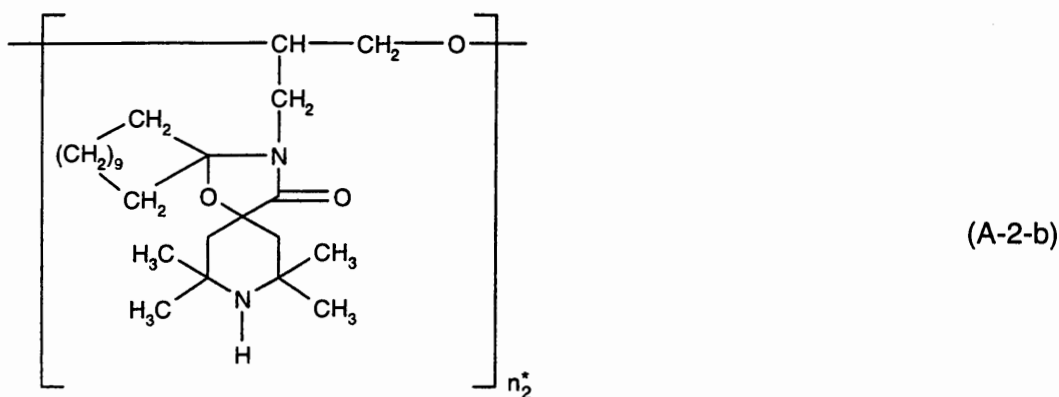
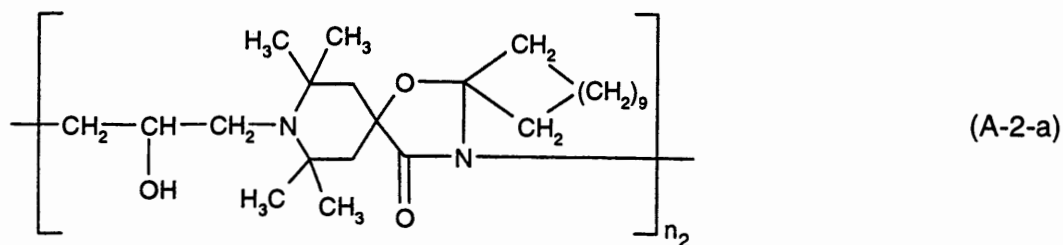
A₁ is hydrogen or C₁-C₄alkyl,

A₂ is a direct bond or C₁-C₁₀alkylene, and

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n_1 is a number from 2 to 50;

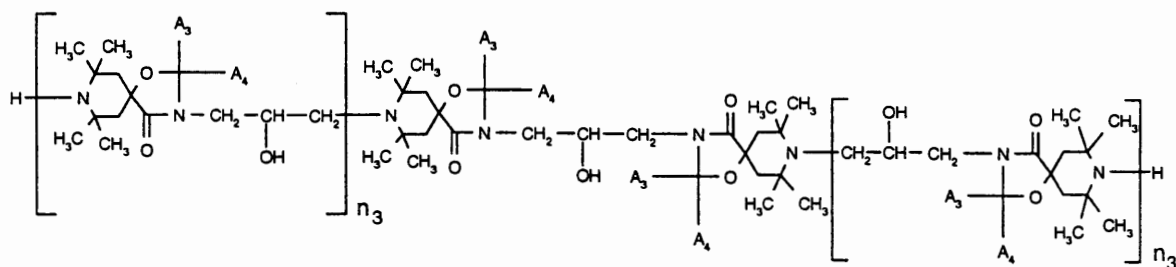
at least one compound of the formulae (A-2-a) and (A-2-b)



wherein

n_2 and n_2^* are a number from 2 to 50;

a compound of the formula (A-3)



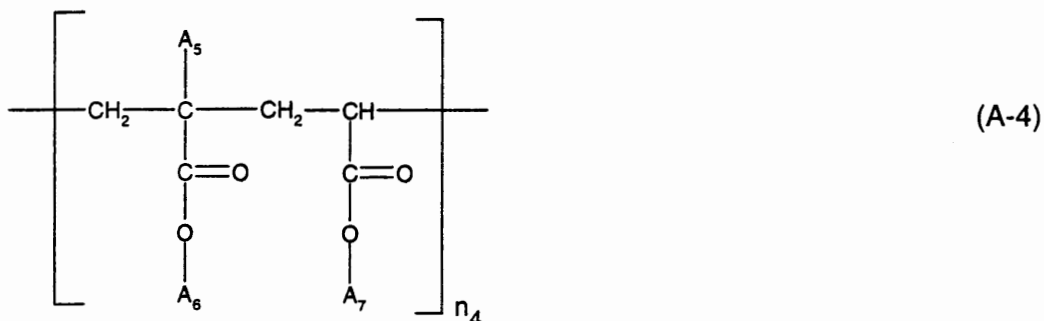
wherein

A_3 and A_4 independently of one another are hydrogen or C_1 - C_8 alkyl, or A_3 and A_4 together form a C_2 - C_{14} alkylene group, and

the variables n_3 independently of one another are a number from 1 to 50;

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a compound of the formula (A-4)



wherein

n_4 is a number from 2 to 50,

A_5 is hydrogen or C_1 - C_4 alkyl,

the radicals A_6 and A_7 independently of one another are C_1 - C_4 alkyl or a group of the formula (a-I)



wherein A_8 is hydrogen, C_1 - C_8 alkyl, $-\text{O}^-$, $-\text{OH}$, $-\text{CH}_2\text{CN}$, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by $-\text{OH}$; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,

with the proviso that at least 50 % of the radicals A_7 are a group of the formula (a-I);

a compound of the formula (B-1)



in which

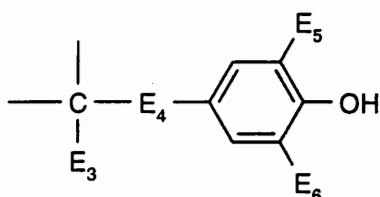
E_1 is hydrogen, C_1 - C_8 alkyl, $-\text{O}^-$, $-\text{OH}$, $-\text{CH}_2\text{CN}$, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by $-\text{OH}$; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,

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m_1 is 1, 2 or 4,

if m_1 is 1, E_2 is C_1 - C_{25} alkyl,

if m_1 is 2, E_2 is C_1 - C_{14} alkylene or a group of the formula (b-I)

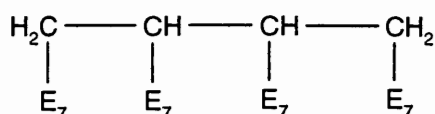


(b-I)

wherein E_3 is C_1 - C_{10} alkyl or C_2 - C_{10} alkenyl, E_4 is C_1 - C_{10} alkylene, and E_5 and E_6 independently of one another are C_1 - C_4 alkyl, cyclohexyl or methylcyclohexyl, and

if m_1 is 4, E_2 is C_4 - C_{10} alkanetetrayl;

a compound of the formula (B-2)

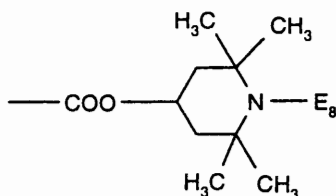


(B-2)

in which

two of the radicals E_7 are $-\text{COO}-(C_1\text{-}C_{20}\text{alkyl})$, and

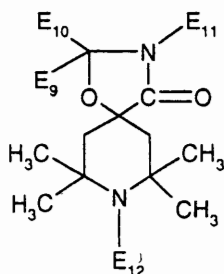
two of the radicals E_7 are a group of the formula (b-II)



(b-II)

with E_8 having one of the meanings of E_1 ;

a compound of the formula (B-3)



(B-3)

in which

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E_9 and E_{10} together form C_2 - C_{14} alkylene,

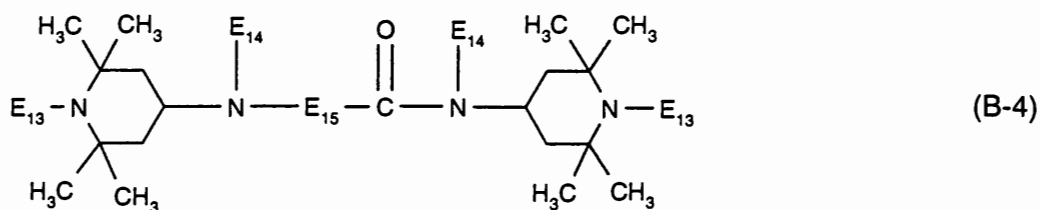
E_{11} is hydrogen or a group $-Z_1-COO-Z_2$,

Z_1 is C_2 - C_{14} alkylene, and

Z_2 is C_1 - C_{24} alkyl, and

E_{12} has one of the meanings of E_1 ;

a compound of the formula (B-4)



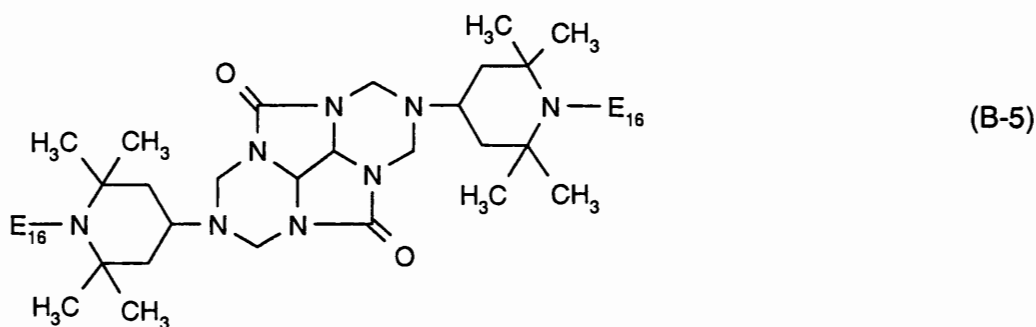
wherein

the radicals E_{13} independently of one another have one of the meanings of E_1 ,

the radicals E_{14} independently of one another are hydrogen or C_1 - C_{12} alkyl, and

E_{15} is C_1 - C_{10} alkylene or C_3 - C_{10} alkylidene;

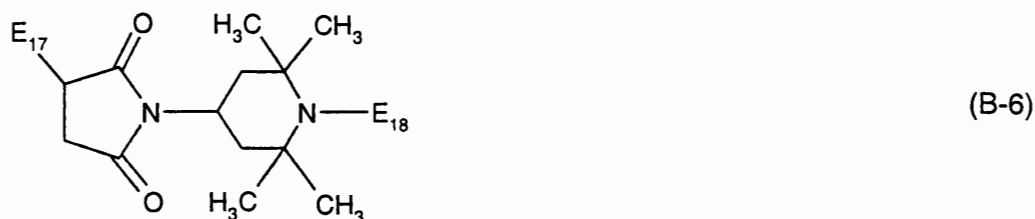
a compound of the formula (B-5)



wherein

the radicals E_{16} independently of one another have one of the meanings of E_1 ;

a compound of the formula (B-6)



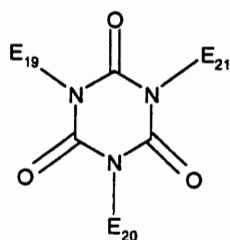
- 6 -

in which

E_{17} is C_1 - C_{24} alkyl, and

E_{18} has one of the meanings of E_1 ;

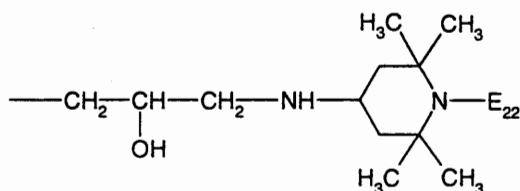
a compound of the formula (B-7)



(B-7)

in which

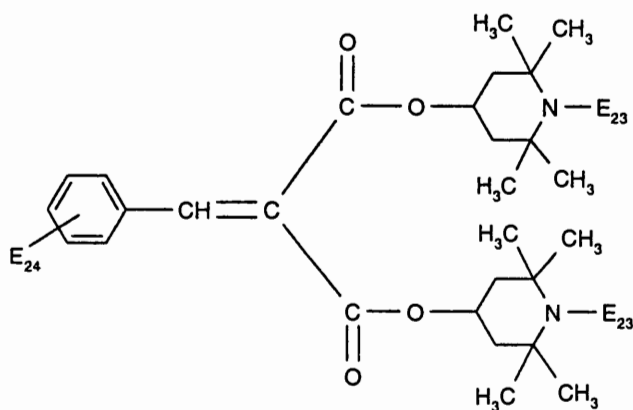
E_{19} , E_{20} and E_{21} independently of one another are a group of the formula (b-III)



(b-III)

wherein E_{22} has one of the meanings of E_1 ;

a compound of the formula (B-8)



(B-8)

wherein

the radicals E_{23} independently of one another have one of the meanings of E_1 ,

and E_{24} is hydrogen, C_1 - C_{12} alkyl or C_1 - C_{12} alkoxy;

a compound of the formula (B-9)

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wherein

m_2 is 1, 2 or 3,

E_{25} has one of the meanings of E_1 , and

when m_2 is 1, E_{26} is a group $-\text{CH}_2\text{CH}_2\text{NH}-$,

when m_2 is 2, E_{26} is $\text{C}_2\text{-C}_{22}$ alkylene, and

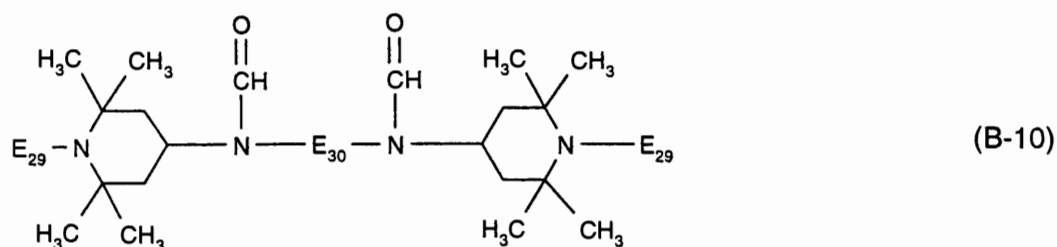
when m_2 is 3, E_{26} is a group of the formula (b-IV)



wherein the radicals E_{27} independently of one another are $\text{C}_2\text{-C}_{12}$ alkylene, and

the radicals E_{28} independently of one another are $\text{C}_1\text{-C}_{12}$ alkyl or $\text{C}_5\text{-C}_{12}$ cycloalkyl;

a compound of the formula (B-10)



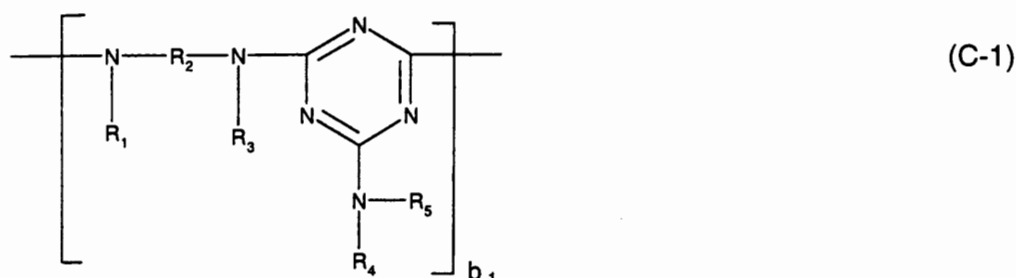
wherein

the radicals E_{29} independently of one another have one of the meanings of E_1 , and

E_{30} is $\text{C}_2\text{-C}_{22}$ alkylene, $\text{C}_5\text{-C}_7$ cycloalkylene, $\text{C}_1\text{-C}_4$ alkylenedi($\text{C}_5\text{-C}_7$ cycloalkylene), phenylene or phenylenedi($\text{C}_1\text{-C}_4$ alkylene);

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a compound of the formula (C-1)



in which

R_1 , R_3 , R_4 and R_5 independently of one another are hydrogen, C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, C_1 - C_4 -alkyl-substituted C_5 - C_{12} cycloalkyl, phenyl, phenyl which is substituted by -OH and/or C_1 - C_{10} alkyl; C_7 - C_9 phenylalkyl, C_7 - C_9 phenylalkyl which is substituted on the phenyl radical by -OH and/or C_1 - C_{10} alkyl; or a group of the formula (c-I)



R_2 is C_2 - C_{18} alkylene, C_5 - C_7 cycloalkylene or C_1 - C_4 alkylenedi(C_5 - C_7 cycloalkylene),

or

the radicals R_1 , R_2 and R_3 , together with the nitrogen atoms to which they are bonded, perform a 5- to 10-membered heterocyclic ring, or

R_4 and R_5 , together with the nitrogen atom to which they are bonded, form a 5- to 10-membered heterocyclic ring,

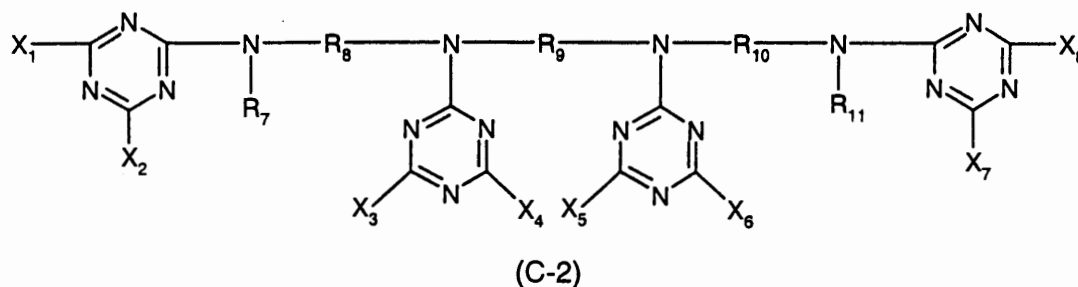
R_6 is hydrogen, C_1 - C_8 alkyl, -O-, -OH, -CH₂CN, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by -OH; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl, and

b_1 is a number from 2 to 50,

with the proviso that at least one of the radicals R_1 , R_3 , R_4 and R_5 is a group of the formula (c-I);

a compound of the formula (C-2)

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wherein

R_7 and R_{11} independently of one another are hydrogen or C_1 - C_{12} alkyl,

R_8 , R_9 and R_{10} independently of one another are C_2 - C_{10} alkylene, and

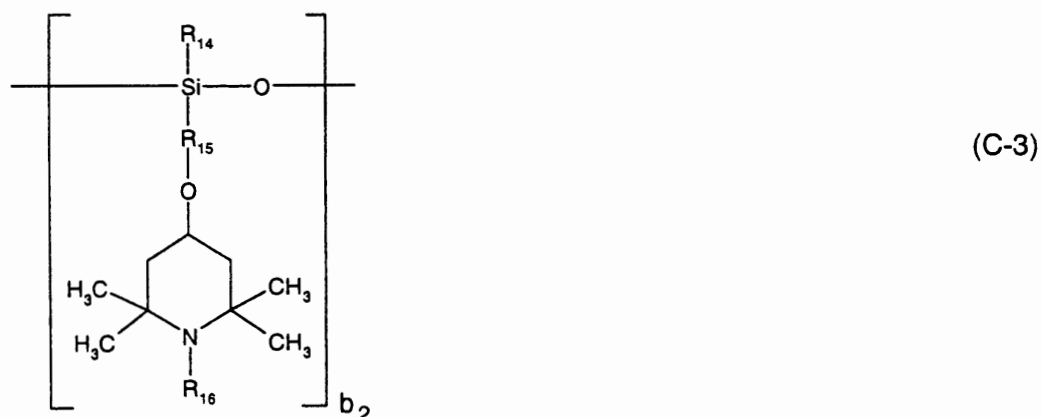
X_1 , X_2 , X_3 , X_4 , X_5 , X_6 , X_7 and X_8 independently of one another are a group of the formula (c-II),



in which R_{12} is hydrogen, C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, C_1 - C_4 alkyl-substituted C_5 - C_{12} cycloalkyl, phenyl, -OH- and/or C_1 - C_{10} alkyl-substituted phenyl, C_7 - C_9 phenylalkyl, C_7 - C_9 phenylalkyl which is substituted on the phenyl radical by -OH and/or C_1 - C_{10} alkyl; or a group of the formula (c-I) as defined above, and

R_{13} has one of the meanings of R_6 ;

a compound of the formula (C-3)



in which

R_{14} is C_1 - C_{10} alkyl, C_5 - C_{12} cycloalkyl, C_1 - C_4 alkyl-substituted C_5 - C_{12} cycloalkyl, phenyl or C_1 - C_{10} alkyl-substituted phenyl,

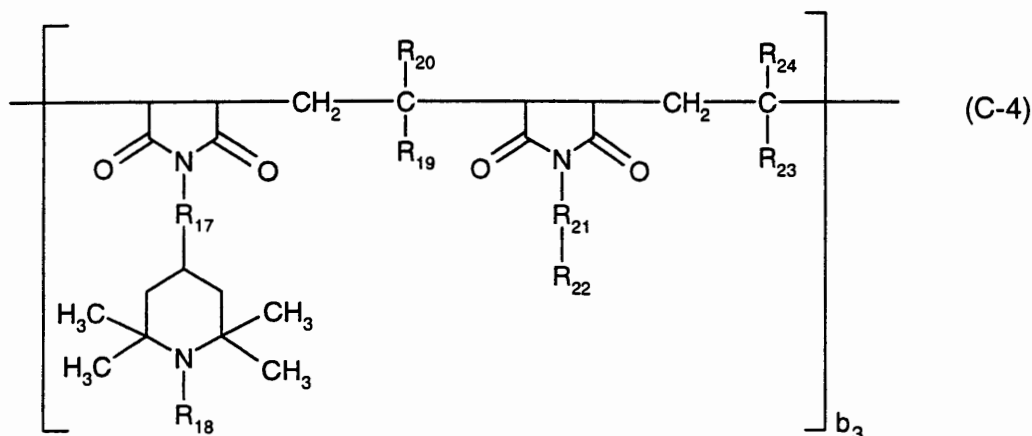
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R_{15} is C_3 - C_{10} alkylene;

R_{16} has one of the meanings of R_6 , and

b_2 is a number from 2 to 50;

a compound of the formula (C-4)



in which

R_{17} and R_{21} independently of one another are a direct bond or a $-N(X_9)-CO-X_{10}-CO-N(X_{11})-$ group, where X_9 and X_{11} independently of one another are hydrogen, C_1 - C_8 alkyl, C_5 - C_{12} cycloalkyl, phenyl, C_7 - C_9 phenylalkyl or a group of the formula (c-I),

X_{10} is a direct bond or C_1 - C_4 alkylene,

R_{18} has one of the meanings of R_6 ,

R_{19} , R_{20} , R_{23} and R_{24} independently of one another are hydrogen, C_1 - C_{30} alkyl,

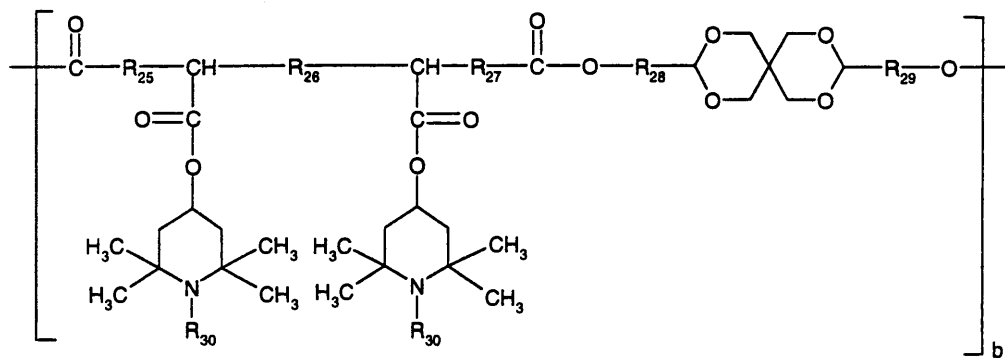
C_5 - C_{12} cycloalkyl or phenyl,

R_{22} is hydrogen, C_1 - C_{30} alkyl, C_5 - C_{12} cycloalkyl, phenyl, C_7 - C_9 phenylalkyl or a group of the formula (c-I), and

b_3 is a number from 1 to 50;

a compound of the formula (C-5)

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(C-5)

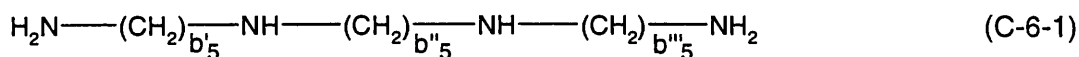
in which

R_{25} , R_{26} , R_{27} , R_{28} and R_{29} independently of one another are a direct bond or C_1 - C_{10} alkylene,

R_{30} has one of the meanings of R_6 , and

b_4 is a number from 1 to 50; and

a product (C-6) obtainable by reacting a product, obtained by reaction of a polyamine of the formula (C-6-1) with cyanuric chloride, with a compound of the formula (C-6-2)



in which

b'_5 , b''_5 and b'''_5 independently of one another are a number from 2 to 12,

R_{31} is hydrogen, C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, phenyl or C_7 - C_9 phenylalkyl, and

R_{32} has one of the meanings of R_6 .

When the agricultural article according to the present invention contains a polyolefin, the presence of an oxidizable unsaturated compound, in particular natural rubber, styrene butadiene resin, fat or oil, is preferably disclaimed.

An agricultural article which is free of an oxidizable unsaturated compound, in particular natural rubber, styrene butadiene resin, fat or oil, is of special interest.

Examples of alkyl having up to 30 carbon atoms are methyl, ethyl, propyl, isopropyl, n-butyl, sec-butyl, isobutyl, tert-butyl, 2-ethylbutyl, n-pentyl, isopentyl, 1-methylpentyl, 1,3-dimethylbutyl, n-hexyl, 1-methylhexyl, n-heptyl, isoheptyl, 1,1,3,3-tetramethylbutyl, 1-methylheptyl, 3-methylheptyl, n-octyl, 2-ethylhexyl, 1,1,3-trimethylhexyl, 1,1,3,3-tetramethylpentyl, nonyl, decyl, undecyl, 1-methylundecyl, dodecyl, 1,1,3,3,5,5-hexamethylhexyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, eicosyl, docosyl and triacontyl. One of the preferred definitions of A_8 , E_1 , E_8 , E_{12} , E_{13} , E_{16} , E_{18} , E_{22} , E_{23} , E_{25} , E_{29} , R_6 , R_{13} , R_{16} , R_{18} , R_{30} and R_{32} is C_1 - C_4 alkyl, especially methyl. R_{31} is preferably butyl.

Examples of alkoxy having up to 18 carbon atoms are methoxy, ethoxy, propoxy, isopropoxy, butoxy, isobutoxy, pentoxy, isopentoxy, hexoxy, heptoxy, octoxy, decyloxy, dodecyloxy, tetradecyloxy, hexadecyloxy and octadecyloxy. One of the preferred meanings of E_1 is octoxy. E_{24} is preferably C_1 - C_4 alkoxy and one of the preferred meanings of R_6 is propoxy.

Examples of C_5 - C_{12} cycloalkyl are cyclopentyl, cyclohexyl, cycloheptyl, cyclooctyl and cyclododecyl. C_5 - C_8 Cycloalkyl, especially cyclohexyl, is preferred.

C_1 - C_4 Alkyl-substituted C_5 - C_{12} cycloalkyl is for example methylcyclohexyl or dimethylcyclohexyl.

Examples of C_5 - C_{12} cycloalkoxy are cyclopentoxy, cyclohexoxy, cycloheptoxy, cyclooctoxy, cyclodecyloxy and cyclododecyloxy. C_5 - C_8 Cycloalkoxy, in particular cyclopentoxy and cyclohexoxy, is preferred.

-OH- and/or C_1 - C_{10} alkyl-substituted phenyl is for example methylphenyl, dimethylphenyl, trimethylphenyl, tert-butylphenyl or 3,5-di-tert-butyl-4-hydroxyphenyl.

Examples of C₇-C₉phenylalkyl are benzyl and phenylethyl.

C₇-C₉Phenylalkyl which is substituted on the phenyl radical by -OH and/or by alkyl having up to 10 carbon atoms is for example methylbenzyl, dimethylbenzyl, trimethylbenzyl, tert-butylbenzyl or 3,5-di-tert-butyl-4-hydroxybenzyl.

Examples of alkenyl having up to 10 carbon atoms are allyl, 2-methallyl, butenyl, pentenyl and hexenyl. Allyl is preferred. The carbon atom in position 1 is preferably saturated.

Examples of acyl containing not more than 8 carbon atoms are formyl, acetyl, propionyl, butyryl, pentanoyl, hexanoyl, heptanoyl, octanoyl, acryloyl, methacryloyl and benzoyl. C₁-C₈Alkanoyl, C₃-C₈alkenyl and benzoyl are preferred. Acetyl and acryloyl are especially preferred.

Examples of alkylene having up to 22 carbon atoms are methylene, ethylene, propylene, trimethylene, tetramethylene, pentamethylene, 2,2-dimethyltrimethylene, hexamethylene, trimethylhexamethylene, octamethylene and decamethylene.

An example of C₃-C₁₀alkylidene is the group $\begin{array}{c} \text{CH}_3 \\ | \\ \text{---C---} \\ | \\ \text{CH}_3 \end{array}$.

An example of C₄-C₁₀alkanetetrayl is 1,2,3,4-butanetetrayl.

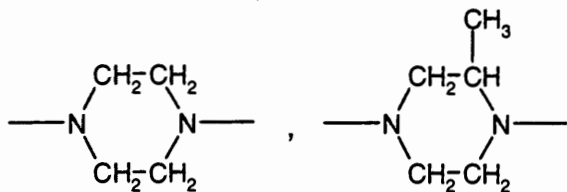
An example of C₅-C₇cycloalkylene is cyclohexylene.

An example of C₁-C₄alkylenedi(C₅-C₇cycloalkylene) is methylenedicyclohexylene.

An example of phenylenedi(C₁-C₄alkylene) is methylene-phenylene-methylene or ethylene-phenylene-ethylene.

Where the radicals R₁, R₂ and R₃, together with the nitrogen atoms to which they are attached, form a 5- to 10-membered heterocyclic ring, this ring is for example

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A 6-membered heterocyclic ring is preferred.

Where the radicals R_4 and R_5 , together with the nitrogen atom to which they are attached, form a 5- to 10-membered heterocyclic ring, this ring is for example 1-pyrrolidyl, piperidino, morpholino, 1-piperazinyl, 4-methyl-1-piperazinyl, 1-hexahydroazepinyl, 5,5,7-trimethyl-1-homopiperazinyl or 4,5,5,7-tetramethyl-1-homopiperazinyl. Morpholino is particularly preferred.

One of the preferred definitions of R_{19} and R_{23} is phenyl.

R_{26} is preferably a direct bond.

n_1 , n_2 , n_2^* and n_4 are preferably a number from 2 to 25, in particular 2 to 20.

n_3 is preferably a number from 1 to 25, in particular 1 to 20 or 2 to 20.

b_1 and b_2 are preferably a number from 2 to 25, in particular 2 to 20.

b_3 and b_4 are preferably a number from 1 to 25, in particular 1 to 20 or 2 to 20.

b'_5 and b''_5 are preferably 3 and b'''_5 is preferably 2.

A_8 is preferably hydrogen, C_1 - C_4 alkyl, C_1 - C_{10} alkoxy, cyclohexyloxy, allyl, benzyl or acetyl.

E_1 , E_8 , E_{12} , E_{13} , E_{16} , E_{18} , E_{22} , E_{23} , E_{25} and E_{29} are preferably hydrogen, C_1 - C_4 alkyl, C_1 - C_{10} alkoxy, cyclohexyloxy, allyl, benzyl or acetyl.

R_6 , R_{13} , R_{16} , R_{18} , R_{30} and R_{32} are preferably hydrogen, C_1 - C_4 alkyl, C_1 - C_{10} alkoxy, cyclohexyloxy, allyl, benzyl or acetyl.

A_8 , E_1 , E_8 , E_{12} , E_{13} , E_{16} , E_{18} , E_{22} , E_{23} , E_{25} , E_{29} , R_6 , R_{13} , R_{16} , R_{18} , R_{30} and R_{32} are preferably hydrogen or methyl and E_1 and R_6 additionally are C_1 - C_8 alkoxy.

The compounds described above as component (III) are essentially known and commercially available. All of them can be prepared by known processes.

The preparation of the compounds of the formulae (A-1), (A-2-a), (A-2-b), (A-3) and (A-4) is disclosed, for example, in US-A-4,233,412, US-A-4,340,534, WO-A-98/51,690 and EP-A-1,803.

The preparation of the compounds of the formulae (B-1), (B-2), (B-3), (B-4), (B-5), (B-6), (B-7), (B-8), (B-9) and (B-10) is disclosed, for example, in US-A-5,679,733, US-A-3,640,928, US-A-4,198,334, US-A-5,204,473, US-A-4,619,958, US-A-4,110,306, US-A-4,110,334, US-A-4,689,416, US-A-4,408,051, SU-A-768,175 (Derwent 88-138,751/20), US-A-5,049,604, US-A-4,769,457, US-A-4,356,307, US-A-4,619,956, US-A-5,182,390, GB-A-2,269,819, US-A-4,292,240, US-A-5,026,849, US-A-5,071,981, US-A-4,547,538 and US-A-4,976,889.

The preparation of the compounds of the formulae (C-1), (C-2), (C-3), (C-4) and (C-5) as well as the product (C-6) is disclosed, for example, in US-A-4,086,204, US-A-6,046,304, US-A-4,331,586, US-A-4,108,829, US-A-5,051,458, WO-A-94/12,544 (Derwent 94-177,274/22), DD-A-262,439 (Derwent 89-122,983/17), US-A-4,857,595, US-A-4,529,760 and US-A-4,477,615 and CAS 136,504-96-6.

The product (C-6) can be prepared analogously to known processes, for example by reacting a polyamine of formula (C-6-1) with cyanuric chloride in a molar ratio of from 1:2 to 1:4 in the presence of anhydrous lithium carbonate, sodium carbonate or potassium carbonate in an organic solvent such as 1,2-dichloroethane, toluene, xylene, benzene, dioxane or tert-amyl alcohol at a temperature of from -20°C to +10°C, preferably from -10°C to +10°C, in particular from 0°C to +10°C, for from 2 to 8 hours, followed by reaction of the resultant product with a 2,2,6,6-tetramethyl-4-piperidylamine of the formula (C-6-2). The molar ratio of the 2,2,6,6-tetramethyl-

4-piperidylamine to polyamine of the formula (C-6-1) employed is for example from 4:1 to 8:1. The quantity of the 2,2,6,6-tetramethyl-4-piperidylamine can be added in one portion or in more than one portion at intervals of a few hours.

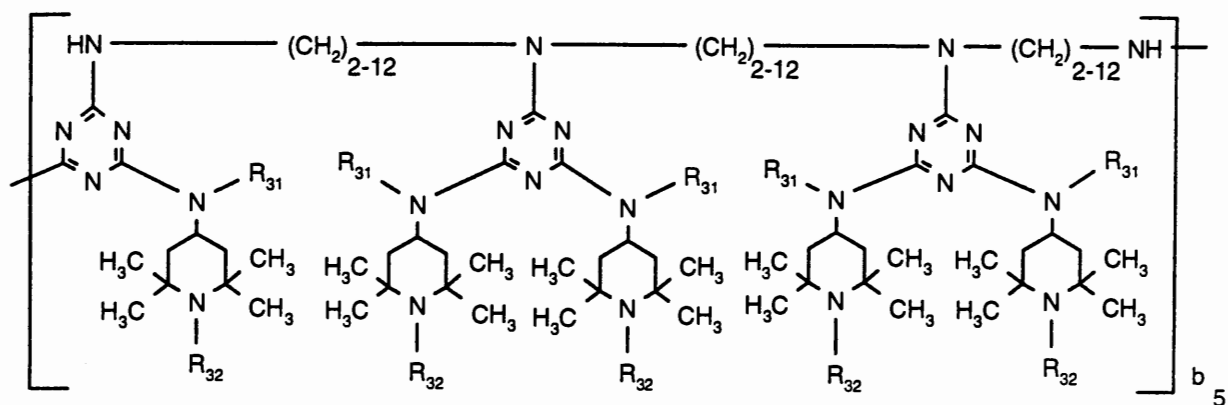
The molar ratio of polyamine of the formula (C-6-1) to cyanuric chloride to 2,2,6,6-tetramethyl-4-piperidylamine of the formula (C-6-2) is preferably from 1:3:5 to 1:3:6.

The following example indicates one way of preparing a preferred product (C-6-a).

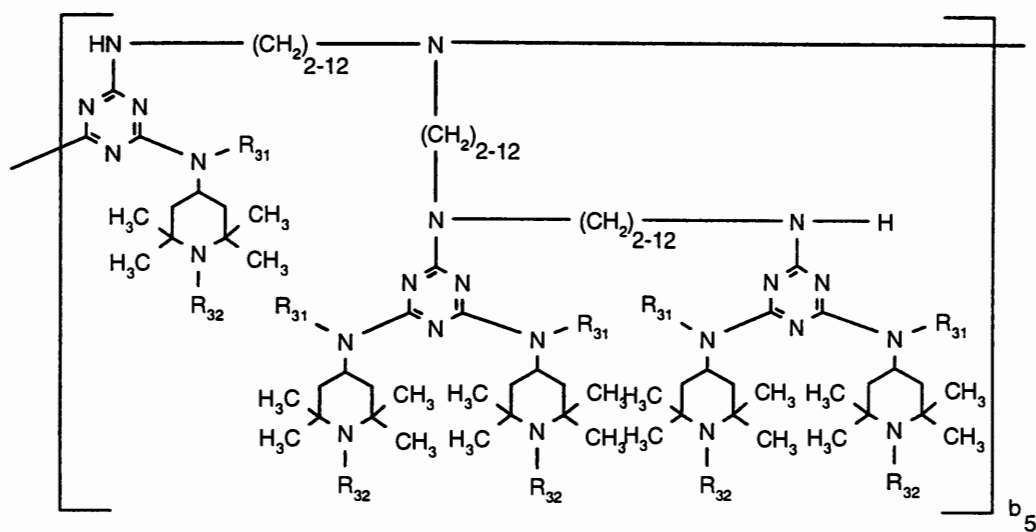
Example: 23.6 g (0.128 mol) of cyanuric chloride, 7.43 g (0.0426 mol) of N,N'-bis[3-aminopropyl]ethylenediamine and 18 g (0.13 mol) of anhydrous potassium carbonate are reacted at 5°C for 3 hours with stirring in 250 ml of 1,2-dichloroethane. The mixture is warmed at room temperature for a further 4 hours. 27.2 g (0.128 mol) of N-(2,2,6,6-tetramethyl-4-piperidyl)butylamine are added and the resultant mixture is warmed at 60°C for 2 hours. A further 18 g (0.13 mol) of anhydrous potassium carbonate are added and the mixture is warmed at 60°C for a further 6 hours. The solvent is removed by distillation under a slight vacuum (200 mbar) and replaced by xylene. 18.2 g (0.085 mol) of N-(2,2,6,6-tetramethyl-4-piperidyl)butylamine and 5.2 g (0.13 mol) of ground sodium hydroxide are added, the mixture is heated at reflux for 2 hours and, for a further 12 hours, the water formed during the reaction is removed by azeotropic distillation. The mixture is filtered. The solution is washed with water and dried over Na₂SO₄. The solvent is evaporated and the residue is dried at 120-130°C in vacuo (0.1 mbar). The desired product is obtained as a colourless resin.

In general, the product (C-6) can for example be represented by a compound of the formula (C-6- α), (C-6- β) or (C-6- γ). It can also be in the form of a mixture of these three compounds.

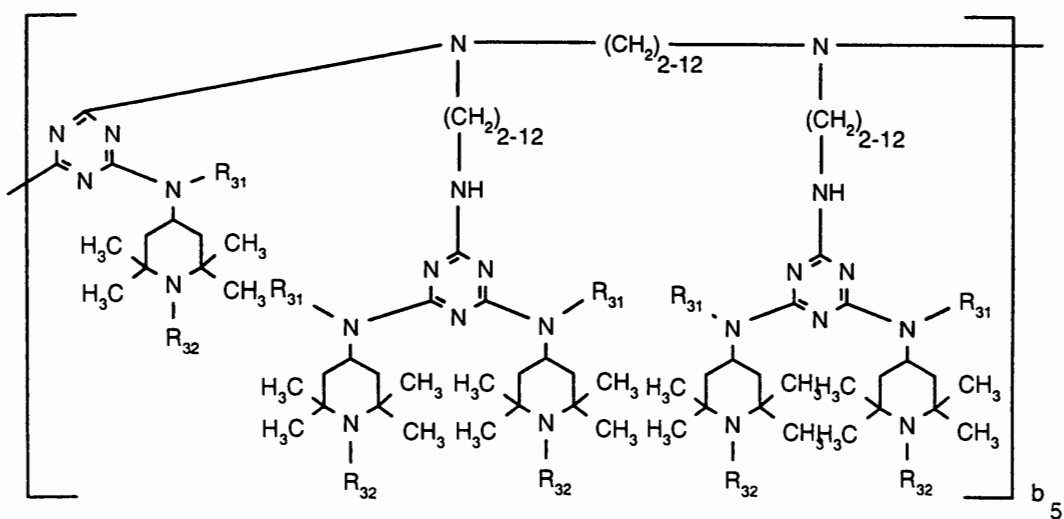
- 17 -



(C-6-α)

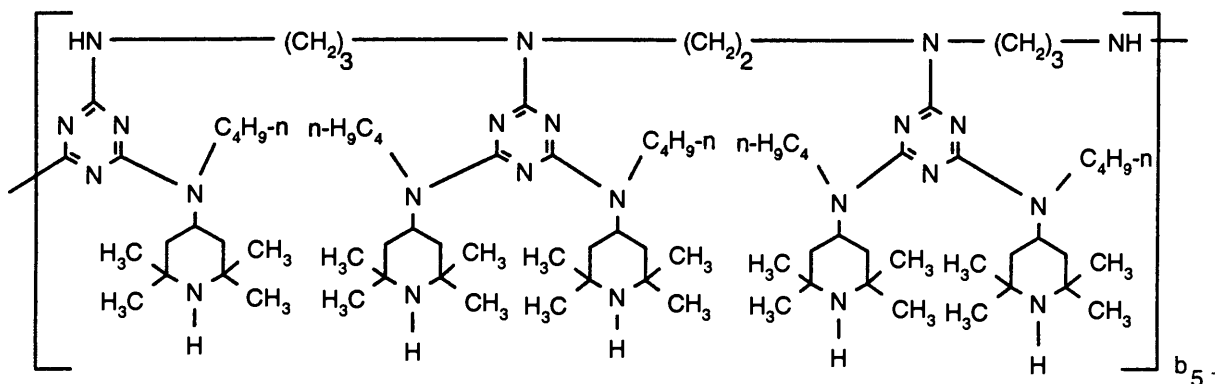


(C-6-β)

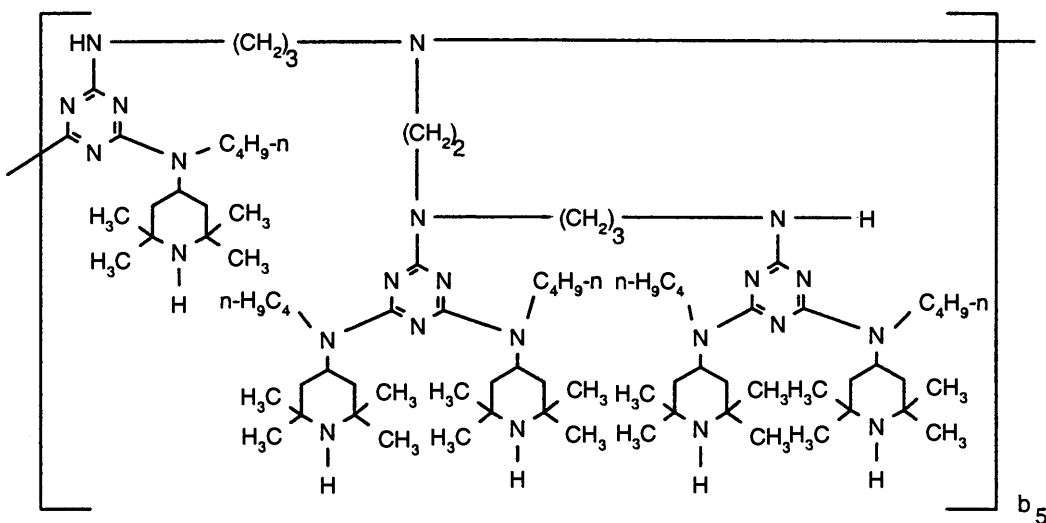


(C-6-γ)

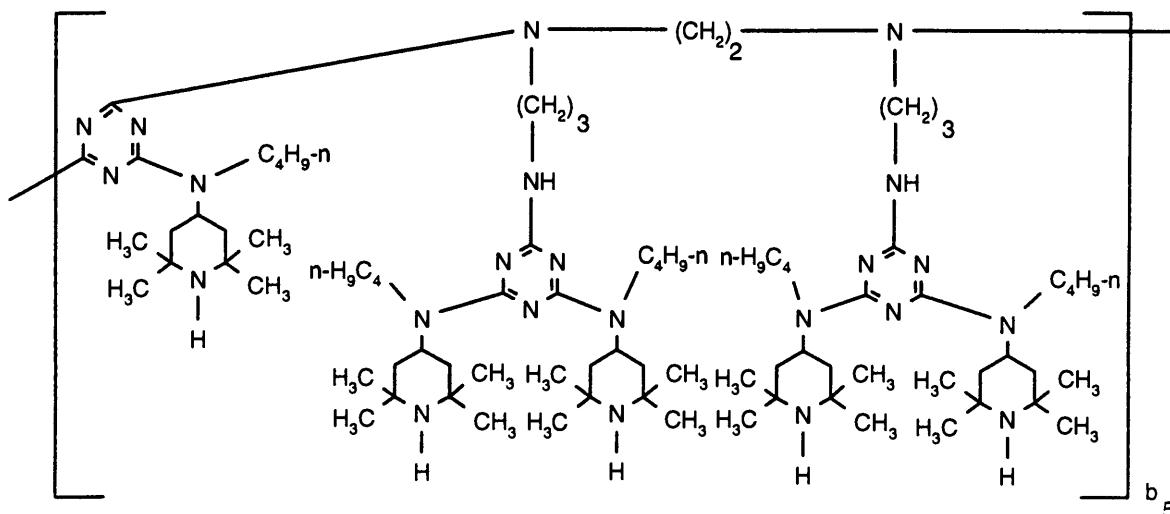
A preferred meaning of the formula (C-6- α) is



A preferred meaning of the formula (C-6- β) is



A preferred meaning of the formula (C-6- γ) is



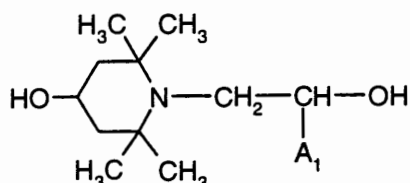
In the above formulae (C-6- α) to (C-6- γ), b_5 is preferably 2 to 20, in particular 2 to 10.

Component (III) is for example TINUVIN 622 (RTM), HOSTAVIN N 30 (RTM), FERRO AM 806 (RTM), DASTIB 845 (RTM), TINUVIN 770 (RTM), TINUVIN 765 (RTM), TINUVIN 144 (RTM), TINUVIN 123 (RTM), ADK STAB LA 52 (RTM), ADK STAB LA 57 (RTM), ADK STAB LA 62 (RTM), ADK STAB LA 67 (RTM), HOSTAVIN N 20 (RTM), HOSTAVIN N 24 (RTM), SANDUVOR 3050 (RTM), DIACETAM 5 (RTM), SUMISORB TM 61 (RTM), UVINUL 4049 (RTM), SANDUVOR PR 31 (RTM), GOODRITE UV 3034 (RTM), GOODRITE UV 3150 (RTM), GOODRITE UV 3159 (RTM), GOODRITE 3110 x 128 (RTM), UVINUL 4050 H (RTM), CHIMASSORB 944 (RTM), CHIMASSORB 2020 (RTM), CYASORB UV 3346 (RTM), CYASORB UV 3529 (RTM), DASTIB 1082 (RTM), CHIMASSORB 119 (RTM), UVASIL 299 (RTM), UVASIL 125 (RTM), UVASIL 2000 (RTM), UVINUL 5050 H (RTM), LICHTSCHUTZSTOFF UV 31 (RTM), LUCHEM HA B 18 (RTM), ADK STAB LA 63 (RTM), ADK STAB LA 68 (RTM), UVASORB HA 88 (RTM).

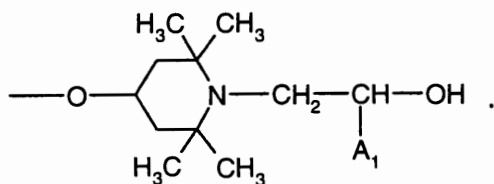
The meanings of the terminal groups which saturate the free valences in the compounds of the formulae (A-1), (A-2-a), (A-2-b), (A-4), (C-1), (C-3), (C-4), (C-5), (C-6- α), (C-6- β) and (C-6- γ) depend on the processes used for their preparation. The terminal groups can also be modified after the preparation of the compounds.

- 20 -

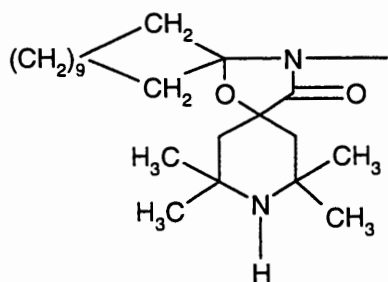
If the compounds of the formula (A-1) are prepared, for example, by reacting a compound of the formula



in which A_1 is hydrogen or methyl, with a dicarboxylic acid diester of the formula $Y-OOC-A_2-COO-Y$, in which Y is, for example, methyl, ethyl or propyl, and A_2 is as defined above, the terminal group bonded to the 2,2,6,6-tetramethyl-4-oxypiperidin-1-yl radical is hydrogen or $-CO-A_2-COO-Y$, and the terminal group bonded to the diacyl radical is $-O-Y$ or



In the compounds of the formula (A-2-a), the terminal group bonded to the nitrogen can be, for example, hydrogen and the terminal group bonded to the 2-hydroxypropylene radical can be, for example, a

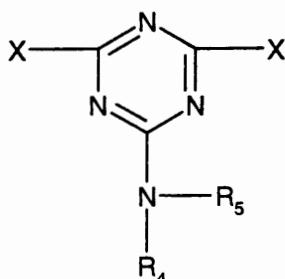


group.

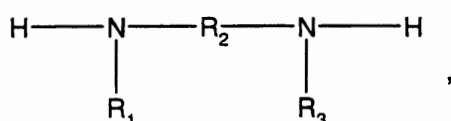
In the compounds of the formula (A-2-b), the terminal group bonded to the dimethylene radical can be, for example, $-OH$, and the terminal group bonded to the oxygen can be, for example, hydrogen. The terminal groups can also be polyether radicals.

In the compounds of the formula (A-4), the end group bonded to the $-\text{CH}_2-$ residue can be, for example, hydrogen and the end group bonded to the $-\text{CH}(\text{CO}_2\text{A}_7)$ residue can be, for example, $-\text{CH}=\text{CH}-\text{COOA}_7$.

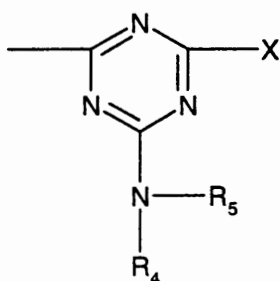
If the compounds of the formula (C-1) are prepared by reacting a compound of the formula



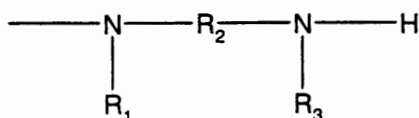
in which X is, for example, halogen, in particular chlorine, and R_4 and R_5 are as defined above, with a compound of the formula



in which R_1 , R_2 and R_3 are as defined above, the terminal group bonded to the diamino radical is hydrogen or

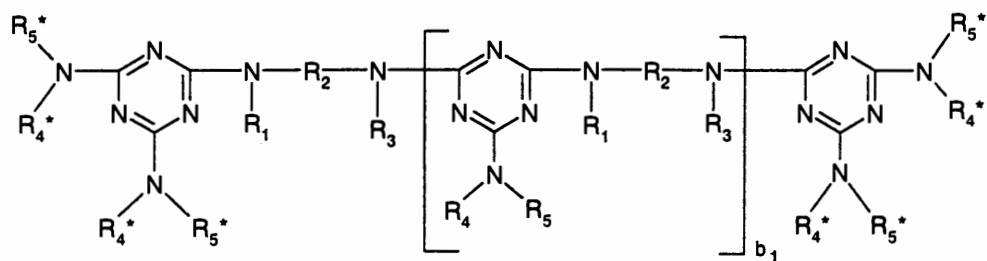


and the terminal group bonded to the triazine radical is X or



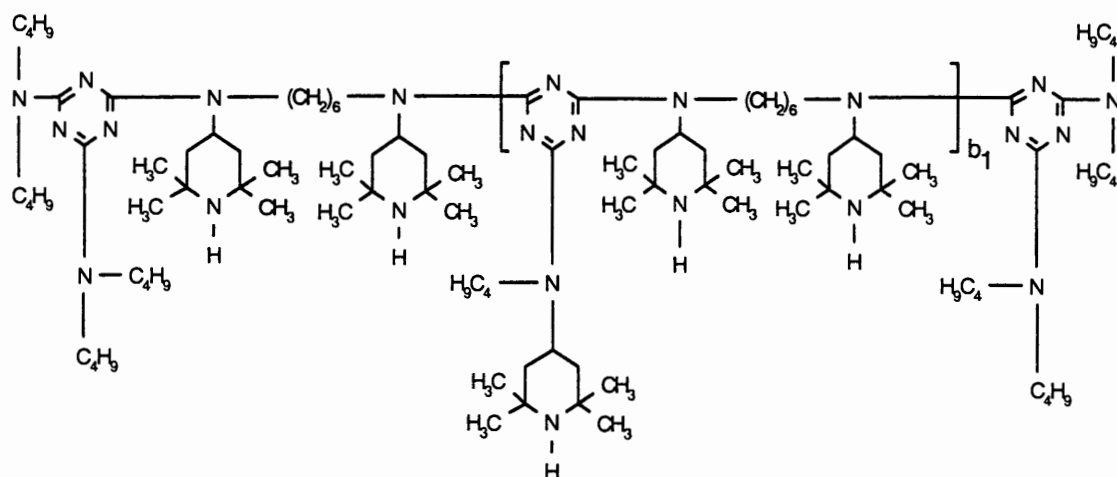
If X is halogen, it is advantageous to replace this, for example, by $-\text{OH}$ or an amino group when the reaction is complete. Examples of amino groups which may be mentioned are pyrrolidin-1-yl, morpholino, $-\text{NH}_2$, $-\text{N}(\text{C}_1\text{-C}_8\text{alkyl})_2$ and $-\text{NR}(\text{C}_1\text{-C}_8\text{alkyl})$, in which R is hydrogen or a group of the formula (c-I).

The compounds of the formula (C-1) also cover compounds of the formula



wherein R_1 , R_2 , R_3 , R_4 , R_5 and b_1 are as defined above and R_4^* has one of the meanings of R_4 and R_5^* has one of the meanings of R_5 .

One of the particularly preferred compounds of the formula (C-1) is



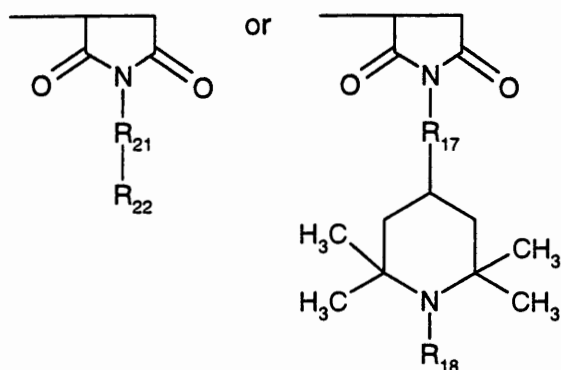
The preparation of this compound is described in Example 10 of US-A-6,046,304.

In the compounds of the formula (C-3), the terminal group bonded to the silicon atom can be, for example, $(R_{14})_3Si-O-$, and the terminal group bonded to the oxygen can be, for example, $-Si(R_{14})_3$.

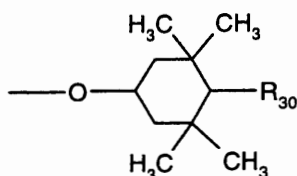
The compounds of the formula (C-3) can also be in the form of cyclic compounds if b_2 is a number from 3 to 10, i.e. the free valences shown in the structural formula then form a direct bond.

In the compounds of the formula (C-4), the terminal group bonded to the 2,5-dioxopyrrolidine ring is, for example, hydrogen, and the terminal group bonded to the $-C(R_{23})(R_{24})-$ radical is, for example,

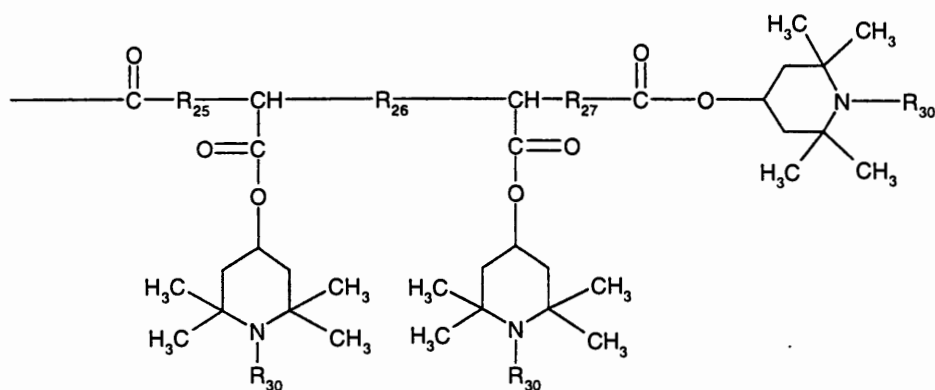
- 23 -



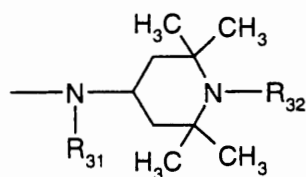
In the compounds of the formula (C-5), the terminal group bonded to the carbonyl radical is, for example,



and the terminal group bonded to the oxygen radical is, for example,

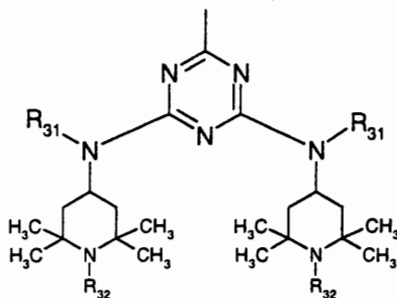


In the compounds of the formulae (C-6- α), (C-6- β) and (C-6- γ), the terminal group bonded to the triazine radical is, for example, Cl or a



group, and the terminal group bonded to the amino radical is, for example, hydrogen or a

- 24 -



group.

According to a preferred embodiment

A₁ is hydrogen or methyl,

A₂ is a direct bond or C₂-C₆alkylene, and

n₁ is a number from 2 to 25;

n₂ and n₂^{*} are a number from 2 to 25;

A₃ and A₄ independently of one another are hydrogen or C₁-C₄alkyl, or A₃ and A₄ together form a C₉-C₁₃alkylene group, and

the variables n₃ independently of one another are a number from 1 to 25;

n₄ is a number from 2 to 25,

A₅ and A₆ independently of one another are C₁-C₄alkyl, and

A₇ is C₁-C₄alkyl or a group of the formula (a-I)

with the proviso that at least 50 % of the radicals A₇ are a group of the formula (a-I);

m₁ is 1, 2 or 4,

if m₁ is 1, E₂ is C₁₂-C₂₀alkyl,

if m₁ is 2, E₂ is C₂-C₁₀alkylene or a group of the formula (b-I),

E₃ is C₁-C₄alkyl,

E₄ is C₁-C₆alkylene, and

E₅ and E₆ independently of one another are C₁-C₄alkyl, and

if m₁ is 4, E₂ is C₄-C₈alkanetetrayl;

two of the radicals E₇ are -COO-(C₁₀-C₁₅alkyl), and

two of the radicals E₇ are a group of the formula (b-II);

E₉ and E₁₀ together form C₉-C₁₃alkylene,

E₁₁ is hydrogen or a group -Z₁-COO-Z₂,

Z₁ is C₂-C₆alkylene, and

Z₂ is C₁₀-C₁₆alkyl;

- 25 -

E_{14} is hydrogen, and

E_{15} is C_2 - C_6 alkylene or C_3 - C_5 alkylidene;

E_{17} is C_{10} - C_{14} alkyl;

E_{24} is C_1 - C_4 alkoxy;

m_2 is 1, 2 or 3,

when m_2 is 1, E_{26} is a group $—CH_2CH_2—NH—$ , ,

when m_2 is 2, E_{26} is C_2 - C_6 alkylene, and

when m_2 is 3, E_{26} is a group of the formula (b-IV)

the radicals E_{27} independently of one another are C_2 - C_6 alkylene, and

the radicals E_{28} independently of one another are C_1 - C_4 alkyl or C_5 - C_8 cycloalkyl; and

E_{30} is C_2 - C_8 alkylene;

R_1 and R_3 independently of one another are a group of the formula (c-I),

R_2 is C_2 - C_8 alkylene,

R_4 and R_5 independently of one another are hydrogen, C_1 - C_{12} alkyl, C_5 - C_8 cycloalkyl or a

group of the formula (c-I), or the radicals R_4 and R_5 , together with the nitrogen atom to which they are bonded, form a 5- to 10-membered heterocyclic ring, and

b_1 is a number from 2 to 25;

R_7 and R_{11} independently of one another are hydrogen or C_1 - C_4 alkyl,

R_8 , R_9 and R_{10} independently of one another are C_2 - C_4 alkylene, and

X_1 , X_2 , X_3 , X_4 , X_5 , X_6 , X_7 and X_8 independently of one another are a group of the formula (c-II),

R_{12} is hydrogen, C_1 - C_4 alkyl, C_5 - C_8 cycloalkyl or a group of the formula (c-I);

R_{14} is C_1 - C_4 alkyl,

R_{15} is C_3 - C_6 alkylene, and

b_2 is a number from 2 to 25;

R_{17} and R_{21} independently of one another are a direct bond or a group

$—N(X_9)—CO—X_{10}—CO—N(X_{11})—$,

X_9 and X_{11} independently of one another are hydrogen or C_1 - C_4 alkyl,

X_{10} is a direct bond,

R_{19} and R_{23} are C_1 - C_{25} alkyl or phenyl,

R_{20} and R_{24} are hydrogen or C_1 - C_4 alkyl,

R_{22} is C_1 - C_{25} alkyl or a group of the formula (c-I), and

b_3 is a number from 1 to 25;

- 26 -

R_{25} , R_{26} , R_{27} , R_{28} and R_{29} independently of one another are a direct bond or C_1 - C_4 alkylene, and

b_4 is a number from 1 to 25;

b'_5 , b''_5 and b'''_5 independently of one another are a number from 2 to 4, and

R_{31} is hydrogen, C_1 - C_4 alkyl, C_5 - C_8 cycloalkyl, phenyl or benzyl.

An agricultural article of interest is one wherein

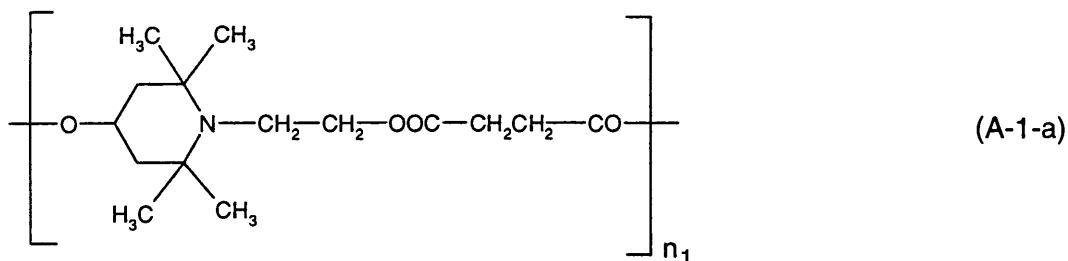
component (III) is one or more sterically hindered amine compounds selected from the group consisting of the compounds of the formulae

(A-1-a), (A-2-a), (A-2-b), (A-3-a), (A-4-a),

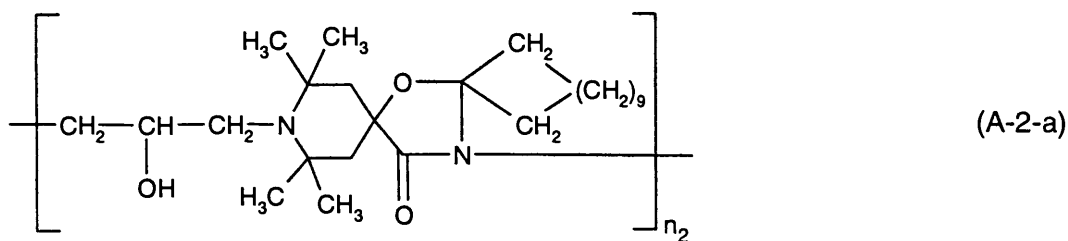
(B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),

(B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),

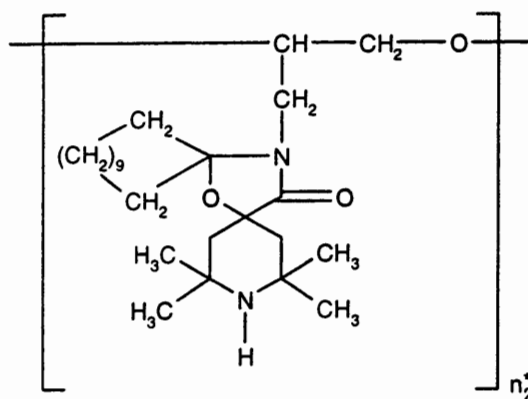
(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a product (C-6-a);



wherein n_1 is a number from 2 to 20;

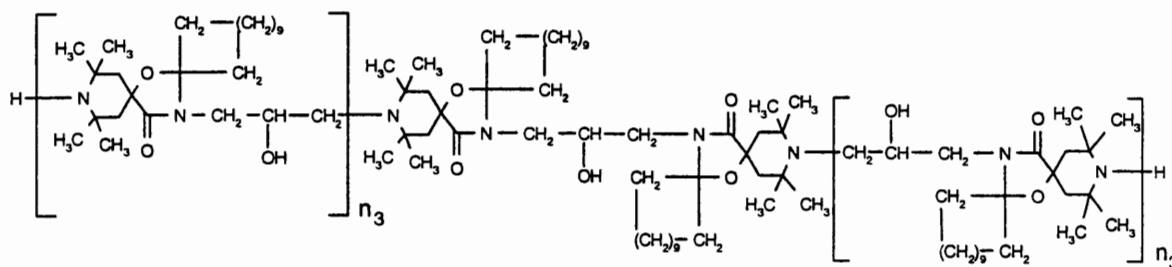


- 27 -



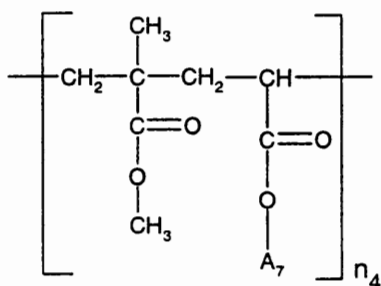
(A-2-b)

wherein n_2 and n_2^* are a number from 2 to 20;



(A-3-a)

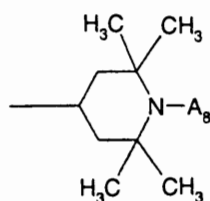
wherein the variables n_3 independently of one another are a number from 1 to 20;



(A-4-a)

wherein n_4 is a number from 2 to 20, and

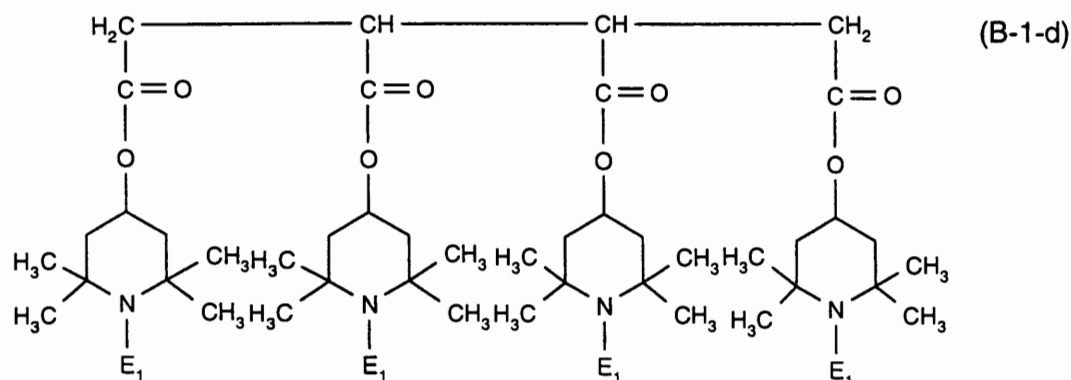
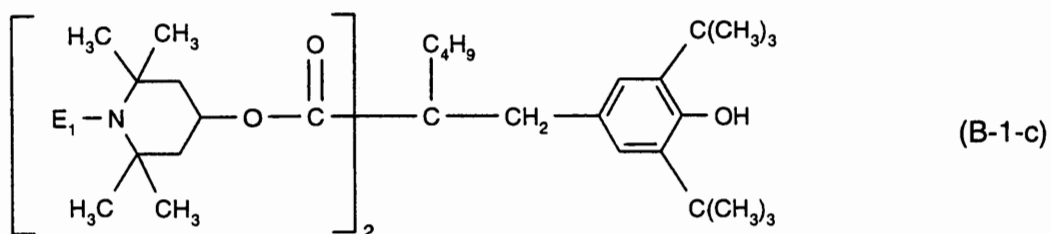
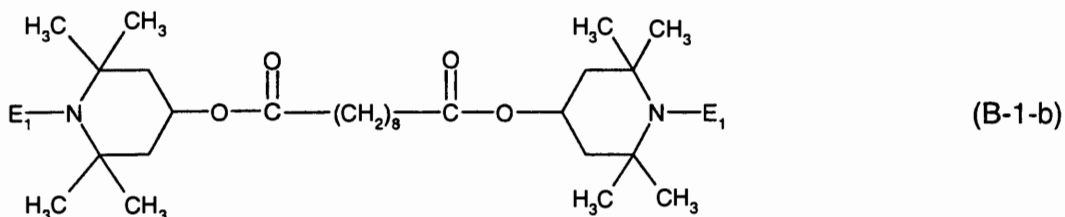
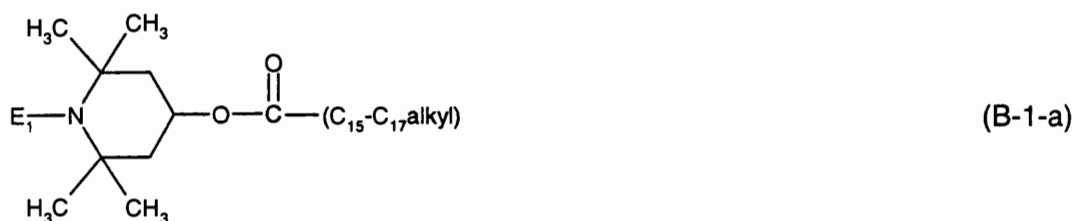
at least 50 % of the radicals A_7 are a group of the formula (a-l)



(a-l)

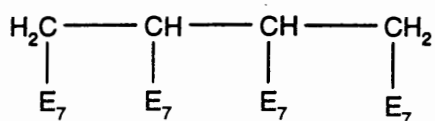
wherein A_8 is hydrogen, C_1 - C_8 alkyl, O , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,

and the remaining radicals A_7 are ethyl;



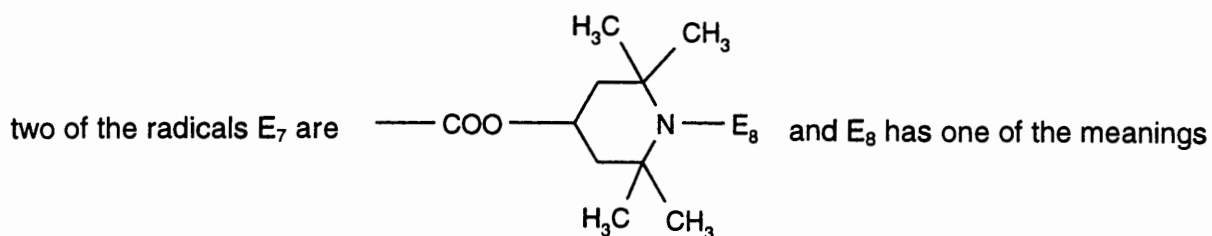
wherein E_1 is hydrogen, C_1 - C_8 alkyl, O , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl;

- 29 -

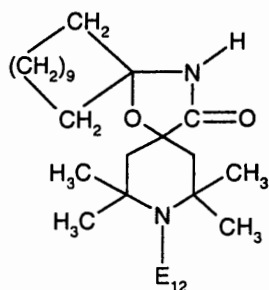


(B-2-a)

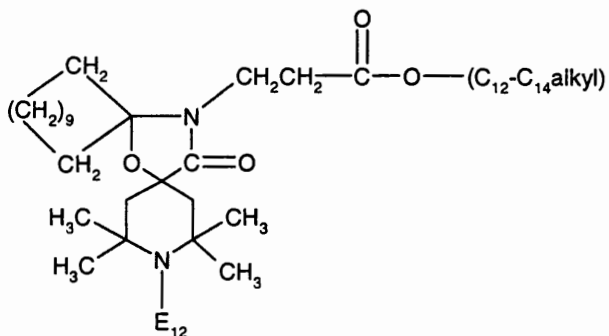
in which two of the radicals E_7 are $-\text{COO}-\text{C}_{13}\text{H}_{27}$ and



of E_1 ;

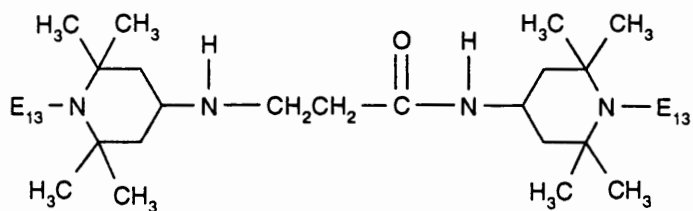


(B-3-a)



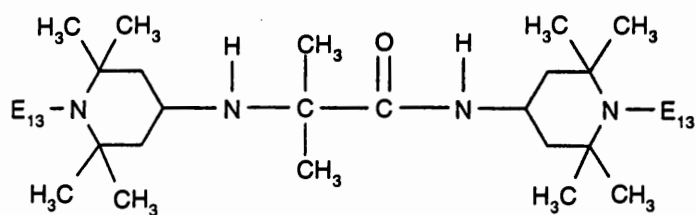
(B-3-b)

wherein E_{12} has one of the meanings of E_1 ;



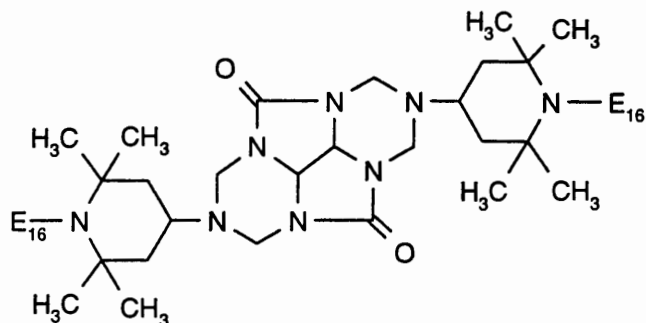
(B-4-a)

- 30 -



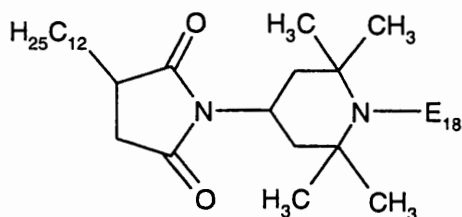
(B-4-b)

wherein E_{13} has one of the meanings of E_1 ;



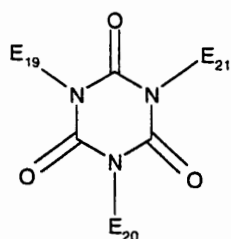
(B-5)

wherein E_{16} has one of the meanings of E_1 ;



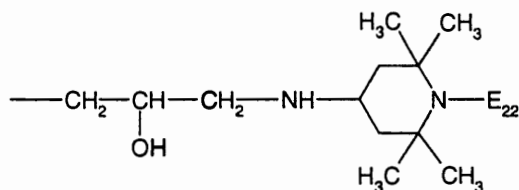
(B-6-a)

wherein E_{18} has one of the meanings of E_1 ;



(B-7)

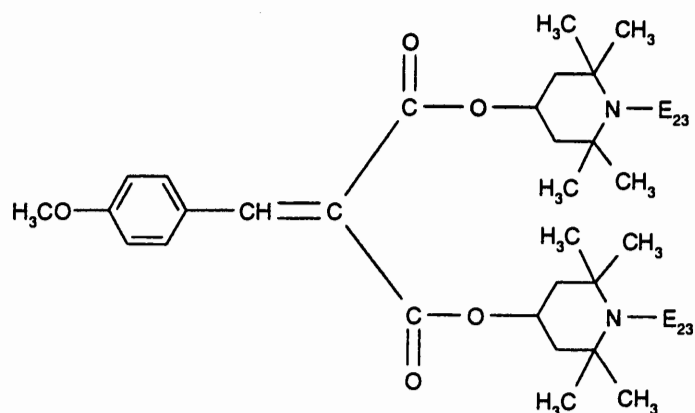
in which E_{19} , E_{20} and E_{21} independently of one another are a group of the formula (b-III)



(b-III)

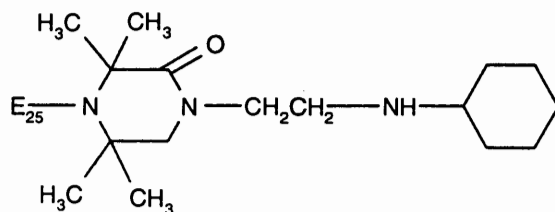
wherein E_{22} has one of the meanings of E_1 ;

- 31 -

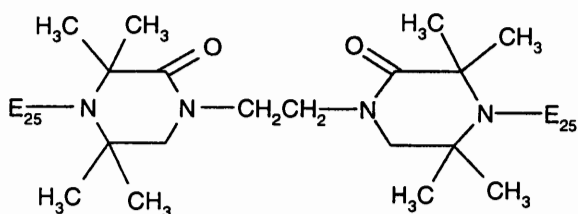


(B-8-a)

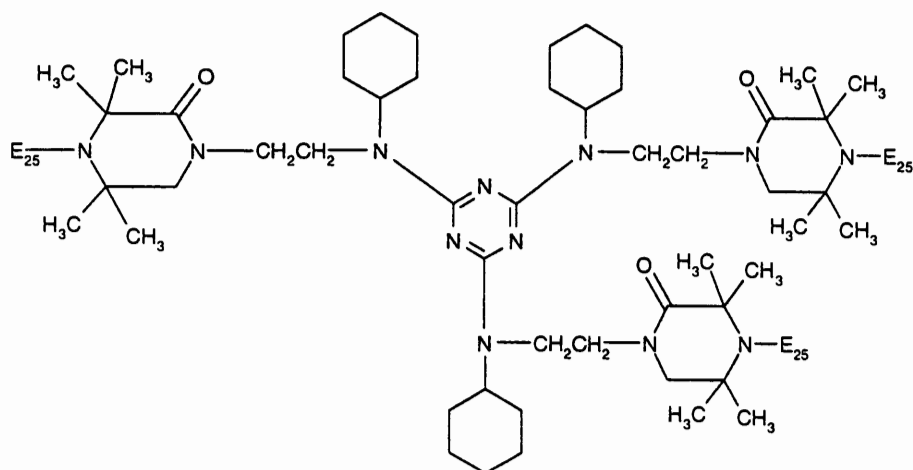
wherein E_{23} has one of the meanings of E_1 ;



(B-9-a)



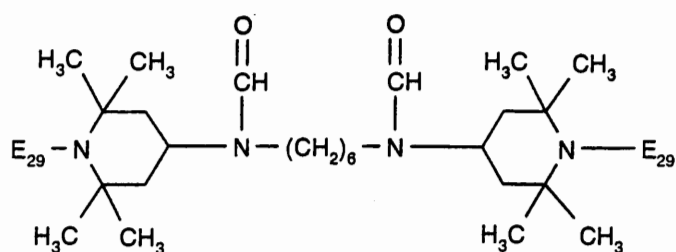
(B-9-b)



(B-9-c)

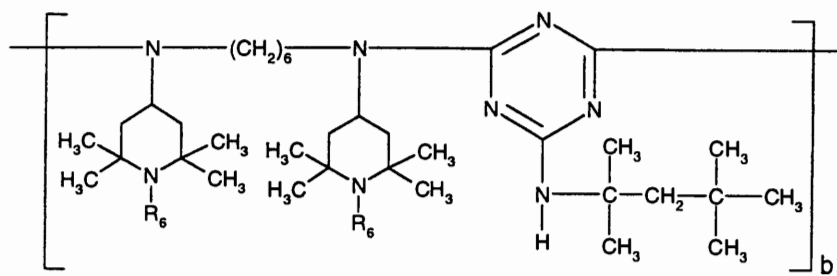
wherein E_{25} has one of the meanings of E_1 ;

- 32 -

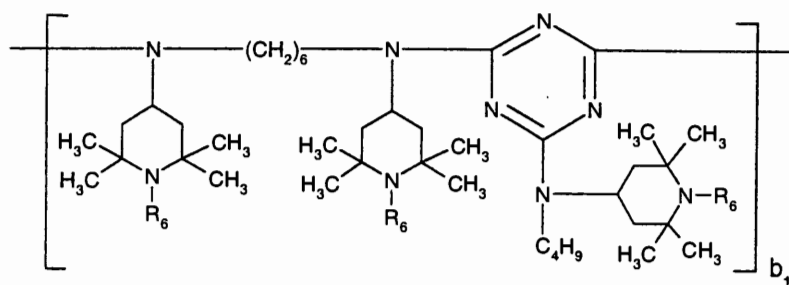


(B-10-a)

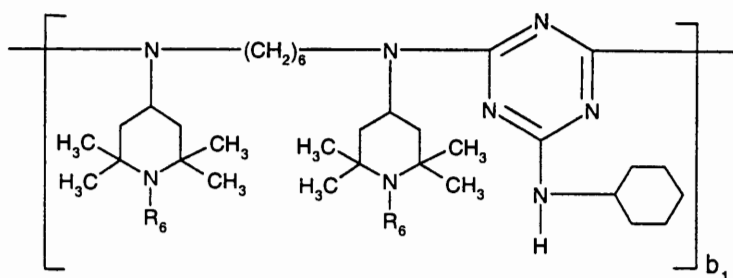
wherein E_{29} has one of the meanings of E_1 ;



(C-1-a)

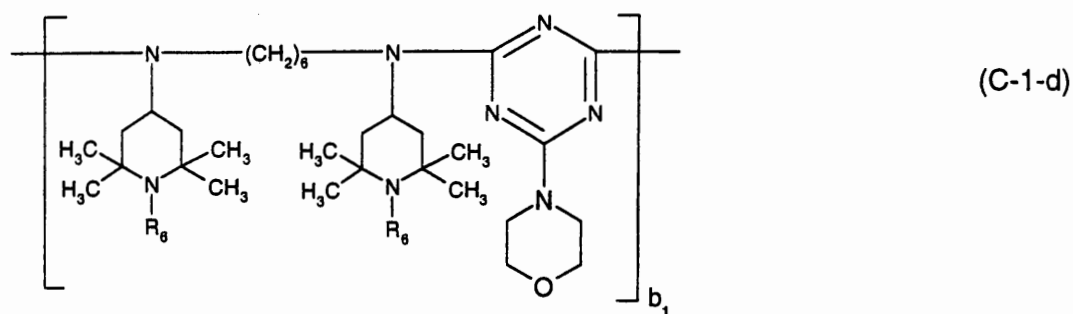


(C-1-b)

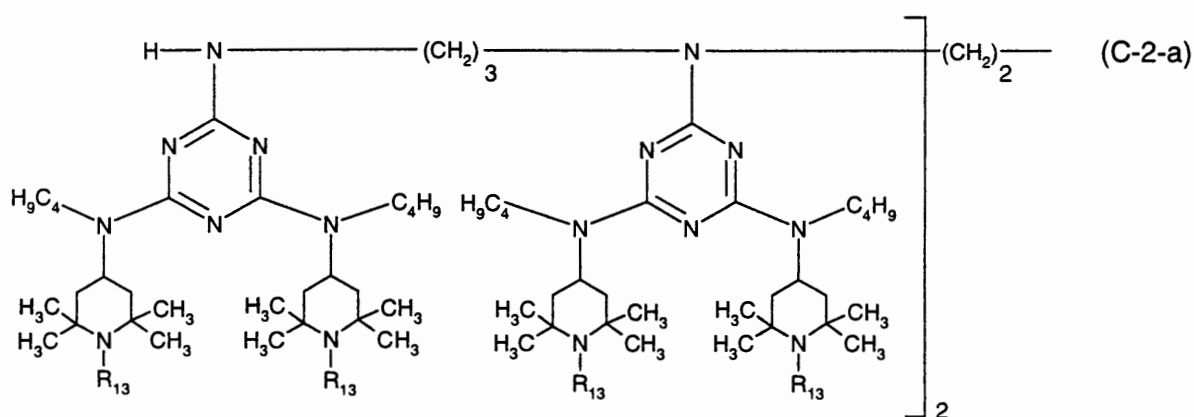


(C-1-c)

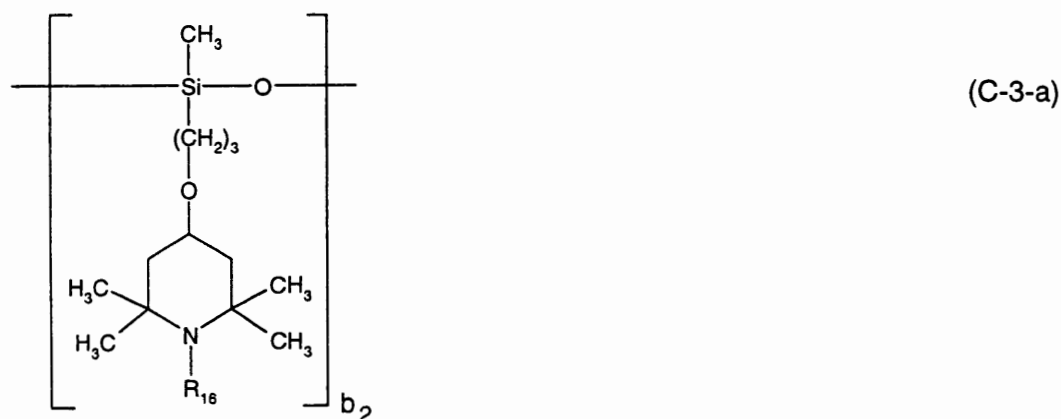
- 33 -



wherein b_1 is a number from 2 to 20 and R_6 is hydrogen, C_1 - C_8 alkyl, O^- , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl;

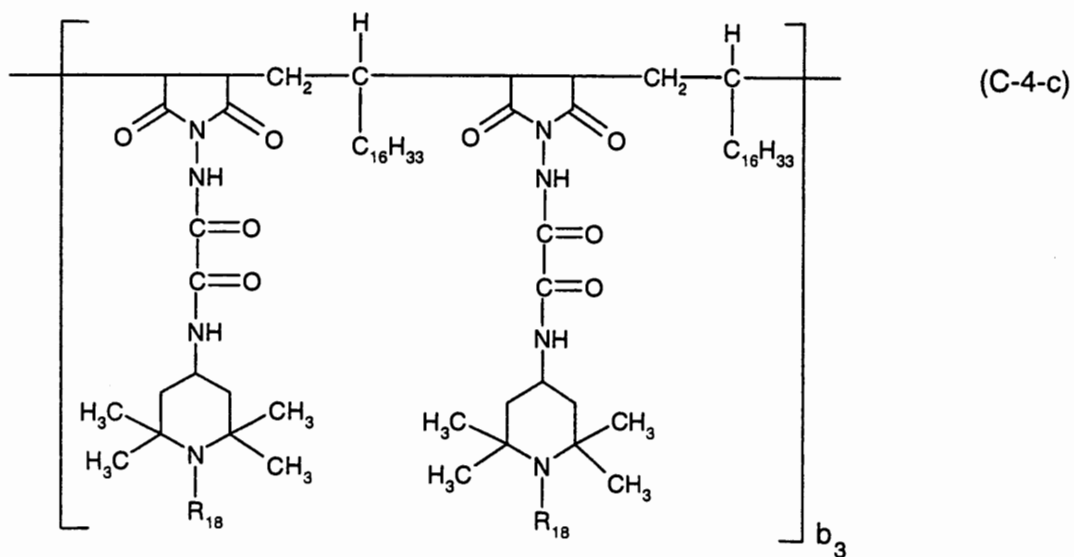
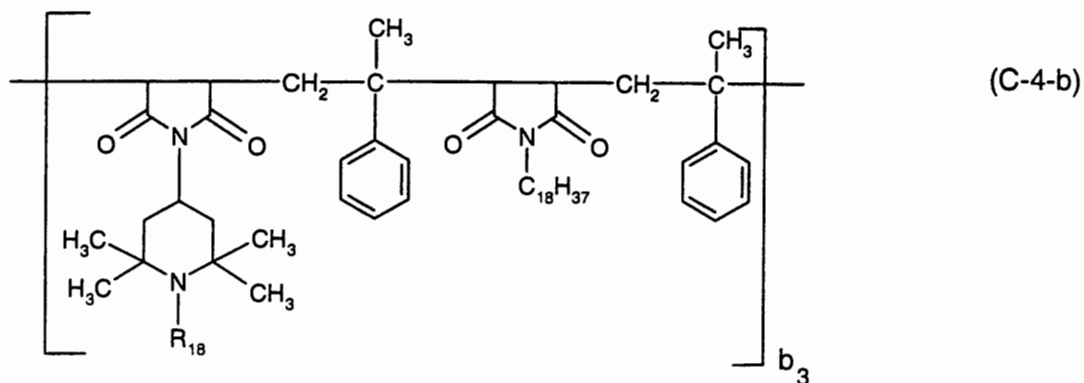
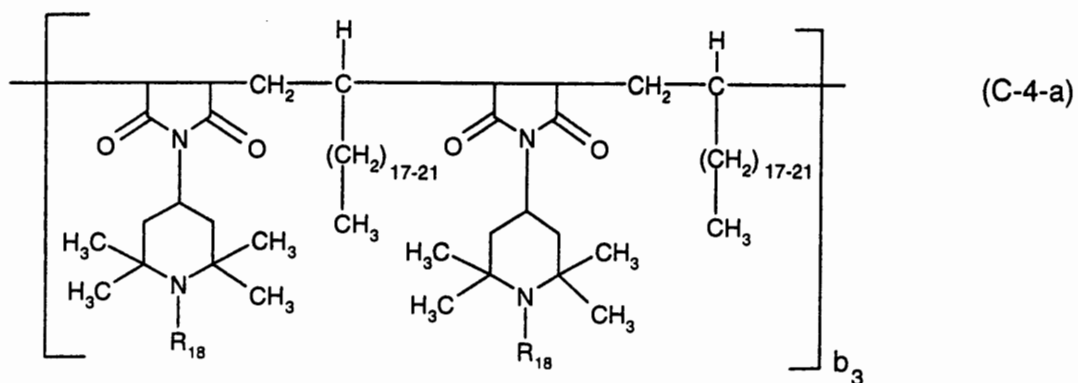


wherein R_{13} has one of the meanings of R_6 ,



wherein b_2 is a number from 2 to 20 and R_{16} has one of the meanings of R_6 ;

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wherein b_3 is a number from 1 to 20 and R_{18} has one of the meanings of R_6 ;

(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a) or (C-5-a) or a product (C-6-a).

An agricultural article which is of interest contains as component (III) two different sterically hindered amine compounds selected from the group consisting of the compounds of the formulae

(A-1-a), (A-2-a), (A-2-b), (A-3-a), (A-4-a),
 (B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),
 (B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),
 (C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a product (C-6-a);

with the proviso that the two different sterically hindered amine compounds are not selected from the same generic formula.

Component (III) is particularly preferred a compound of the formula (A-1-a), or
 a compound of the formula (C-1-a) wherein R_6 is hydrogen, or
 a combination of a compound of the formula (A-1-a) with a compound of the formula (C-1-a) wherein R_6 is hydrogen, or
 a combination of a compound of the formula (A-1-a) with a compound of the formula (C-2-a) wherein R_{13} is methyl, or
 a combination of a compound of the formula (B-1-b) wherein E_1 is hydrogen with a compound of the formula (C-1-a) wherein R_6 is hydrogen.

Component (II) is preferably a C_2 - C_{24} carboxylate of Fe, Ce, Co, Mn, Cu or Vd, in particular Ce, Co or Mn.

C_{10} - C_{20} alkanoates of Ce, Co or Mn or C_{10} - C_{20} alkenoates of Ce, Co or Mn are of particular interest.

Examples of component (II) are stearates, oleates, linoleates, linolenates, neodecanoates, behenates, myristates, erucates and naphthenates of Fe, Ce, Co, Mn, Cu or Vd.

A particular preferred embodiment relates to stearates of Ce, Co or Mn.

Examples of component (I) are :

1. Polymers of monoolefins and diolefins, for example polypropylene, polyisobutylene, polybut-1-ene, poly-4-methylpent-1-ene, polyvinylcyclohexane, polyisoprene or polybutadiene, as well as polymers of cycloolefins, for instance of cyclopentene or norbornene, polyethylene (which optionally can be crosslinked), for example high density polyethylene (HDPE), high density and high molecular weight polyethylene (HDPE-HMW), high density and ultrahigh molecular weight polyethylene (HDPE-UHMW), medium density polyethylene (MDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), (VLDPE) and (ULDPE).

Polyolefins, i.e. the polymers of monoolefins exemplified in the preceding paragraph, preferably polyethylene and polypropylene, can be prepared by different, and especially by the following, methods:

- a) radical polymerisation (normally under high pressure and at elevated temperature).
- b) catalytic polymerisation using a catalyst that normally contains one or more than one metal of groups IVb, Vb, VIb or VIII of the Periodic Table. These metals usually have one or more than one ligand, typically oxides, halides, alcoholates, esters, ethers, amines, alkyls, alkenyls and/or aryls that may be either π - or σ -coordinated. These metal complexes may be in the free form or fixed on substrates, typically on activated magnesium chloride, titanium(III) chloride, alumina or silicon oxide. These catalysts may be soluble or insoluble in the polymerisation medium. The catalysts can be used by themselves in the polymerisation or further activators may be used, typically metal alkyls, metal hydrides, metal alkyl halides, metal alkyl oxides or metal alkyloxanes, said metals being elements of groups Ia, IIa and/or IIIa of the Periodic Table. The activators may be modified conveniently with further ester, ether, amine or silyl ether groups. These catalyst systems are usually termed Phillips, Standard Oil Indiana, Ziegler (-Natta), TNZ (DuPont), metallocene or single site catalysts (SSC).

2. Mixtures of the polymers mentioned under 1), for example mixtures of polypropylene with polyisobutylene, polypropylene with polyethylene (for example PP/HDPE, PP/LDPE) and mixtures of different types of polyethylene (for example LDPE/HDPE).

3. Copolymers of monoolefins and diolefins with each other or with other vinyl monomers, for example ethylene/propylene copolymers, linear low density polyethylene (LLDPE) and mixtures thereof with low density polyethylene (LDPE), propylene/but-1-ene copolymers, propylene/isobutylene copolymers, ethylene/but-1-ene copolymers, ethylene/hexene copolymers, ethylene/methylpentene copolymers, ethylene/heptene copolymers, ethylene/octene copolymers, ethylene/vinylcyclohexane copolymers, ethylene/cycloolefin copolymers (e.g. ethylene/norbornene like COC), ethylene/1-olefins copolymers, where the 1-olefin is generated in-situ; propylene/butadiene copolymers, isobutylene/isoprene copolymers, ethylene/vinylcyclohexene copolymers, ethylene/alkyl acrylate copolymers, ethylene/alkyl methacrylate copolymers, ethylene/vinyl acetate copolymers or ethylene/acrylic acid copolymers and their salts (ionomers) as well as terpolymers of ethylene with propylene and a diene such as hexadiene, dicyclopentadiene or ethylidene-norbornene; and mixtures of such copolymers with one another and with polymers mentioned in 1) above, for example polypropylene/ethylene-propylene copolymers, LDPE/ethylene-vinyl acetate copolymers (EVA), LDPE/ethylene-acrylic acid copolymers (EAA), LLDPE/EVA, LLDPE/EAA and alternating or random polyalkylene/carbon monoxide copolymers and mixtures thereof with other polymers, for example polyamides.

4. Hydrocarbon resins (for example C_5 - C_9) including hydrogenated modifications thereof (e.g. tackifiers) and mixtures of polyalkylenes and starch.

Homopolymers and copolymers from 1.) - 4.) may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

5. Polystyrene, poly(p-methylstyrene), poly(α -methylstyrene).

6. Aromatic homopolymers and copolymers derived from vinyl aromatic monomers including styrene, α -methylstyrene, all isomers of vinyl toluene, especially p-vinyltoluene, all isomers of ethyl styrene, propyl styrene, vinyl biphenyl, vinyl naphthalene, and vinyl anthracene, and mixtures thereof. Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

6a. Copolymers including aforementioned vinyl aromatic monomers and comonomers selected from ethylene, propylene, dienes, nitriles, acids, maleic anhydrides, maleimides, vinyl acetate and vinyl chloride or acrylic derivatives and mixtures thereof, for example styrene/butadiene, styrene/acrylonitrile, styrene/ethylene (interpolymers), styrene/alkyl methacrylate, styrene/butadiene/alkyl acrylate, styrene/butadiene/alkyl methacrylate, styrene/maleic anhydride, styrene/acrylonitrile/methyl acrylate; mixtures of high impact strength of styrene copolymers and another polymer, for example a polyacrylate, a diene polymer or an ethylene/propylene/diene terpolymer; and block copolymers of styrene such as styrene/butadiene/styrene, styrene/isoprene/styrene, styrene/ethylene/butylene/styrene or styrene/ethylene/propylene/styrene.

6b. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6.), especially including polycyclohexylethylene (PCHE) prepared by hydrogenating atactic polystyrene, often referred to as polyvinylcyclohexane (PVCH).

6c. Hydrogenated aromatic polymers derived from hydrogenation of polymers mentioned under 6a.).

Homopolymers and copolymers may have any stereostructure including syndiotactic, isotactic, hemi-isotactic or atactic; where atactic polymers are preferred. Stereoblock polymers are also included.

7. Graft copolymers of vinyl aromatic monomers such as styrene or α -methylstyrene, for example styrene on polybutadiene, styrene on polybutadiene-styrene or polybutadiene-acrylonitrile copolymers; styrene and acrylonitrile (or methacrylonitrile) on polybutadiene; styrene, acrylonitrile and methyl methacrylate on polybutadiene; styrene and maleic anhydride on polybutadiene; styrene, acrylonitrile and maleic anhydride or maleimide on polybutadiene; styrene and maleimide on polybutadiene; styrene and alkyl acrylates or methacrylates on polybutadiene; styrene and acrylonitrile on ethylene/propylene/diene terpolymers; styrene and acrylonitrile on polyalkyl acrylates or polyalkyl methacrylates, styrene and acrylonitrile on acrylate/butadiene copolymers, as well as mixtures thereof with the copolymers listed under 6), for example the copolymer mixtures known as ABS, MBS, ASA or AES polymers.

8. Halogen-containing polymers such as polychloroprene, chlorinated rubbers, chlorinated and brominated copolymer of isobutylene-isoprene (halobutyl rubber), chlorinated or sulfo-chlorinated polyethylene, copolymers of ethylene and chlorinated ethylene, epichlorohydrin homo- and copolymers, especially polymers of halogen-containing vinyl compounds, for example polyvinyl chloride, polyvinylidene chloride, polyvinyl fluoride, polyvinylidene fluoride, as well as copolymers thereof such as vinyl chloride/vinylidene chloride, vinyl chloride/vinyl acetate or vinylidene chloride/vinyl acetate copolymers.
9. Polymers derived from α,β -unsaturated acids and derivatives thereof such as polyacrylates and polymethacrylates; polymethyl methacrylates, polyacrylamides and polyacrylonitriles, impact-modified with butyl acrylate.
10. Copolymers of the monomers mentioned under 9) with each other or with other unsaturated monomers, for example acrylonitrile/ butadiene copolymers, acrylonitrile/alkyl acrylate copolymers, acrylonitrile/alkoxyalkyl acrylate or acrylonitrile/vinyl halide copolymers or acrylonitrile/ alkyl methacrylate/butadiene terpolymers.
11. Polymers derived from unsaturated alcohols and amines or the acyl derivatives or acetals thereof, for example polyvinyl alcohol, polyvinyl acetate, polyvinyl stearate, polyvinyl benzoate, polyvinyl maleate, polyvinyl butyral, polyallyl phthalate or polyallyl melamine; as well as their copolymers with olefins mentioned in 1) above.
12. Homopolymers and copolymers of cyclic ethers such as polyalkylene glycols, polyethylene oxide, polypropylene oxide or copolymers thereof with bisglycidyl ethers.
13. Polyacetals such as polyoxymethylene and those polyoxymethylenes which contain ethylene oxide as a comonomer; polyacetals modified with thermoplastic polyurethanes, acrylates or MBS.
14. Polyphenylene oxides and sulfides, and mixtures of polyphenylene oxides with styrene polymers or polyamides.

15. Polyurethanes derived from hydroxyl-terminated polyethers, polyesters or polybutadienes on the one hand and aliphatic or aromatic polyisocyanates on the other, as well as precursors thereof.

16. Polyamides and copolyamides derived from diamines and dicarboxylic acids and/or from aminocarboxylic acids or the corresponding lactams, for example polyamide 4, polyamide 6, polyamide 6/6, 6/10, 6/9, 6/12, 4/6, 12/12, polyamide 11, polyamide 12, aromatic polyamides starting from m-xylene diamine and adipic acid; polyamides prepared from hexamethylenediamine and isophthalic or/and terephthalic acid and with or without an elastomer as modifier, for example poly-2,4,4-trimethylhexamethylene terephthalamide or poly-m-phenylene isophthalamide; and also block copolymers of the aforementioned polyamides with polyolefins, olefin copolymers, ionomers or chemically bonded or grafted elastomers; or with polyethers, e.g. with polyethylene glycol, polypropylene glycol or polytetramethylene glycol; as well as polyamides or copolyamides modified with EPDM or ABS; and polyamides condensed during processing (RIM polyamide systems).

17. Polyureas, polyimides, polyamide-imides, polyetherimids, polyesterimids, polyhydantoins and polybenzimidazoles.

18. Polyesters derived from dicarboxylic acids and diols and/or from hydroxycarboxylic acids or the corresponding lactones, for example polyethylene terephthalate, polybutylene terephthalate, poly-1,4-dimethylolcyclohexane terephthalate, polyalkylene naphthalate (PAN) and polyhydroxybenzoates, as well as block copolyether esters derived from hydroxyl-terminated polyethers; and also polyesters modified with polycarbonates or MBS.

19. Polycarbonates and polyester carbonates.

20. Polyketones.

21. Polysulfones, polyether sulfones and polyether ketones.

22. Crosslinked polymers derived from aldehydes on the one hand and phenols, ureas and melamines on the other hand, such as phenol/formaldehyde resins, urea/formaldehyde resins and melamine/formaldehyde resins.

23. Drying and non-drying alkyd resins.

24. Unsaturated polyester resins derived from copolyesters of saturated and unsaturated dicarboxylic acids with polyhydric alcohols and vinyl compounds as crosslinking agents, and also halogen-containing modifications thereof of low flammability.

25. Crosslinkable acrylic resins derived from substituted acrylates, for example epoxy acrylates, urethane acrylates or polyester acrylates.

26. Alkyd resins, polyester resins and acrylate resins crosslinked with melamine resins, urea resins, isocyanates, isocyanurates, polyisocyanates or epoxy resins.

27. Crosslinked epoxy resins derived from aliphatic, cycloaliphatic, heterocyclic or aromatic glycidyl compounds, e.g. products of diglycidyl ethers of bisphenol A and bisphenol F, which are crosslinked with customary hardeners such as anhydrides or amines, with or without accelerators.

28. Natural polymers such as cellulose, rubber, gelatin and chemically modified homologous derivatives thereof, for example cellulose acetates, cellulose propionates and cellulose butyrates, or the cellulose ethers such as methyl cellulose; as well as rosins and their derivatives.

29. Blends of the aforementioned polymers (polyblends), for example PP/EPDM, Polyamide/EPDM or ABS, PVC/EVA, PVC/ABS, PVC/MBS, PC/ABS, PBTP/ABS, PC/ASA, PC/PBT, PVC/CPE, PVC/acrylates, POM/thermoplastic PUR, PC/thermoplastic PUR, POM/acrylate, POM/MBS, PPO/HIPS, PPO/PA 6.6 and copolymers, PA/HDPE, PA/PP, PA/PPO, PBT/PC/ABS or PBT/PET/PC.

Component (I) is preferably a synthetic polymer, in particular from one of the above groups. Polyolefins are preferred and polyethylene, polypropylene, a polyethylene copolymer or a polypropylene copolymer are particularly preferred.

According to a further preferred embodiment, component (I) is a polyolefin homo- or copolymer, a starch modified polyolefin, a starch based polymer composite or a biopolymer.

According to another preferred embodiment component (I) is a biopolymer selected from the group consisting of polycaprolactone, polylactic acid, polyglycolic acid, polyhydroxybutyrate-valerate, polybutylene succinate, polyvinyl alcohol, polyhydroxyalcanoate and polyethylene adipate.

The agricultural article of this invention may contain further one or more conventional additives. Examples are

1. Antioxidants

1.1. Alkylated monophenols, for example 2,6-di-tert-butyl-4-methylphenol, 2-tert-butyl-4,6-dimethylphenol, 2,6-di-tert-butyl-4-ethylphenol, 2,6-di-tert-butyl-4-n-butylphenol, 2,6-di-tert-butyl-4-isobutylphenol, 2,6-dicyclopentyl-4-methylphenol, 2-(α -methylcyclohexyl)-4,6-dimethylphenol, 2,6-dioctadecyl-4-methylphenol, 2,4,6-tricyclohexylphenol, 2,6-di-tert-butyl-4-methoxymethylphenol, nonylphenols which are linear or branched in the side chains, for example 2,6-di-nonyl-4-methylphenol, 2,4-dimethyl-6-(1'-methylundec-1'-yl)phenol, 2,4-dimethyl-6-(1'-methylheptadec-1'-yl)phenol, 2,4-dimethyl-6-(1'-methyltridec-1'-yl)phenol and mixtures thereof.

1.2. Alkylthiomethylphenols, for example 2,4-dioctylthiomethyl-6-tert-butylphenol, 2,4-dioctylthiomethyl-6-methylphenol, 2,4-dioctylthiomethyl-6-ethylphenol, 2,6-di-dodecylthiomethyl-4-nonylphenol.

1.3. Hydroquinones and alkylated hydroquinones, for example 2,6-di-tert-butyl-4-methoxyphenol, 2,5-di-tert-butylhydroquinone, 2,5-di-tert-amylhydroquinone, 2,6-diphenyl-4-octadecyloxyphenol, 2,6-di-tert-butylhydroquinone, 2,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyanisole, 3,5-di-tert-butyl-4-hydroxyphenyl stearate, bis(3,5-di-tert-butyl-4-hydroxyphenyl) adipate.

1.4. Tocopherols, for example α -tocopherol, β -tocopherol, γ -tocopherol, δ -tocopherol and mixtures thereof (vitamin E).

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

1.6. Alkylidenebisphenols, for example 2,2'-methylenebis(6-tert-butyl-4-methylphenol), 2,2'-methylenebis(6-tert-butyl-4-ethylphenol), 2,2'-methylenebis[4-methyl-6-(α -methylcyclohexyl)-phenol], 2,2'-methylenebis(4-methyl-6-cyclohexylphenol), 2,2'-methylenebis(6-nonyl-4-methylphenol), 2,2'-methylenebis(4,6-di-tert-butylphenol), 2,2'-ethylidenebis(4,6-di-tert-butylphenol), 2,2'-ethylidenebis(6-tert-butyl-4-isobutylphenol), 2,2'-methylenebis[6-(α -methylbenzyl)-4-nonylphenol], 2,2'-methylenebis[6-(α,α -dimethylbenzyl)-4-nonylphenol], 4,4'-methylenebis(2,6-di-tert-butylphenol), 4,4'-methylenebis(6-tert-butyl-2-methylphenol), 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 2,6-bis(3-tert-butyl-5-methyl-2-hydroxybenzyl)-4-methylphenol, 1,1,3-tris(5-tert-butyl-4-hydroxy-2-methylphenyl)butane, 1,1-bis(5-tert-butyl-4-hydroxy-2-methylphenyl)-3-n-dodecylmercaptobutane, ethylene glycol bis[3,3-bis(3'-tert-butyl-4'-hydroxyphenyl)butyrate], bis(3-tert-butyl-4-hydroxy-5-methylphenyl)dicyclopentadiene, bis[2-(3'-tert-butyl-2'-hydroxy-5'-methylbenzyl)-6-tert-butyl-4-methylphenyl]terephthalate, 1,1-bis-(3,5-dimethyl-2-hydroxyphenyl)butane, 2,2-bis(3,5-di-tert-butyl-4-hydroxyphenyl)propane, 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.

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

1.8. Hydroxybenzylated malonates, for example dioctadecyl-2,2-bis(3,5-di-tert-butyl-2-hydroxybenzyl)malonate, di-octadecyl-2-(3-tert-butyl-4-hydroxy-5-methylbenzyl)malonate, di-dodecylmercaptoethyl-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate, bis[4-(1,1,3,3-tetramethylbutyl)phenyl]-2,2-bis(3,5-di-tert-butyl-4-hydroxybenzyl)malonate.

1.9. Aromatic hydroxybenzyl compounds, for example 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-2,4,6-trimethylbenzene, 1,4-bis(3,5-di-tert-butyl-4-hydroxybenzyl)-2,3,5,6-tetramethylbenzene, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl)phenol.

1.10. Triazine compounds, for example 2,4-bis(octylmercapto)-6-(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyanilino)-1,3,5-triazine, 2-octylmercapto-4,6-bis(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,3,5-triazine, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenoxy)-1,2,3-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)isocyanurate, 1,3,5-tris(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl)isocyanurate, 2,4,6-tris(3,5-di-tert-butyl-4-hydroxyphenylethyl)-1,3,5-triazine, 1,3,5-tris(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)-hexahydro-1,3,5-triazine, 1,3,5-tris(3,5-dicyclohexyl-4-hydroxybenzyl)isocyanurate.

1.11. Benzylphosphonates, for example dimethyl-2,5-di-tert-butyl-4-hydroxybenzylphosphonate, diethyl-3,5-di-tert-butyl-4-hydroxybenzylphosphonate, dioctadecyl-3,5-di-tert-butyl-4-hydroxybenzylphosphonate, dioctadecyl-5-tert-butyl-4-hydroxy-3-methylbenzylphosphonate, the calcium salt of the monoethyl ester of 3,5-di-tert-butyl-4-hydroxybenzylphosphonic acid.

1.12. Acylaminophenols, for example 4-hydroxylauranilide, 4-hydroxystearanilide, octyl N-(3,5-di-tert-butyl-4-hydroxyphenyl)carbamate.

1.13. Esters of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid with mono- or polyhydric alcohols, e.g. with methanol, ethanol, n-octanol, i-octanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentyl glycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)oxamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylol propane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane.

1.14. Esters of β -(5-tert-butyl-4-hydroxy-3-methylphenyl)propionic acid with mono- or polyhydric alcohols, e.g. with methanol, ethanol, n-octanol, i-octanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentyl glycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)oxamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethyl-

olpropane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane; 3,9-bis[2-{3-(3-tert-butyl-4-hydroxy-5-methylphenyl)propionyloxy}-1,1-dimethylethyl]-2,4,8,10-tetraoxaspiro[5.5]-undecane.

1.15. Esters of β -(3,5-dicyclohexyl-4-hydroxyphenyl)propionic acid with mono- or polyhydric alcohols, e.g. with methanol, ethanol, octanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentyl glycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)oxamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane.

1.16. Esters of 3,5-di-tert-butyl-4-hydroxyphenyl acetic acid with mono- or polyhydric alcohols, e.g. with methanol, ethanol, octanol, octadecanol, 1,6-hexanediol, 1,9-nonanediol, ethylene glycol, 1,2-propanediol, neopentyl glycol, thiodiethylene glycol, diethylene glycol, triethylene glycol, pentaerythritol, tris(hydroxyethyl)isocyanurate, N,N'-bis(hydroxyethyl)oxamide, 3-thiaundecanol, 3-thiapentadecanol, trimethylhexanediol, trimethylolpropane, 4-hydroxymethyl-1-phospha-2,6,7-trioxabicyclo[2.2.2]octane.

1.17. Amides of β -(3,5-di-tert-butyl-4-hydroxyphenyl)propionic acid e.g. N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hexamethylenediamide, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)trimethylenediamide, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazide, N,N'-bis[2-{3-[3,5-di-tert-butyl-4-hydroxyphenyl]propionyloxy}ethyl]oxamide (Nau-gard®XL-1, supplied by Uniroyal).

1.18. Ascorbic acid (vitamin C)

1.19. Aminic antioxidants, for example N,N'-di-isopropyl-p-phenylenediamine, N,N'-di-sec-butyl-p-phenylenediamine, N,N'-bis(1,4-dimethylpentyl)-p-phenylenediamine, N,N'-bis(1-ethyl-3-methylpentyl)-p-phenylenediamine, N,N'-bis(1-methylheptyl)-p-phenylenediamine, N,N'-dicyclohexyl-p-phenylenediamine, N,N'-diphenyl-p-phenylenediamine, N,N'-bis(2-naphthyl)-p-phenylenediamine, N-isopropyl-N'-phenyl-p-phenylenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine, N-(1-methylheptyl)-N'-phenyl-p-phenylenediamine, N-cyclohexyl-N'-phenyl-p-phenylenediamine, 4-(p-toluenesulfamoyl)diphenylamine, N,N'-dimethyl-N,N'-di-sec-butyl-p-phenylenediamine, diphenylamine, N-allyldiphenylamine, 4-isopropoxydiphenyl-

amine, N-phenyl-1-naphthylamine, N-(4-tert-octylphenyl)-1-naphthylamine, N-phenyl-2-naphthylamine, octylated diphenylamine, for example p,p'-di-tert-octyldiphenylamine, 4-n-butylaminophenol, 4-butyrylaminophenol, 4-nonanoylaminophenol, 4-dodecanoylaminophenol, 4-octadecanoylaminophenol, bis(4-methoxyphenyl)amine, 2,6-di-tert-butyl-4-dimethylaminomethylphenol, 2,4'-diaminodiphenylmethane, 4,4'-diaminodiphenylmethane, N,N,N',N'-tetramethyl-4,4'-diaminodiphenylmethane, 1,2-bis[(2-methylphenyl)amino]ethane, 1,2-bis(phenylamino)propane, (o-tolyl)biguanide, bis[4-(1',3'-dimethylbutyl)phenyl]amine, tert-octylated N-phenyl-1-naphthylamine, a mixture of mono- and dialkylated tert-butyl/tert-octyldiphenylamines, a mixture of mono- and dialkylated nonyldiphenylamines, a mixture of mono- and dialkylated dodecyldiphenylamines, a mixture of mono- and dialkylated isopropyl/isohexyldiphenylamines, a mixture of mono- and dialkylated tert-butylidiphenylamines, 2,3-dihydro-3,3-dimethyl-4H-1,4-benzothiazine, phenothiazine, a mixture of mono- and dialkylated tert-butyl/tert-octylphenothiazines, a mixture of mono- and dialkylated tert-octylphenothiazines, N-allylphenothiazine, N,N,N',N'-tetraphenyl-1,4-diaminobut-2-ene, N,N-bis(2,2,6,6-tetramethylpiperid-4-yl)-hexamethylenediamine, bis(2,2,6,6-tetramethylpiperid-4-yl)sebacate, 2,2,6,6-tetramethylpiperidin-4-one, 2,2,6,6-tetramethylpiperidin-4-ol.

2. UV absorbers and light stabilisers

2.1. 2-(2'-Hydroxyphenyl)benzotriazoles, for example 2-(2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(5'-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-5'-(1,1,3,3-tetramethylbutyl)phenyl)benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-methylphenyl)-5-chlorobenzotriazole, 2-(3'-sec-butyl-5'-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-4'-octyloxyphenyl)benzotriazole, 2-(3',5'-di-tert-amyl-2'-hydroxyphenyl)benzotriazole, 2-(3',5'-bis(α,α -dimethylbenzyl)-2'-hydroxyphenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-octyloxycarbonyl)ethyl)phenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)carbonyl]ethyl)-2'-hydroxyphenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonyl)ethyl)phenyl)-5-chlorobenzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonyl)ethyl)phenyl)benzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)carbonyl]ethyl)-2'-hydroxyphenyl)benzotriazole, 2-(3'-dodecyl-2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-isooctyloxycarbonyl)ethyl)phenyl)benzotriazole, 2,2'-methylenebis[4-(1,1,3,3-tetramethylbutyl)-6-benzotriazole-2-ylphenol]; the transesterification product of 2-[3'-tert-butyl-2'-hydroxy-5'-(2-isooctyloxycarbonyl)ethyl]phenyl)-5-chlorobenzotriazole.

tyl-5'-(2-methoxycarbonylethyl)-2'-hydroxyphenyl]-2H-benzotriazole with polyethylene glycol 300; $\left[R-CH_2CH_2-COO-CH_2CH_2 \right]_2$, where R = 3'-tert-butyl-4'-hydroxy-5'-2H-benzotriazol-2-ylphenyl, 2-[2'-hydroxy-3'-(α,α -dimethylbenzyl)-5'-(1,1,3,3-tetramethylbutyl)phenyl]-benzotriazole; 2-[2'-hydroxy-3'-(1,1,3,3-tetramethylbutyl)-5'-(α,α -dimethylbenzyl)phenyl]benzotriazole.

2.2. 2-Hydroxybenzophenones, for example the 4-hydroxy, 4-methoxy, 4-octyloxy, 4-decyloxy, 4-dodecyloxy, 4-benzyloxy, 4,2',4'-trihydroxy and 2'-hydroxy-4,4'-dimethoxy derivatives.

2.3. Esters of substituted and unsubstituted benzoic acids, for example 4-tert-butylphenyl salicylate, phenyl salicylate, octylphenyl salicylate, dibenzoyl resorcinol, bis(4-tert-butylbenzoyl)resorcinol, benzoyl resorcinol, 2,4-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate, hexadecyl 3,5-di-tert-butyl-4-hydroxybenzoate, octadecyl 3,5-di-tert-butyl-4-hydroxybenzoate, 2-methyl-4,6-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate.

2.4. Acrylates, for example ethyl α -cyano- β,β -diphenylacrylate, isooctyl α -cyano- β,β -diphenylacrylate, methyl α -carbomethoxycinnamate, methyl α -cyano- β -methyl-p-methoxycinnamate, butyl α -cyano- β -methyl-p-methoxycinnamate, methyl α -carbomethoxy-p-methoxycinnamate and N-(β -carbomethoxy- β -cyanovinyl)-2-methylindoline.

2.5. Nickel compounds, for example nickel complexes of 2,2'-thiobis[4-(1,1,3,3-tetramethylbutyl)phenol], such as the 1:1 or 1:2 complex, with or without additional ligands such as n-butylamine, triethanolamine or N-cyclohexyldiethanolamine, nickel dibutyldithiocarbamate, nickel salts of the monoalkyl esters, e.g. the methyl or ethyl ester, of 4-hydroxy-3,5-di-tert-butylbenzylphosphonic acid, nickel complexes of ketoximes, e.g. of 2-hydroxy-4-methylphenylundecylketoxime, nickel complexes of 1-phenyl-4-lauroyl-5-hydroxypyrazole, with or without additional ligands.

2.6. Sterically hindered amines, for example bis(2,2,6,6-tetramethyl-4-piperidyl)sebacate, bis(2,2,6,6-tetramethyl-4-piperidyl)succinate, bis(1,2,2,6,6-pentamethyl-4-piperidyl)sebacate, bis(1-octyloxy-2,2,6,6-tetramethyl-4-piperidyl)sebacate, bis(1,2,2,6,6-pentamethyl-4-piperidyl) n-butyl-3,5-di-tert-butyl-4-hydroxybenzylmalonate, the condensate of 1-(2-hydroxyethyl)-2,2,6,6-tetramethyl-4-hydroxypiperidine and succinic acid, linear or cyclic condensates of

N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-tert-octylamino-2,6-dichloro-1,3,5-triazine, tris(2,2,6,6-tetramethyl-4-piperidyl)nitrilotriacetate, tetrakis(2,2,6,6-tetramethyl-4-piperidyl)-1,2,3,4-butanetetracarboxylate, 1,1'-(1,2-ethanediyl)-bis(3,3,5,5-tetramethylpiperazinone), 4-benzoyl-2,2,6,6-tetramethylpiperidine, 4-stearyloxy-2,2,6,6-tetramethylpiperidine, bis(1,2,2,6,6-pentamethylpiperidyl)-2-n-butyl-2-(2-hydroxy-3,5-di-tert-butylbenzyl)-malonate, 3-n-octyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decane-2,4-dione, bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)sebacate, bis(1-octyloxy-2,2,6,6-tetramethylpiperidyl)succinate, linear or cyclic condensates of N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-morpholino-2,6-dichloro-1,3,5-triazine, the condensate of 2-chloro-4,6-bis(4-n-butylamino-2,2,6,6-tetramethylpiperidyl)-1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane, the condensate of 2-chloro-4,6-di-(4-n-butylamino-1,2,2,6,6-pentamethylpiperidyl)-1,3,5-triazine and 1,2-bis(3-aminopropylamino)ethane, 8-acetyl-3-dodecyl-7,7,9,9-tetramethyl-1,3,8-triazaspiro[4.5]decane-2,4-dione, 3-dodecyl-1-(2,2,6,6-tetramethyl-4-piperidyl)pyrrolidine-2,5-dione, 3-dodecyl-1-(1,2,2,6,6-pentamethyl-4-piperidyl)pyrrolidine-2,5-dione, a mixture of 4-hexadecyloxy- and 4-stearyloxy-2,2,6,6-tetramethylpiperidine, a condensate of N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine and 4-cyclohexylamino-2,6-dichloro-1,3,5-triazine, a condensate of 1,2-bis(3-aminopropylamino)ethane and 2,4,6-trichloro-1,3,5-triazine as well as 4-butylamino-2,2,6,6-tetramethylpiperidine (CAS Reg. No. [136504-96-6]); a condensate of 1,6-hexanediamine and 2,4,6-trichloro-1,3,5-triazine as well as N,N-dibutylamine and 4-butylamino-2,2,6,6-tetramethylpiperidine (CAS Reg. No. [192268-64-7]); N-(2,2,6,6-tetramethyl-4-piperidyl)-n-dodecylsuccinimide, N-(1,2,2,6,6-pentamethyl-4-piperidyl)-n-dodecylsuccinimide, 2-undecyl-7,7,9,9-tetramethyl-1-oxa-3,8-diaza-4-oxo-spiro[4,5]decane, a reaction product of 7,7,9,9-tetramethyl-2-cycloundecyl-1-oxa-3,8-diaza-4-oxospiro-[4,5]decane and epichlorohydrin, 1,1-bis(1,2,2,6,6-pentamethyl-4-piperidyloxycarbonyl)-2-(4-methoxyphenyl)ethene, N,N'-bis-formyl-N,N'-bis(2,2,6,6-tetramethyl-4-piperidyl)hexamethylenediamine, a diester of 4-methoxymethylenemalononic acid with 1,2,2,6,6-pentamethyl-4-hydroxypiperidine, poly[methylpropyl-3-oxy-4-(2,2,6,6-tetramethyl-4-piperidyl)]siloxane, a reaction product of maleic acid anhydride- α -olefin copolymer with 2,2,6,6-tetramethyl-4-aminopiperidine or 1,2,2,6,6-pentamethyl-4-aminopiperidine.

2.7. Oxamides, for example 4,4'-dioctyloxyoxanilide, 2,2'-diethoxyoxanilide, 2,2'-dioctyloxy-5,5'-di-tert-butoxanilide, 2,2'-didodecyloxy-5,5'-di-tert-butoxanilide, 2-ethoxy-2'-ethyloxanilide, N,N'-bis(3-dimethylaminopropyl)oxamide, 2-ethoxy-5-tert-butyl-2'-ethoxanilide and its mixture

with 2-ethoxy-2'-ethyl-5,4'-di-tert-butoxanilide, mixtures of o- and p-methoxy-disubstituted oxanilides and mixtures of o- and p-ethoxy-disubstituted oxanilides.

2.8. 2-(2-Hydroxyphenyl)-1,3,5-triazines, for example 2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-tridecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-butyloxypropoxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-octyloxypropyloxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-[4-(dodecyloxy/tridecyloxy-2-hydroxypropoxy)-2-hydroxyphenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-dodecyloxypropoxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine, 2-(2-hydroxy-4-methoxyphenyl)-4,6-diphenyl-1,3,5-triazine, 2,4,6-tris[2-hydroxy-4-(3-butoxy-2-hydroxypropoxy)phenyl]-1,3,5-triazine, 2-(2-hydroxyphenyl)-4-(4-methoxyphenyl)-6-phenyl-1,3,5-triazine, 2-[2-hydroxy-4-[3-(2-ethylhexyl-1-oxy)-2-hydroxypropyloxy]phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine.

3. Metal deactivators, for example N,N'-diphenyloxamide, N-salicylal-N'-salicyloyl hydrazine, N,N'-bis(salicyloyl)hydrazine, N,N'-bis(3,5-di-tert-butyl-4-hydroxyphenylpropionyl)hydrazine, 3-salicyloylamino-1,2,4-triazole, bis(benzylidene)oxalyl dihydrazide, oxanilide, isophthaloyl dihydrazide, sebacoyl bisphenylhydrazide, N,N'-diacetyl adipoyl dihydrazide, N,N'-bis(salicyloyl)oxalyl dihydrazide, N,N'-bis(salicyloyl)thiopropionyl dihydrazide.

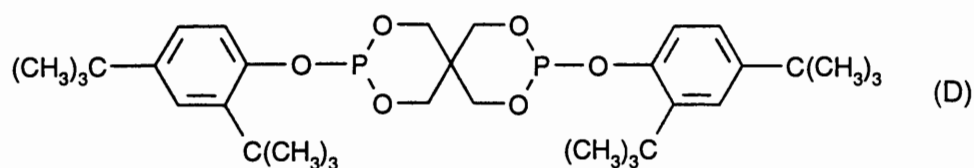
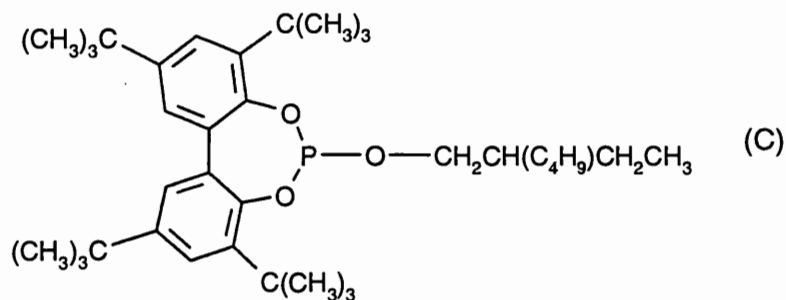
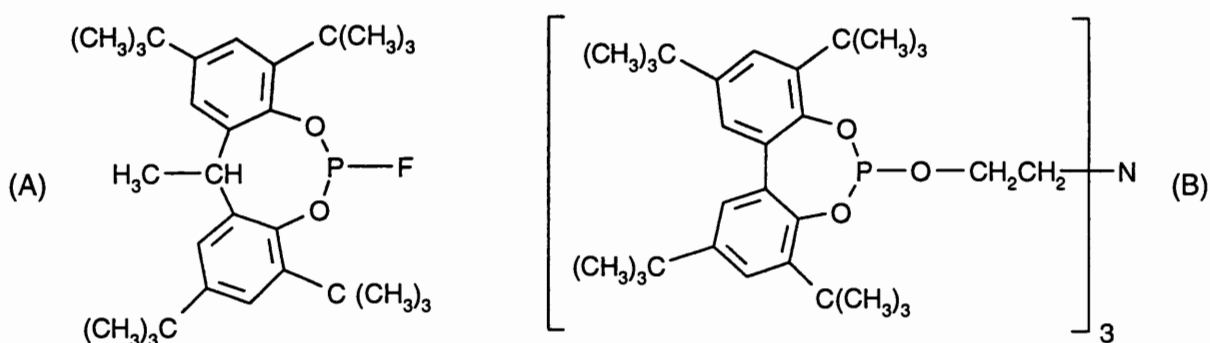
4. Phosphites and phosphonites, for example triphenyl phosphite, diphenylalkyl phosphites, phenyldialkyl phosphites, tris(nonylphenyl) phosphite, trilauryl phosphite, trioctadecyl phosphite, distearyl pentaerythritol diphosphite, tris(2,4-di-tert-butylphenyl) phosphite, diisodecyl pentaerythritol diphosphite, bis(2,4-di-tert-butylphenyl)pentaerythritol diphosphite, bis(2,4-dicumylphenyl)pentaerythritol diphosphite, bis(2,6-di-tert-butyl-4-methylphenyl)pentaerythritol diphosphite, diisodecyl pentaerythritol diphosphite, bis(2,4-di-tert-butyl-6-methylphenyl)pentaerythritol diphosphite, bis(2,4,6-tris(tert-butylphenyl)pentaerythritol diphosphite, tristearyl sorbitol triphosphite, tetrakis(2,4-di-tert-butylphenyl) 4,4'-biphenylene diphosphonite, 6-isooctyloxy-2,4,8,10-tetra-tert-butyl-12H-dibenz[d,g]-1,3,2-dioxaphosphocin, bis(2,4-di-tert-

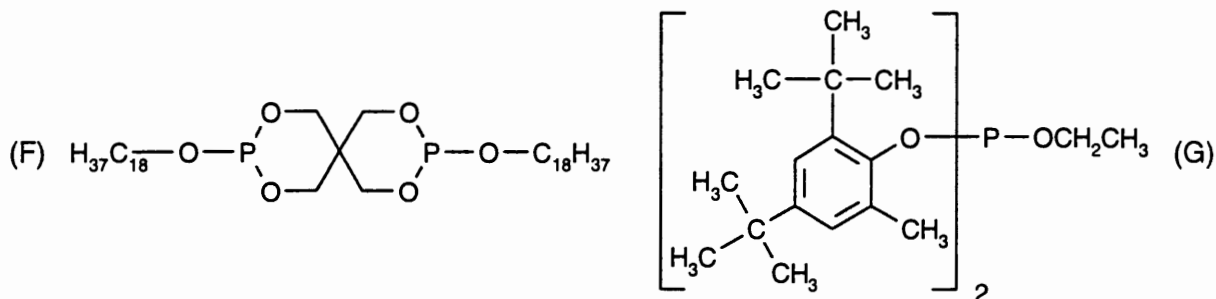
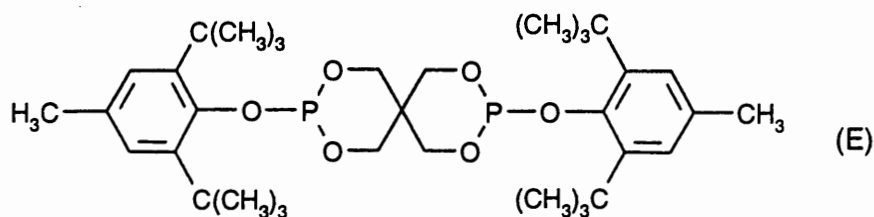
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butyl-6-methylphenyl)methyl phosphite, bis(2,4-di-tert-butyl-6-methylphenyl)ethyl phosphite, 6-fluoro-2,4,8,10-tetra-tert-butyl-12-methyl-dibenz[d,g]-1,3,2-dioxaphosphocin, 2,2',2''-nitrido-[triethyltris(3,3',5,5'-tetra-tert-butyl-1,1'-biphenyl-2,2'-diyl)phosphite], 2-ethylhexyl(3,3',5,5'-tetra-tert-butyl-1,1'-biphenyl-2,2'-diyl)phosphite, 5-butyl-5-ethyl-2-(2,4,6-tri-tert-butylphenoxy)-1,3,2-dioxaphosphirane.

The following phosphites are especially preferred:

Tris(2,4-di-tert-butylphenyl) phosphite (Irgafos®168, Ciba-Geigy), tris(nonylphenyl) phosphite,





5. Hydroxylamines, for example N,N-dibenzylhydroxylamine, N,N-diethylhydroxylamine, N,N-dioctylhydroxylamine, N,N-dilaurylhydroxylamine, N,N-ditetradecylhydroxylamine, N,N-dihexadecylhydroxylamine, N,N-dioctadecylhydroxylamine, N-hexadecyl-N-octadecylhydroxylamine, N-heptadecyl-N-octadecylhydroxylamine, N,N-dialkylhydroxylamine derived from hydrogenated tallow amine.

6. Nitrones, for example N-benzyl-alpha-phenylnitrone, N-ethyl-alpha-methylnitrone, N-octyl-alpha-heptylnitrone, N-lauryl-alpha-undecylnitrone, N-tetradecyl-alpha-tridecyl-nitrone, N-hexadecyl-alpha-pentadecylnitrone, N-octadecyl-alpha-heptadecylnitrone, N-hexadecyl-alpha-heptadecylnitrone, N-octadecyl-alpha-pentadecylnitrone, N-heptadecyl-alpha-heptadecylnitrone, N-octadecyl-alpha-hexadecylnitrone, nitrone derived from N,N-dialkylhydroxylamine derived from hydrogenated tallow amine.

7. Thiosynergists, for example dilauryl thiodipropionate or distearyl thiodipropionate.

8. Peroxide scavengers, for example esters of β -thiodipropionic acid, for example the lauryl, stearyl, myristyl or tridecyl esters, mercaptobenzimidazole or the zinc salt of 2-mercaptobenzimidazole, zinc dibutyldithiocarbamate, dioctadecyl disulfide, pentaerythritol tetrakis(β -dodecylmercapto)propionate.

9. Polyamide stabilisers, for example copper salts in combination with iodides and/or phosphorus compounds and salts of divalent manganese.

10. Basic co-stabilisers, for example melamine, polyvinylpyrrolidone, dicyandiamide, triallyl cyanurate, urea derivatives, hydrazine derivatives, amines, polyamides, polyurethanes, alkali metal salts and alkaline earth metal salts of higher fatty acids, for example calcium stearate, zinc stearate, magnesium behenate, magnesium stearate, sodium ricinoleate and potassium palmitate, antimony pyrocatecholate or zinc pyrocatecholate.

11. Nucleating agents, for example inorganic substances, such as talcum, metal oxides, such as titanium dioxide or magnesium oxide, phosphates, carbonates or sulfates of, preferably, alkaline earth metals; organic compounds, such as mono- or polycarboxylic acids and the salts thereof, e.g. 4-tert-butylbenzoic acid, adipic acid, diphenylacetic acid, sodium succinate or sodium benzoate; polymeric compounds, such as ionic copolymers (ionomers). Especially preferred are 1,3:2,4-bis(3',4'-dimethylbenzylidene)sorbitol, 1,3:2,4-di(paramethyldibenzylidene)sorbitol, and 1,3:2,4-di(benzylidene)sorbitol.

12. Fillers and reinforcing agents, for example calcium carbonate, silicates, glass fibres, glass bulbs, asbestos, talc, kaolin, mica, barium sulfate, metal oxides and hydroxides, carbon black, graphite, wood flour and flours or fibers of other natural products, synthetic fibers.

13. Other additives, for example plasticisers, lubricants, emulsifiers, pigments, rheology additives, catalysts, flow-control agents, optical brighteners, flameproofing agents, antistatic agents and blowing agents.

14. Benzofuranones and indolinones, for example those disclosed in U.S. 4,325,863; U.S. 4,338,244; U.S. 5,175,312; U.S. 5,216,052; U.S. 5,252,643; DE-A-4316611; DE-A-4316622; DE-A-4316876; EP-A-0589839 or EP-A-0591102 or 3-[4-(2-acetoxyethoxy)-phenyl]-5,7-di-tert-butylbenzofuran-2-one, 5,7-di-tert-butyl-3-[4-(2-stearoyloxyethoxy)phenyl]-benzofuran-2-one, 3,3'-bis[5,7-di-tert-butyl-3-(4-[2-hydroxyethoxy]phenyl)benzofuran-2-one], 5,7-di-tert-butyl-3-(4-ethoxyphenyl)benzofuran-2-one, 3-(4-acetoxy-3,5-dimethylphenyl)-5,7-di-tert-butylbenzofuran-2-one, 3-(3,5-dimethyl-4-pivaloyloxyphenyl)-5,7-di-tert-butylbenzofuran-2-one, 3-(3,4-dimethylphenyl)-5,7-di-tert-butylbenzofuran-2-one, 3-(2,3-dimethylphenyl)-5,7-di-tert-butylbenzofuran-2-one.

A preferred agricultural article additionally contains an aliphatic poly hydroxy-carboxyl acid, in particular citric acid.

An aliphatic poly hydroxy-carboxyl acid is in particular an aliphatic acid having either more than one –OH or more than one –COOH group in the organic acid. Examples are the aliphatic, dihydroxy, monocarboxyl acids, such as glyoxylic acid and glyceric acid; the aliphatic, polyhydroxy, monocarboxyl acids, such as erythric acid, arabic acid or mannitic acid; the aliphatic, monohydric, dicarboxyl acids, such as tartronic acid or malic acid; the aliphatic, dihydroxy, dicarboxyl acids, such as tartaric acid; the aliphatic, polyhydroxy, dicarboxyl acids, such as trihydroxyglutaric acid and succharic acid; and the aliphatic, monohydroxy, tricarboxyl acids, such as citric acid.

A further preferred embodiment of this invention relates to an agricultural article which contains in addition one or more of the following components

- (IV) an antioxidant,
- (V) an UV absorber,
- (VI) a filler,
- (VII) a pigment,
- (VIII) an inorganic or organic salt of Ca, Mg, Zn or Al.

Preferred antioxidants (component IV)) are those which are described above under item 1.

Suitable examples of fillers (component VI)) are those described above under item 12.

Preferred fillers are inorganic or synthetic carbonates, nepheline syenite, talc, magnesium hydroxide, aluminum trihydrate, diatomaceous earth, mica, natural or synthetic silica and calcinated clay.

Examples of the UV absorber (component V)) are a 2-(2'-hydroxyphenyl)benzotriazole, a 2-hydroxybenzophenone, an ester of substituted or unsubstituted benzoic acid, an acrylate, an oxamide, a 2-(2-hydroxyphenyl)-1,3,5-triazine, a monobenzoate of resorcinol or a formamidine.

The 2-(2'-hydroxyphenyl)benzotriazole is e.g. 2-(2'-hydroxy-5'-methylphenyl)-benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(5'-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-5'-(1,1,3,3-tetramethylbutyl)phenyl)benzotriazole, 2-(3',5'-di-tert-butyl-2'-hydroxyphenyl)-5-chloro-benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-methylphenyl)-5-chloro-benzotriazole, 2-(3'-sec-butyl-5'-tert-butyl-2'-hydroxyphenyl)benzotriazole, 2-(2'-hydroxy-4'-octyloxyphenyl)benzotriazole, 2-(3',5'-di-tert-amyl-2'-hydroxyphenyl)benzotriazole, 2-(3',5'-bis-(α,α -dimethylbenzyl)-2'-hydroxyphenyl)benzotriazole, mixture of 2-(3'-tert-butyl-2'-hydroxy-5'-(2-octyloxycarbonylethyl)phenyl)-5-chloro-benzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)-carbonylethyl]-2'-hydroxyphenyl)-5-chloro-benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonylethyl)phenyl)-5-chloro-benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-methoxycarbonylethyl)phenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-octyloxycarbonylethyl)phenyl)benzotriazole, 2-(3'-tert-butyl-5'-[2-(2-ethylhexyloxy)carbonylethyl]-2'-hydroxyphenyl)benzotriazole, 2-(3'-dodecyl-2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-(2-isooctyloxycarbonylethyl)phenyl)benzotriazole, 2,2'-methylene-bis[4-(1,1,3,3-tetramethylbutyl)-6-benzotriazole-2-ylphenol] or the transesterification product of 2-[3'-tert-butyl-5'-(2-methoxycarbonylethyl)-2'-hydroxyphenyl]-2H-benzotriazole with polyethylene glycol 300; $[R-CH_2CH_2-COO(CH_2)_3-]_2$ where $R = 3'$ -tert-butyl-4'-hydroxy-5'-2H-benzotriazol-2-ylphenyl.

2-(3',5'-Di-tert-butyl-2'-hydroxyphenyl)-5-chloro-benzotriazole, 2-(3'-tert-butyl-2'-hydroxy-5'-methylphenyl)-5-chloro-benzotriazole and 2-(3',5'-di-tert-amyl-2'-hydroxyphenyl)-benzotriazole are preferred.

The 2-hydroxybenzophenone is for example the 4-hydroxy, 4-methoxy, 4-octyloxy, 4-decyloxy, 4-dodecyloxy, 4-benzyloxy, 4,2',4'-trihydroxy or 2'-hydroxy-4,4'-dimethoxy derivatives.

2-Hydroxy-4-octyloxybenzophenone is preferred.

The ester of a substituted or unsubstituted benzoic acid is for example 4-tert-butyl-phenyl salicylate, phenyl salicylate, octylphenyl salicylate, dibenzoyl resorcinol, bis(4-tert-butylbenzoyl) resorcinol, benzoyl resorcinol, 2,4-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate, hexadecyl 3,5-di-tert-butyl-4-hydroxybenzoate, octadecyl 3,5-di-tert-butyl-4-hydroxybenzoate or 2-methyl-4,6-di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate.

2,4-Di-tert-butylphenyl 3,5-di-tert-butyl-4-hydroxybenzoate and hexadecyl 3,5-di-tert-butyl-4-hydroxybenzoate are preferred.

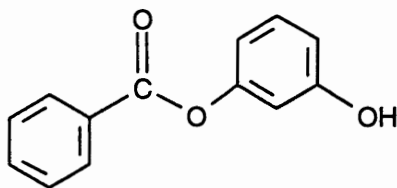
The acrylate is for example ethyl α -cyano- β,β -diphenylacrylate, isooctyl α -cyano- β,β -diphenylacrylate, methyl α -carbomethoxycinnamate, methyl α -cyano- β -methyl-p-methoxycinnamate, butyl α -cyano- β -methyl-p-methoxycinnamate, methyl α -carbomethoxy-p-methoxycinnamate or N-(β -carbomethoxy- β -cyanovinyl)-2-methylindoline.

The oxamide is for example 4,4'-dioctyloxyoxanilide, 2,2'-diethoxyoxanilide, 2,2'-dioctyloxy-5,5'-di-tert-butoxanilide, 2,2'-didodecyloxy-5,5'-di-tert-butoxanilide, 2-ethoxy-2'-ethyloxanilide, N,N'-bis(3-dimethylaminopropyl)oxamide, 2-ethoxy-5-tert-butyl-2'-ethoxanilide or its mixture with 2-ethoxy-2'-ethyl-5,4'-di-tert-butoxanilide or mixtures of ortho- and para-methoxy-disubstituted oxanilides or mixtures of o- and p-ethoxy-disubstituted oxanilides.

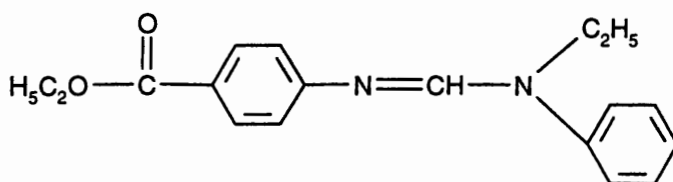
The 2-(2-hydroxyphenyl)-1,3,5-triazine is for example 2,4,6-tris(2-hydroxy-4-octyloxyphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2,4-dihydroxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2,4-bis(2-hydroxy-4-propyloxyphenyl)-6-(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-octyloxyphenyl)-4,6-bis(4-methylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-dodecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-tridecyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-butyloxy-propoxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-octyloxy-propyloxy)phenyl]-4,6-bis(2,4-dimethyl)-1,3,5-triazine, 2-[4-(dodecyloxy/tridecyloxy-2-hydroxypropoxy)-2-hydroxy-phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-[2-hydroxy-4-(2-hydroxy-3-dodecyloxy-propoxy)phenyl]-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine, 2-(2-hydroxy-4-methoxyphenyl)-4,6-diphenyl-1,3,5-triazine, 2,4,6-tris[2-hydroxy-4-(3-butoxy-2-hydroxy-propoxy)phenyl]-1,3,5-triazine, 2-(2-hydroxyphenyl)-4-(4-methoxyphenyl)-6-phenyl-1,3,5-triazine or 2-[2-hydroxy-4-(2-ethylhexyloxy)phenyl]-4,6-bis[4-phenylphenyl]-1,3,5-triazine.

2-(2-Hydroxy-4-octyloxyphenyl)-4,6-bis(2,4-dimethylphenyl)-1,3,5-triazine, 2-(2-hydroxy-4-hexyloxy)phenyl-4,6-diphenyl-1,3,5-triazine and 2-[2-hydroxy-4-(2-ethylhexyloxy)phenyl]-4,6-bis[4-phenylphenyl]-1,3,5-triazine are preferred.

The monobenzoate of resorcinol is for example the compound of the formula



The formamidine is for example the compound of the formula



The UV absorber is in particular a

2-(2'-hydroxyphenyl)benzotriazole, a 2-hydroxybenzophenone or a hydroxyphenyltriazine.

The pigment (component (VII)) may be an inorganic or organic pigment.

Examples of inorganic pigments are titanium dioxide, zinc oxide, carbon black, cadmium sulfide, cadmium selenide, chromium oxide, iron oxide, lead oxide and so on.

Examples of organic pigments are azo pigments, anthraquinones, phthalocyanines, tetrachloroisindolinones, quinacridones, isoindolines, perylenes, pyrrolopyrroles (such as Pigment Red 254) and so on.

All pigments described in "Gächter/Müller: Plastics Additives Handbook, 3rd Edition, Hanser Publishers, Munich Vienna New York", page 647 to 659, point 11.2.1.1 to 11.2.4.2 can be used as component (VII).

Particularly preferred pigments are titanium dioxide or carbon black, optionally in combination with an organic pigment.

Examples of such organic pigments are:

C.I. (Colour Index) Pigment Yellow 93, C.I. Pigment Yellow 95, C.I. Pigment Yellow 138, C.I. Pigment Yellow 139, C.I. Pigment Yellow 155, C.I. Pigment Yellow 162, C.I. Pigment Yellow 168, C.I. Pigment Yellow 180, C.I. Pigment Yellow 183, C.I. Pigment Red 44, C.I. Pigment Red 170, C.I. Pigment Red 202, C.I. Pigment Red 214, C.I. Pigment Red 254, C.I. Pigment Red 264, C.I. Pigment Red 272, C.I. Pigment Red 48:2, C.I. Pigment Red 48:3, C.I. Pigment Red 53:1, C.I. Pigment Red 57:1, C.I. Pigment Green 7, C.I. Pigment Blue 15:1, C.I. Pigment Blue 15:3 and C.I. Pigment Violet 19.

The organic salt of calcium, magnesium, zinc or aluminum defined in component (VII) is preferably a compound of the formula MeL_2 , in which Me is calcium, magnesium or zinc, or a compound of the formula AlL_3 . L is an anion of an organic acid or of an enol. The organic acid can, for example, be a sulfonic acid, sulfinic acid, phosphonic acid or phosphinic acid, but is preferably a carboxylic acid. The acid can be aliphatic, aromatic, araliphatic or cycloaliphatic; it can be linear or branched; it can be substituted by hydroxyl or alkoxy groups; it can be saturated or unsaturated and it preferably contains 1 to 24 carbon atoms.

Examples of carboxylic acids of this type are formic, acetic, propionic, butyric, isobutyric, caproic, 2-ethylcaproic, caprylic, capric, lauric, palmitic, stearic, behenic, oleic, lactic, ricinoleic, 2-ethoxypropionic, benzoic, salicylic, 4-butylbenzoic, toluic, 4-dodecylbenzoic, phenylacetic, naphthylacetic, cyclohexanecarboxylic, 4-butylcyclohexanecarboxylic or cyclohexylacetic acid. The carboxylic acid can also be a technical mixture of carboxylic acids, for example technical mixtures of fatty acids or mixtures of alkylated benzoic acids.

Examples of organic acids containing sulfur or phosphorus are methanesulfonic, ethanesulfonic, α,α -dimethylethanesulfonic, n-butanesulfonic, n-dodecanesulfonic, benzenesulfonic, toluenesulfonic, 4-nonylbenzenesulfonic, 4-dodecylbenzenesulfonic or cyclohexanesulfonic acid, dodecanesulfinic, benzenesulfinic or naphthalenesulfinic acid, butylphosphonic acid, phenylphosphonic acid, monomethyl or monoethyl phenylphosphonate, monobutyl benzylphosphonate, dibutylphosphinic acid or diphenylphosphinic acid.

If L is an enolate anion, it is preferably an anion of a β -dicarbonyl compound or of an

o-acylphenol. Examples of β -dicarbonyl compounds are acetylacetone, benzoylacetone, dibenzoylmethane, ethyl acetoacetate, butyl acetoacetate, lauryl acetoacetate or α -acetylcyclohexanone. Examples of o-acylphenols are 2-acetylphenol, 2-butyroylphenol, 2-acetyl-1-naphthol, 2-benzoylphenol or salicylaldehyde. The enolate is preferably the anion of a β -dicarbonyl compound having 5 to 20 carbon atoms.

Organic salts of zinc or magnesium are preferably an acetylacetonate or an aliphatic monocarboxylate having, for example, 1 to 24 carbon atoms. Magnesium acetate, laurate and stearate, zinc formate, acetate, oenanthate, laurate and stearate as well as zinc acetylacetonate and magnesium acetylacetonate are some of the particular preferred examples.

Zinc stearate, magnesium stearate, zinc acetylacetonate, magnesium acetylacetonate, zinc acetate and magnesium acetate are of special interest.

The inorganic salt of zinc, magnesium or aluminum is for example a carbonate containing compound such as

- Zn-hydroxide-carbonate, Mg-hydroxide-carbonate, dolomite, e.g a Ca/Mg carbonate such as Microdol Super (RTM) from Micro Minerals (RTM); or
- a natural or synthetic hydrotalcite.

The natural hydrotalcite is held to possess a structure $\text{Mg}_6\text{Al}_2(\text{OH})_{16}\text{CO}_3 \cdot 4 \text{H}_2\text{O}$.

A typical empirical formula of a synthetic hydrotalcite is



Examples of the synthetic product include:



Preferred synthetic hydrotalcites are L-55R II (RTM) from REHEIS (RTM) as well as ZHT-4A (RTM) and DHT-4A (RTM) from Kyowa Chemical Industry Co (RTM).

Component (VII) can also be a mixture of two different Mg- and/or Zn- compounds, for example

- Mg-stearate and hydrotalcite (DHT-4A (RTM)),
- Zn-stearate and hydrotalcite (DHT-4A (RTM)),
- Mg-acetylacetonate and hydrotalcite (DHT-4A (RTM)),
- Mg-oxide and hydrotalcite (DHT-4A (RTM)),
- Mg-hydroxide and hydrotalcite (DHT-4A (RTM)),
- Zn-hydroxide-carbonate and Mg-stearate,
- Zn-hydroxide-carbonate and Zn-stearate,
- Zn-hydroxide-carbonate and Mg-acetylacetonate,
- Zn-hydroxide-carbonate and Mg-oxide,
- Zn-hydroxide-carbonate and Zn-oxide,
- Zn-hydroxide-carbonate and Mg-hydroxide,
- hydrotalcite (REHEIS (RTM)) and Mg-stearate,
- hydrotalcite (REHEIS (RTM)) and Zn-stearate,
- hydrotalcite (REHEIS (RTM)) and Mg-oxide,
- dolomite (Microdol Super (RTM)) and Zn-stearate,
- dolomite (Microdol Super (RTM)) and Mg-stearate,
- dolomite (Microdol Super (RTM)) and Zn-oxide,
- dolomite (Microdol Super (RTM)) and Mg-hydroxide,
- Mg-stearate and Zn-stearate,
- Mg-stearate and Zn-acetylacetonate,
- Mg-stearate and Mg-oxide,
- Mg-stearate and Zn-oxide,
- Mg-stearate and Mg-hydroxide,
- Zn-stearate and Mg-acetate,
- Zn-stearate and Mg-oxide,
- Zn-stearate and Mg-hydroxide,
- Mg-acetylacetonate and Zn-acetylacetonate,
- Mg-acetylacetonate and Mg-oxide,
- Mg-acetylacetonate and Zn-oxide,
- Mg-acetylacetonate and Mg-hydroxide,
- Zn-acetylacetonate and Mg-oxide,

- Zn-acetylacetonate and Zn-oxide, or
- Mg-oxide and Zn-oxide.

In this case, the two different compounds of component (VII) may be present in a weight ratio of 1:10 to 10:1.

According to a preferred embodiment of this invention component (VII) is selected from the group consisting of Mg carboxylates, Zn carboxylates, Al carboxylates, Mg oxides, Zn oxides, Al oxides, Mg hydroxides, Zn hydroxides, Al hydroxides, Mg carbonates, Zn carbonates or Al carbonates.

Preferred examples of component (VII) as an organic salt of Ca are carboxylates such as Ca-stearate, Ca-laurate, Ca-lactate and Ca-stearoyl-lactate.

Examples of component (VII) as an inorganic salt of Ca are CaO, Ca(OH)₂, CaCO₃, CaCl₂, CaF₂, Ca₃(PO₄)₂, CaHPO₄, Ca(PO₃)₂, Ca₂P₂O₇, CaSO₄ and CaSiO₃.

According to another preferred embodiment of this invention component (VII) is a Ca carboxylate, a Mg carboxylate, a Zn carboxylate or a hydrotalcite.

Components (II) and (III) and optionally components (IV) to (VIII) may be added to the organic polymer either individually or mixed with one another.

Components (II) and (III) and optionally components (IV) to (VIII) are present in the organic polymer in an amount suitable to obtain a sufficient weathering resistance and to initiate a controlled degradation at a desired moment.

The possibility of lifetime control is fundamental for agricultural articles. The article has to keep its properties and its performance during the service and degradation has to take place when the function of the article is finished. Service lifetimes can vary dramatically depending on the country, crop, type of film, season and many other variables. However, degradation has to lead to complete disappearance of the plastic according to the farmer practices.

The main components being present in the organic polymer are one or more prodegradant additives (component (II)) and one or more stabilizers (components (III) to (VIII)). By appropriately dosing the amount of prodegradant and the amount of stabilizer, the required service periods and time to disappearance can be obtained.

Component (II) may be present in the organic polymer in an amount of, for example, 0.005 to 10 % or 0.005 to 5 %, preferably 0.005 to 1 %, in particular 0.03 to 0.4 %, relative to the weight of the organic polymer.

Component (III) may be present in the organic polymer in an amount of, for example 0.01 to 20 % or 0.01 to 10 % or 0.01 to 5 %, preferably 0.01 to 1.5 %, in particular 0.05 to 1.2 %, relative to the weight of the organic polymer.

Component (IV) may be present in the organic polymer in an amount of preferably 0.005 to 1%, in particular 0.01 to 0.3 %, relative to the weight of the organic polymer.

Component (V) may be present in the organic polymer in an amount of preferably 0.01 to 5 %, in particular 0.1 to 2 %, relative to the weight of the organic polymer.

Component (VI) may be present in the organic polymer in an amount of preferably 0.05 to 80 %, in particular 0.5 to 70 %, relative to the weight of the organic polymer.

Component (VII) may be present in the organic polymer in an amount of preferably 0.05 to 40 %, in particular 0.5 to 30 %, relative to the weight of the organic polymer.

Component (VIII) may be present in the organic polymer in an amount of preferably 0.005 to 5 %, in particular 0.05 to 1 %, relative to the weight of the organic polymer.

The total amount of the components (III) to (VIII) being present in the organic polymer is preferably 0.15 to 90 %, in particular 1.2 to 80 %, relative to the weight of the organic polymer.

The weight ratio of the components (II):(III) may be for example 0.0003:1 to 1000:1 or 0.003:1 to 100:1, in particular 0.025:1 to 8:1.

The weight ratio of the components (II):(IV) may be for example 0.005:1 to 200:1, in particular 0.1:1 to 40:1.

The weight ratio of the components (II):(V) may be for example 0.001:1 to 100:1, in particular 0.015:1 to 4:1.

The weight ratio of the components (II):(VI) may be for example 0.0001:1 to 20:1, in particular 0.0004:1 to 1.0:1.

The weight ratio of the components (II):(VII) may be for example 0.001:1 to 200:1, in particular 0.015:1 to 8:1.

The weight ratio of the components (II):(VIII) may be for example 0.001:1 to 200:1, in particular 0.015:1 to 8:1.

The above components can be incorporated into the organic polymer to be stabilized in a controlled form by known methods, for example before or during shaping or by applying the dissolved or dispersed compounds to the organic polymer, if necessary with subsequent evaporation of the solvent. The components can be added to the organic polymer in the form of a powder, granules or a masterbatch, which contains these components in, for example, a concentration of from 2.5 to 25 % by weight.

If desired, the components (II) and (III) and optionally (IV) to (VIII) can be blended with each other before incorporation into the organic polymer. They can be added to the polymer before or during the polymerization or before the crosslinking.

The agricultural articles according to the present invention may be for example mulch films, small tunnel films and banana bags. Direct covers, nonwoven, twines and pots for agricultural use are also of interest.

Mulch films represent a particular preferred embodiment of the present invention.

Mulch films are used to protect crops in the early stages of their development. Mulch films, depending on the type of crop and on the purpose, can be laid after the seeding or at the same time as the seeding. They protect the crop until the crop has reached a certain development stage. When the harvest is finished, the field is prepared for another cultivation.

Standard plastic films have to be collected and disposed in order to allow the new cultivation. The additive systems of the present invention (components (II) to (VIII)), when added to the standard plastic mulch films, allow the film to keep its properties until the crop has reached the required development, then degradation starts and the film is completely embrittled when the new cultivation has to be started.

The length of the service period and of the time to degradation and time to complete disappearance depends on the type of crop and on the environmental conditions. Depending on the specific time requirements, the additive combinations are designed.

The main components of the present additive system are a prodegradant additive (component (II)) and a weathering stabilizer (component (III)). By appropriately dosing the amount of the prodegradant and the amount of the weathering stabilizer, the required service periods and time to degradation and disappearance can be obtained. Examples of typical life times of mulch films are 10 to 180 days, lifes up to 24 months can also be required and achieved.

Thus, a further preferred embodiment of the present invention is a mulch film containing the components (I), (II) and (III) as defined above and having a life time of 10 to 720 days.

Mulch films can be mono or multilayer (preferably three layers), transparent or appropriately pigmented (white, black, silver, green, brown) on the base of the agronomic needs.

The thickness of the mulch films can range, for example, between 5 to 100 microns. Films from 10 to 60 microns are preferred.

The example below illustrates the invention in greater detail. All percentages and parts are by weight, unless stated otherwise.

Example 1:

Each compound of the list reported below is mixed via master batch, in a slow mixer, with low density polyethylene (LDPE) pellets (Riblene FF 29 (RTM), supplied by Polimeri Europa(RTM); characterized by a density of 0.921 g/cm³ and a melt flow index of 0.60 at 190°C and 2.16 Kg), and with linear low density polyethylene (LLDPE) pellets (Clearflex FG308 (RTM), supplied by Polimeri Europa (RTM); characterized by a density of 0.924 g/cm³ and a melt flow index of 0.97 at 190°C and 2.16 Kg). The ratio LDPE/LLDPE is 1:4.

The mixture is blown at 210°C and films of 12 and 25 microns thickness are obtained.

The films are exposed outdoors in Pontecchio Marconi (Bologna, Italy) according to the below reported procedure to simulate mulch films conditions. Total irradiation in the location is 110 Klys/year.

Plastic boxes are filled with soil; the film is laid on the soil in the box, one part of the film being exposed to the light and another part being covered by the soil. The boxes can be exposed outdoors in July. During the exposure, the films are periodically checked visually and the time to start of degradation (fessuration) and to embrittlement (= very fragile film = end of the life time) is registered.

The results are indicated in Tables 1 to 4.

Table 1:

Films without pigment, 25 microns thick.

Cobalt Stearate %	1:1 Mixture of Stabilizer (A-1-a) and Stabilizer (C-1-a-1) %	Stabilizer (A-1-a) %	Days to fessuration	Days to embrittlement
Without	Without	Without	92	350
0.13	0.05	Without	39	67
0.13	Without	0.2	52	108

Table 2:

Films without pigment, 12 microns thick.

Cobalt Stearate %	1:1 Mixture of Stabilizer (A-1-a) and Stabilizer (C-1-a-1) %	Days to fessuration	Days to embrittlement
0.13	0.05	43	65
0.13	0.2	43	128

Table 3:

Films with 3 % of carbon black, 25 microns thick.

Cobalt Stearate %	1:1 Mixture of Stabilizer (A-1-a) and Stabilizer (C-1-a-1) %	Days to fessuration	Days to embrittlement
Without	Without	120	410
0.13	0.6	57	79

Table 4:

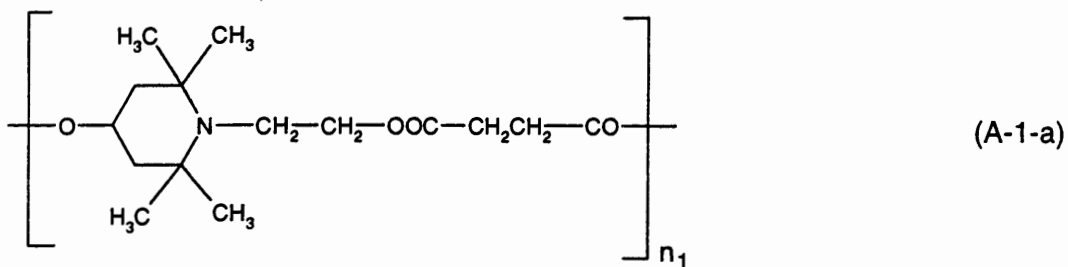
Films with 3 % of carbon black, 12 microns thick.

Cobalt Stearate %	1:1 Mixture of Stabilizer (A-1-a) and Stabilizer (C-1-a-1) %	Days to fessuration	Days to embrittlement
0.13	0.2	36	57
0.13	0.6	53	75

Stabilizer (A-1-a):

TINUVIN 622 (RTM)

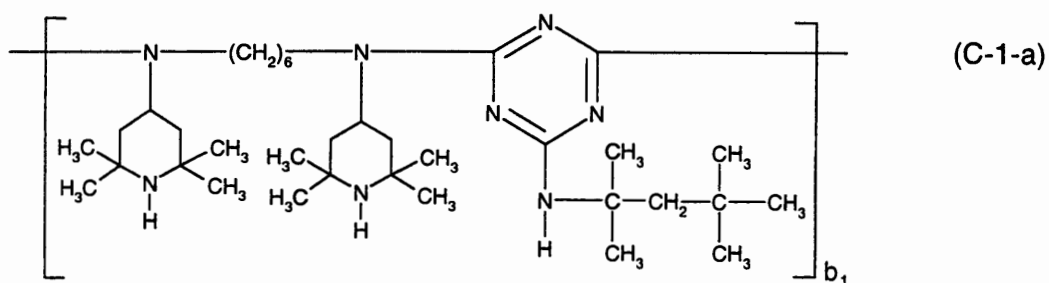
- 67 -



wherein n_1 is a number from 2 to 20.

Stabilizer (C-1-a-1):

CHIMASSORB 944 (RTM)



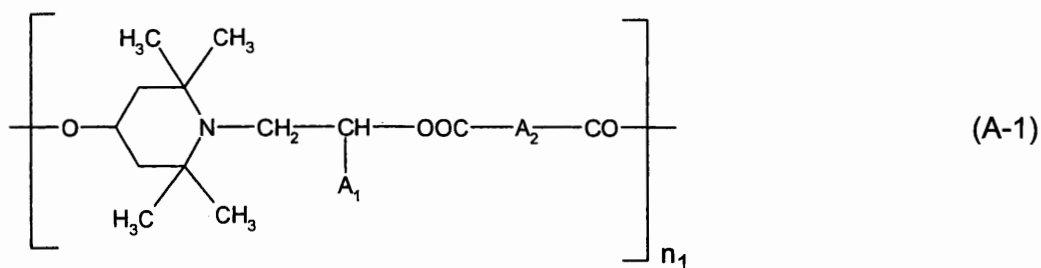
wherein b_1 is a number from 2 to 20.

Claims:

1. A mulch film comprising the components

- (I) an organic polymer,
 5 (II) an organic salt of Fe, Ce, Co, Mn, Cu or V, and
 (III) one or more sterically hindered amine compounds selected from the group consisting of

a compound of the formula (A-1)



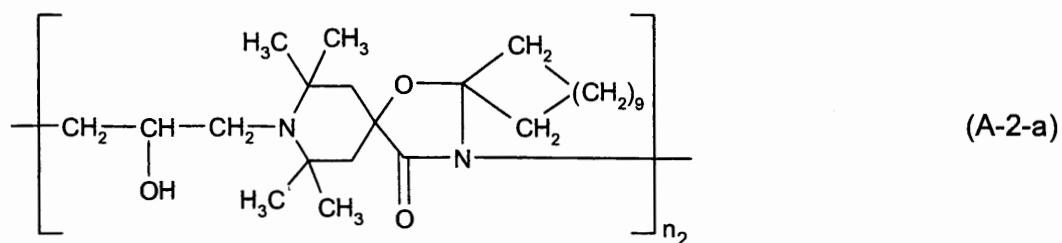
10 wherein

A_1 is hydrogen or C_1 - C_4 alkyl,

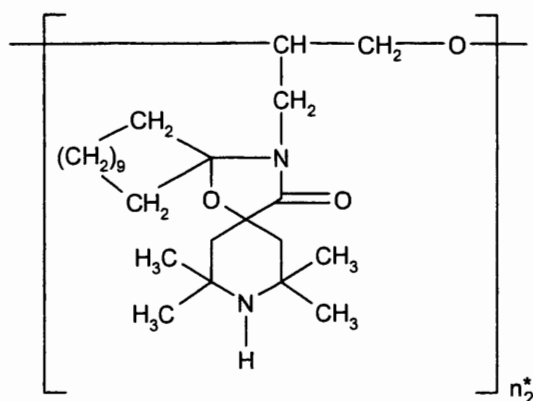
A_2 is a direct bond or C_1 - C_{10} alkylene, and

n_1 is a number from 2 to 50;

15 at least one compound of the formulae (A-2-a) and (A-2-b)



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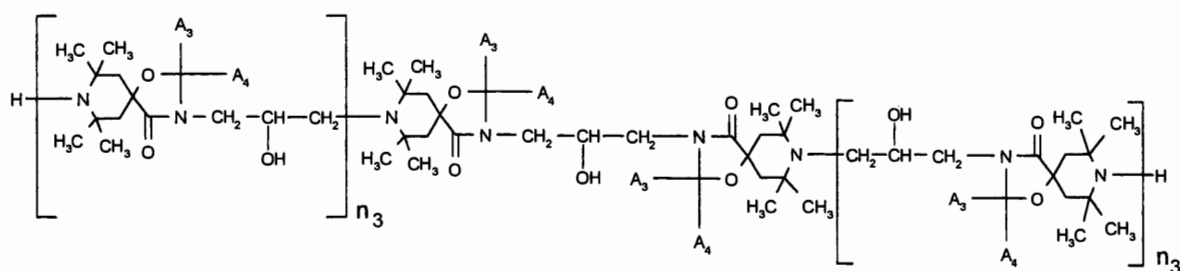


(A-2-b)

wherein

n_2 and n_2^* are a number from 2 to 50;

5 a compound of the formula (A-3)



(A-3)

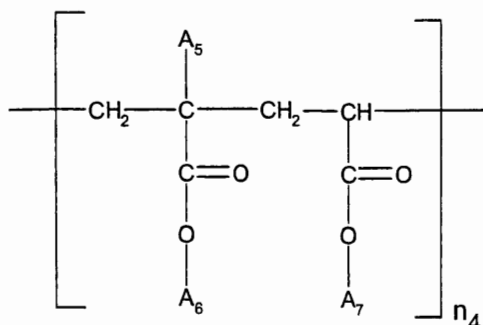
wherein

A_3 and A_4 independently of one another are hydrogen or C_1 - C_8 alkyl, or A_3 and A_4 together

10 form a C_2 - C_{14} alkylene group, and

the variables n_3 independently of one another are a number from 1 to 50;

a compound of the formula (A-4)



(A-4)

- 70 -

wherein

n_4 is a number from 2 to 50,

A_5 is hydrogen or C_1 - C_4 alkyl,

the radicals A_6 and A_7 independently of one another are C_1 - C_4 alkyl or a group of the formula

5 (a-I)



wherein A_8 is hydrogen, C_1 - C_8 alkyl, $-O^{\cdot}$, $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by $-OH$; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,

10 with the proviso that at least 50 % of the radicals A_7 are a group of the formula (a-I);

a compound of the formula (B-1)



in which

15 E_1 is hydrogen, C_1 - C_8 alkyl, $-O^{\cdot}$, $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by $-OH$; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,

m_1 is 1, 2 or 4,

if m_1 is 1, E_2 is C_1 - C_{25} alkyl,

20 if m_1 is 2, E_2 is C_1 - C_{14} alkylene or a group of the formula (b-I)



wherein E_3 is C_1 - C_{10} alkyl or C_2 - C_{10} alkenyl, E_4 is C_1 - C_{10} alkylene, and

- 71 -

E_5 and E_6 independently of one another are C_1 - C_4 alkyl, cyclohexyl or methylcyclohexyl, and
 if m_1 is 4, E_2 is C_4 - C_{10} alkanetetrayl;

5 a compound of the formula (B-2)



in which

two of the radicals E_7 are $-\text{COO}-(C_1\text{-}C_{20}\text{alkyl})$, and
 two of the radicals E_7 are a group of the formula (b-II)



with E_8 having one of the meanings of E_1 ;

a compound of the formula (B-3)



15 in which

E_9 and E_{10} together form C_2 - C_{14} alkylene,

E_{11} is hydrogen or a group $-\text{Z}_1-\text{COO}-\text{Z}_2$,

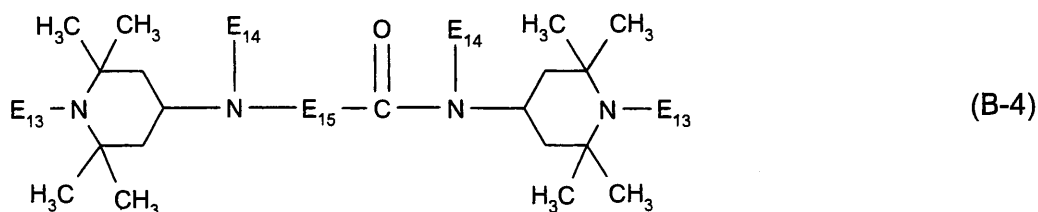
Z_1 is C_2 - C_{14} alkylene, and

Z_2 is C_1 - C_{24} alkyl, and

20 E_{12} has one of the meanings of E_1 ;

a compound of the formula (B-4)

- 72 -



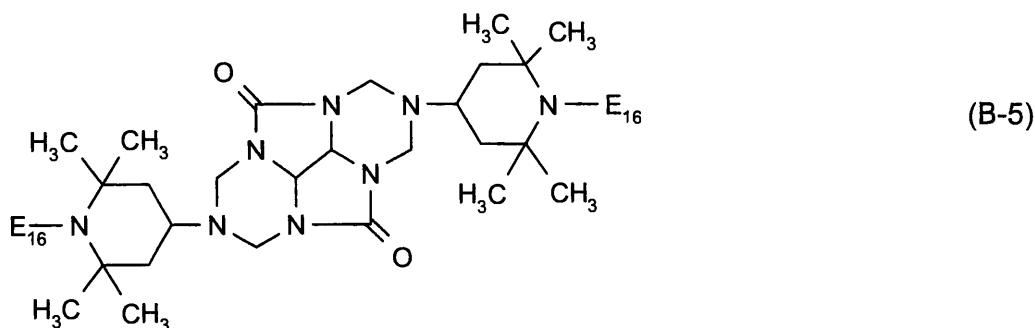
wherein

the radicals E_{13} independently of one another have one of the meanings of E_1 ,

the radicals E_{14} independently of one another are hydrogen or C_1 - C_{12} alkyl, and

- 5 E_{15} is C_1 - C_{10} alkylene or C_3 - C_{10} alkylidene;

a compound of the formula (B-5)



wherein

- 10 the radicals E_{16} independently of one another have one of the meanings of E_1 ;

a compound of the formula (B-6)

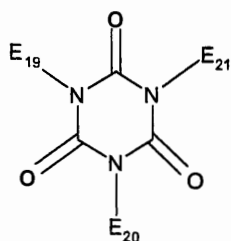


in which

- 15 E_{17} is C_1 - C_{24} alkyl, and
 E_{18} has one of the meanings of E_1 ;

a compound of the formula (B-7)

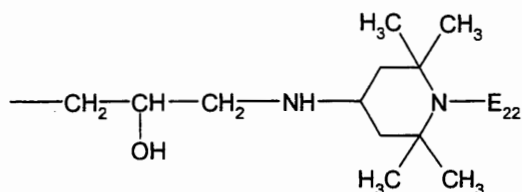
- 73 -



(B-7)

in which

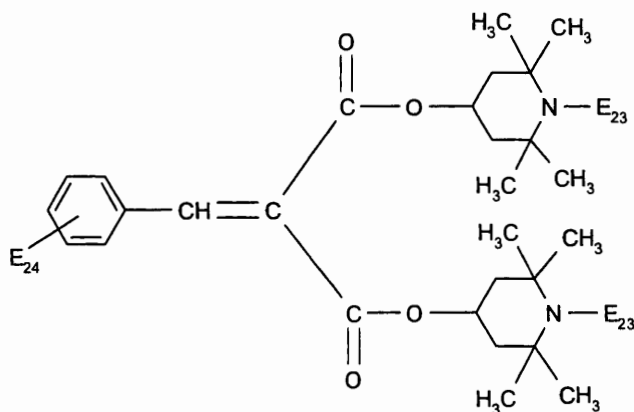
E_{19} , E_{20} and E_{21} independently of one another are a group of the formula (b-III)



(b-III)

5 wherein E_{22} has one of the meanings of E_1 ;

a compound of the formula (B-8)

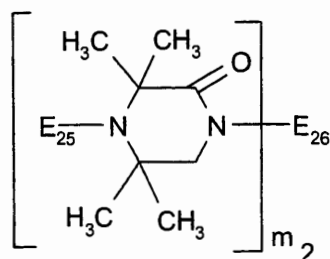


(B-8)

wherein

10 the radicals E_{23} independently of one another have one of the meanings of E_1 , and E_{24} is hydrogen, C_1 - C_{12} alkyl or C_1 - C_{12} alkoxy;

a compound of the formula (B-9)



(B-9)

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wherein

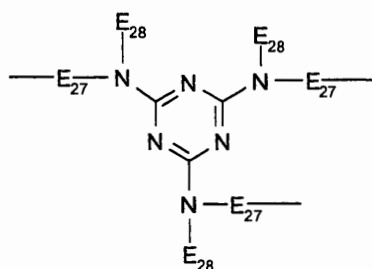
m_2 is 1, 2 or 3,

E_{25} has one of the meanings of E_1 , and

when m_2 is 1, E_{26} is a group $-\text{CH}_2\text{CH}_2\text{NH}-$  ,

5 when m_2 is 2, E_{26} is $\text{C}_2\text{-C}_{22}$ alkylene, and

when m_2 is 3, E_{26} is a group of the formula (b-IV)



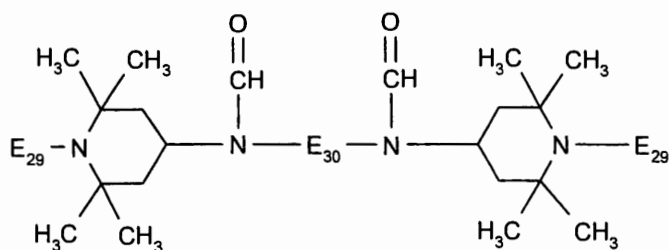
(b-IV)

wherein the radicals E_{27} independently of one another are $\text{C}_2\text{-C}_{12}$ alkylene, and

the radicals E_{28} independently of one another are $\text{C}_1\text{-C}_{12}$ alkyl or $\text{C}_5\text{-C}_{12}$ cycloalkyl;

10

a compound of the formula (B-10)



(B-10)

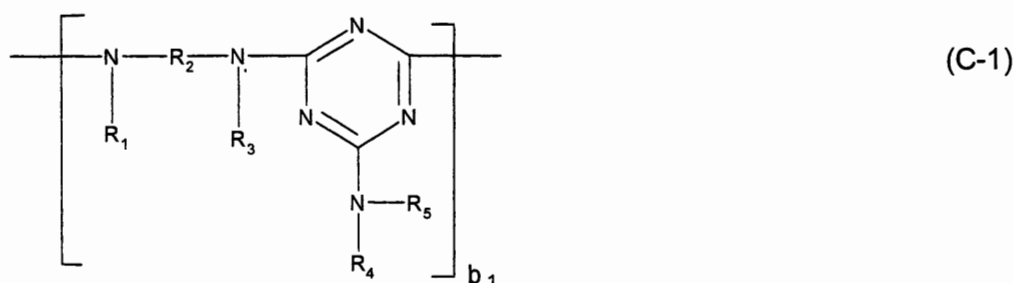
wherein

the radicals E_{29} independently of one another have one of the meanings of E_1 , and

15 E_{30} is $\text{C}_2\text{-C}_{22}$ alkylene, $\text{C}_5\text{-C}_7$ cycloalkylene, $\text{C}_1\text{-C}_4$ alkylenedi($\text{C}_5\text{-C}_7$ cycloalkylene), phenylene or phenylenedi($\text{C}_1\text{-C}_4$ alkylene);

a compound of the formula (C-1)

- 75 -



in which

- R_1 , R_3 , R_4 and R_5 independently of one another are hydrogen, C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, C_1 - C_4 -alkyl-substituted C_5 - C_{12} cycloalkyl, phenyl, phenyl which is substituted by -OH and/or C_1 - C_{10} alkyl; C_7 - C_9 phenylalkyl, C_7 - C_9 phenylalkyl which is substituted on the phenyl radical by -OH and/or C_1 - C_{10} alkyl; or a group of the formula (c-I)



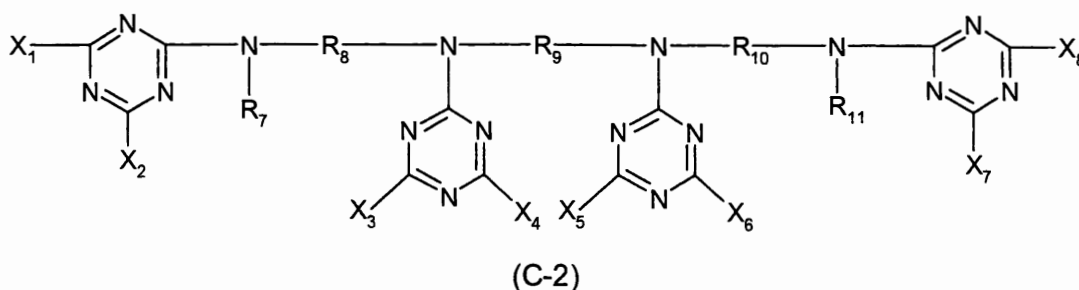
R_2 is C_2 - C_{18} alkylene, C_5 - C_7 cycloalkylene or C_1 - C_4 alkylenedi(C_5 - C_7 cycloalkylene),

or

- the radicals R_1 , R_2 and R_3 , together with the nitrogen atoms to which they are bonded, perform a 5- to 10-membered heterocyclic ring, or
- R_4 and R_5 , together with the nitrogen atom to which they are bonded, form a 5- to 10-membered heterocyclic ring,
- R_6 is hydrogen, C_1 - C_8 alkyl, -O-, -OH, -CH₂CN, C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by -OH; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl, and
- b_1 is a number from 2 to 50,
- with the proviso that at least one of the radicals R_1 , R_3 , R_4 and R_5 is a group of the formula (c-I);

a compound of the formula (C-2)

- 76 -



wherein

R₇ and R₁₁ independently of one another are hydrogen or C₁-C₁₂alkyl,

5 R₈, R₉ and R₁₀ independently of one another are C₂-C₁₀alkylene, and

X₁, X₂, X₃, X₄, X₅, X₆, X₇ and X₈ independently of one another are a group of the formula (c-II),

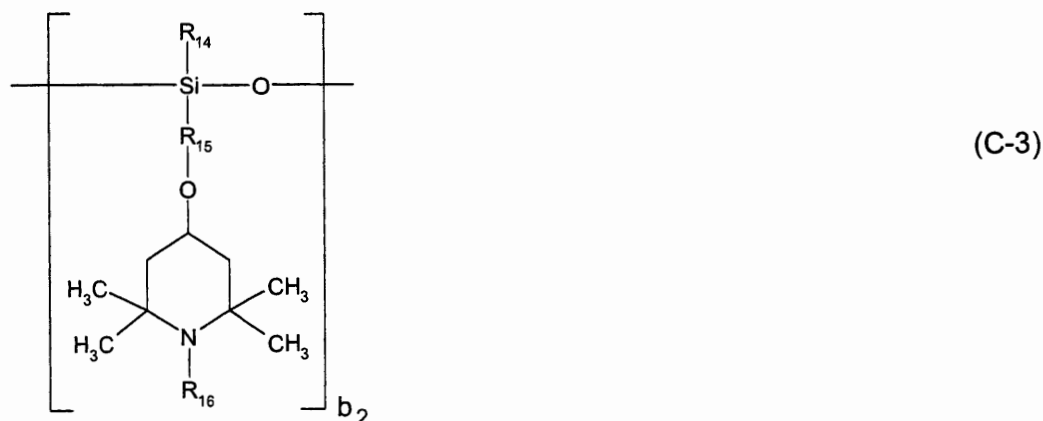


in which R₁₂ is hydrogen, C₁-C₁₂alkyl, C₅-C₁₂cycloalkyl, C₁-C₄alkyl-substituted

10 C₅-C₁₂cycloalkyl, phenyl, -OH- and/or C₁-C₁₀alkyl-substituted phenyl, C₇-C₉phenylalkyl, C₇-C₉phenylalkyl which is substituted on the phenyl radical by -OH and/or C₁-C₁₀alkyl; or a group of the formula (c-I) as defined above, and

R₁₃ has one of the meanings of R₆;

15 a compound of the formula (C-3)



in which

R₁₄ is C₁-C₁₀alkyl, C₅-C₁₂cycloalkyl, C₁-C₄alkyl-substituted C₅-C₁₂cycloalkyl, phenyl or C₁-C₁₀alkyl-substituted phenyl,

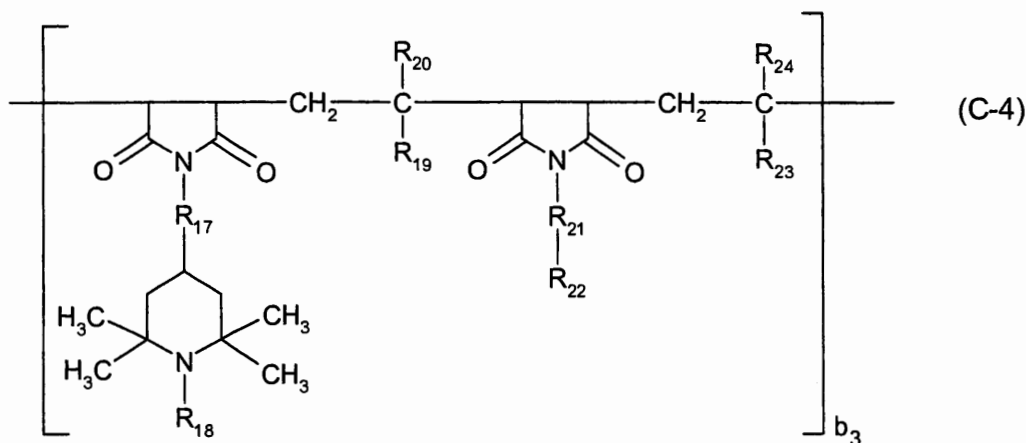
- 77 -

R_{15} is C_3 - C_{10} alkylene,

R_{16} has one of the meanings of R_6 , and

b_2 is a number from 2 to 50;

- 5 a compound of the formula (C-4)



in which

R_{17} and R_{21} independently of one another are a direct bond or a $-N(X_9)-CO-X_{10}-CO-N(X_{11})-$ group, where X_9 and X_{11} independently of one another are hydrogen, C_1 - C_8 alkyl,

- 10 C_5 - C_{12} cycloalkyl, phenyl, C_7 - C_9 phenylalkyl or a group of the formula (c-I),

X_{10} is a direct bond or C_1 - C_4 alkylene,

R_{18} has one of the meanings of R_6 ,

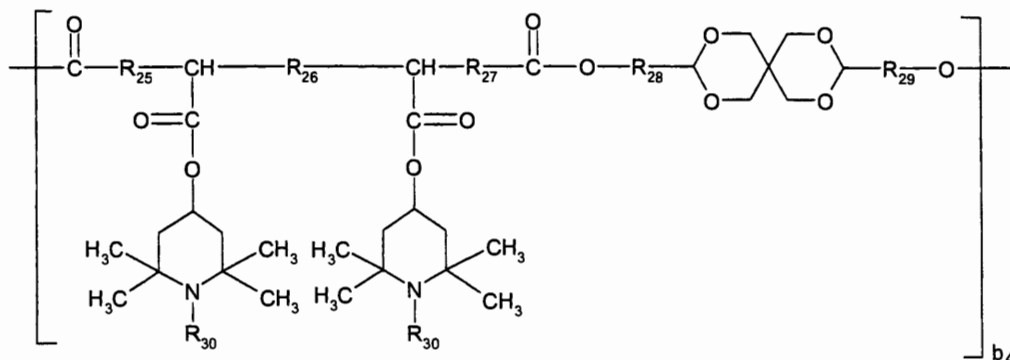
R_{19} , R_{20} , R_{23} and R_{24} independently of one another are hydrogen, C_1 - C_{30} alkyl, C_5 - C_{12} cycloalkyl or phenyl,

- 15 R_{22} is hydrogen, C_1 - C_{30} alkyl, C_5 - C_{12} cycloalkyl, phenyl, C_7 - C_9 phenylalkyl or a group of the formula (c-I), and

b_3 is a number from 1 to 50;

a compound of the formula (C-5)

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(C-5)

in which

R_{25} , R_{26} , R_{27} , R_{28} and R_{29} independently of one another are a direct bond or

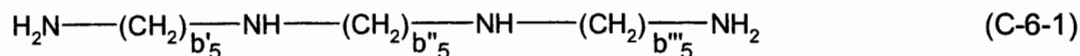
5 C_1 - C_{10} alkylene,

R_{30} has one of the meanings of R_6 , and

b_4 is a number from 1 to 50; and

a product (C-6) obtainable by reacting a product, obtained by reaction of a polyamine of the

10 formula (C-6-1) with cyanuric chloride, with a compound of the formula (C-6-2)



in which

15 b'_5 , b''_5 and b'''_5 independently of one another are a number from 2 to 12,

R_{31} is hydrogen, C_1 - C_{12} alkyl, C_5 - C_{12} cycloalkyl, phenyl or C_7 - C_9 phenylalkyl, and

R_{32} has one of the meanings of R_6 .

20 **2.** A mulch film according to claim 1 wherein

component (I) is a polyolefin homo- or copolymer, a starch modified polyolefin, a starch based polymer composite or a biopolymer.

3. A mulch film according to claim 1 wherein

5 component (I) is polyethylene, polypropylene, a polyethylene copolymer or a polypropylene copolymer.

4. A mulch film according to claim 1 wherein

10 component (I) is a biopolymer selected from the group consisting of polycaprolactone, polylactic acid, polyglycolic acid, polyhydroxybutyrate-valerate, polybutylene succinate, polyvinyl alcohol, polyhydroxyalcanoate and polyethylene adipate.

5. A mulch film according to claim 1 wherein

15 component (II) is a C_2 - C_{24} carboxylate of Fe, Ce, Co, Mn, Cu or V.

6. A mulch film according to claim 1 wherein

component (II) is a C_2 - C_{24} carboxylate of Ce, Co or Mn.

7. A mulch film according to claim 1 wherein

20 component (II) is a C_{10} - C_{20} alkanooate of Ce, Co or Mn or a C_{10} - C_{20} alkenoate of Ce, Co or Mn.

8. A mulch film according to claim 1 wherein

A_1 is hydrogen or methyl,

A_2 is a direct bond or C_2 - C_6 alkylene, and

25 n_1 is a number from 2 to 25;

n_2 and n_2^* are a number from 2 to 25;

A_3 and A_4 independently of one another are hydrogen or C_1 - C_4 alkyl, or A_3 and A_4 together form a C_9 - C_{13} alkylene group, and

the variables n_3 independently of one another are a number from 1 to 25;

30 n_4 is a number from 2 to 25,

A_5 and A_6 independently of one another are C_1 - C_4 alkyl, and

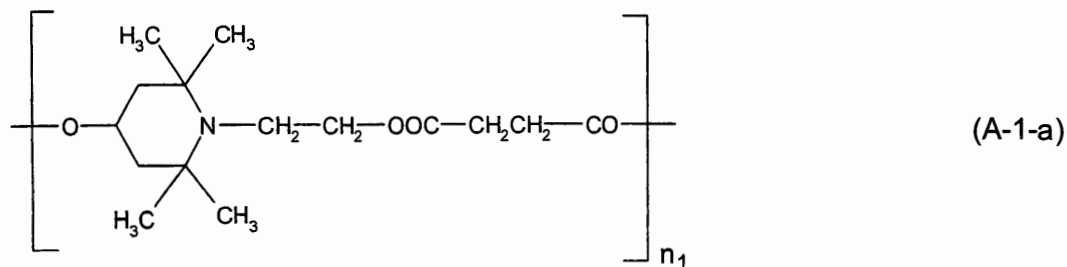
A_7 is C_1 - C_4 alkyl or a group of the formula (a-I)

with the proviso that at least 50 % of the radicals A_7 are a group of the formula (a-I);

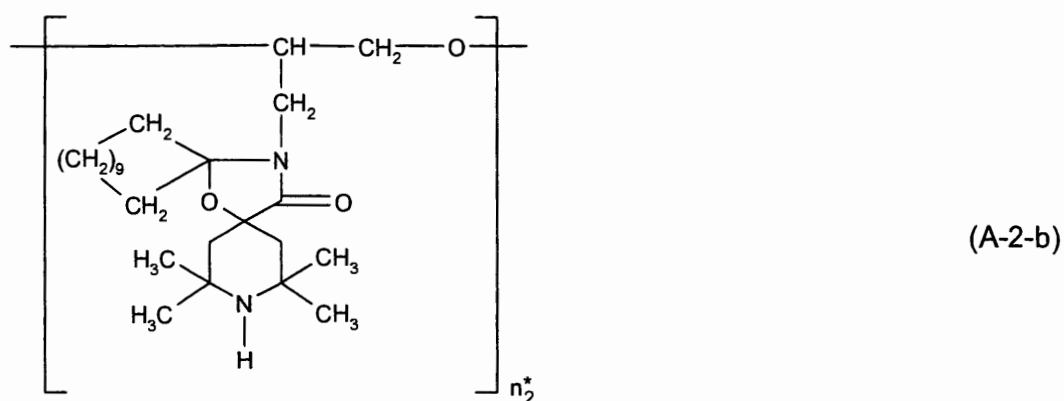
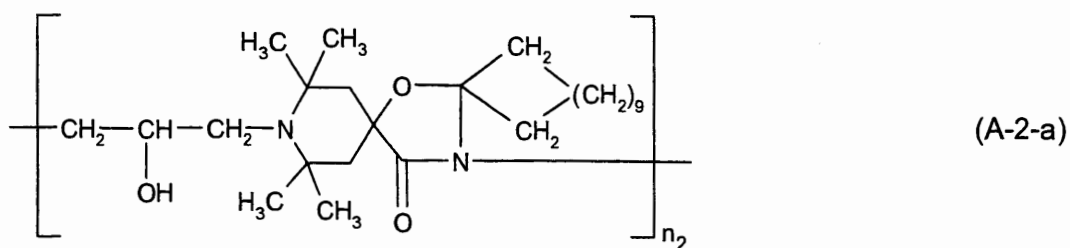
m_1 is 1, 2 or 4,

- if m_1 is 1, E_2 is C_{12} - C_{20} alkyl,
 if m_1 is 2, E_2 is C_2 - C_{10} alkylene or a group of the formula (b-I),
 E_3 is C_1 - C_4 alkyl,
 E_4 is C_1 - C_6 alkylene, and
- 5 E_5 and E_6 independently of one another are C_1 - C_4 alkyl, and
 if m_1 is 4, E_2 is C_4 - C_8 alkanetetrayl;
 two of the radicals E_7 are $-COO-(C_{10}$ - C_{15} alkyl), and
 two of the radicals E_7 are a group of the formula (b-II);
 E_9 and E_{10} together form C_9 - C_{13} alkylene,
- 10 E_{11} is hydrogen or a group $-Z_1-COO-Z_2$,
 Z_1 is C_2 - C_6 alkylene, and
 Z_2 is C_{10} - C_{16} alkyl;
 E_{14} is hydrogen, and
 E_{15} is C_2 - C_6 alkylene or C_3 - C_5 alkylidene;
- 15 E_{17} is C_{10} - C_{14} alkyl;
 E_{24} is C_1 - C_4 alkoxy;
 m_2 is 1, 2 or 3,
- when m_2 is 1, E_{26} is a group $—CH_2CH_2-NH-$  ,
- when m_2 is 2, E_{26} is C_2 - C_6 alkylene, and
- 20 when m_2 is 3, E_{26} is a group of the formula (b-IV)
 the radicals E_{27} independently of one another are C_2 - C_6 alkylene, and
 the radicals E_{28} independently of one another are C_1 - C_4 alkyl or C_5 - C_8 cycloalkyl; and
 E_{30} is C_2 - C_8 alkylene;
 R_1 and R_3 independently of one another are a group of the formula (c-I),
- 25 R_2 is C_2 - C_8 alkylene,
 R_4 and R_5 independently of one another are hydrogen, C_1 - C_{12} alkyl, C_5 - C_8 cycloalkyl or a
 group of the formula (c-I), or the radicals R_4 and R_5 , together with the nitrogen atom to which
 they are bonded, form a 5- to 10-membered heterocyclic ring, and
 b_1 is a number from 2 to 25;
- 30 R_7 and R_{11} independently of one another are hydrogen or C_1 - C_4 alkyl,
 R_8 , R_9 and R_{10} independently of one another are C_2 - C_4 alkylene, and
 X_1 , X_2 , X_3 , X_4 , X_5 , X_6 , X_7 and X_8 independently of one another are a group of the formula
 (c-II),

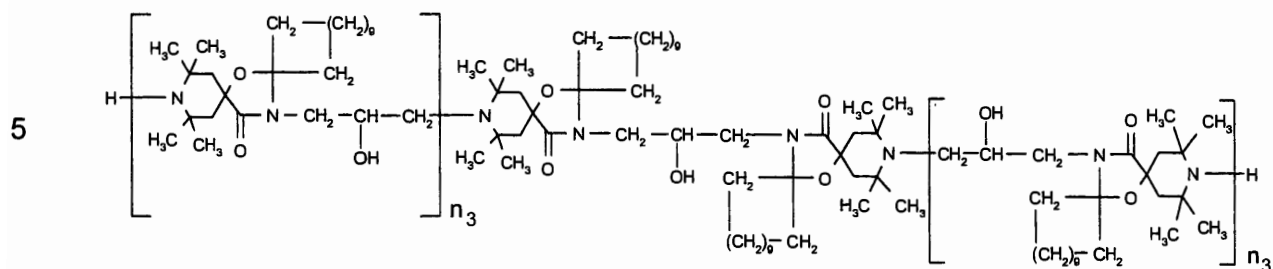
- R_{12} is hydrogen, C_1 - C_4 alkyl, C_5 - C_8 cycloalkyl or a group of the formula (c-I);
 R_{14} is C_1 - C_4 alkyl,
 R_{15} is C_3 - C_6 alkylene, and
 b_2 is a number from 2 to 25;
- 5 R_{17} and R_{21} independently of one another are a direct bond or a group
 $-N(X_9)-CO-X_{10}-CO-N(X_{11})-$,
 X_9 and X_{11} independently of one another are hydrogen or C_1 - C_4 alkyl,
 X_{10} is a direct bond,
 R_{19} and R_{23} are C_1 - C_{25} alkyl or phenyl,
- 10 R_{20} and R_{24} are hydrogen or C_1 - C_4 alkyl,
 R_{22} is C_1 - C_{25} alkyl or a group of the formula (c-I), and
 b_3 is a number from 1 to 25;
 R_{25} , R_{26} , R_{27} , R_{28} and R_{29} independently of one another are a direct bond or
 C_1 - C_4 alkylene, and
- 15 b_4 is a number from 1 to 25;
 b'_5 , b''_5 and b'''_5 independently of one another are a number from 2 to 4, and
 R_{31} is hydrogen, C_1 - C_4 alkyl, C_5 - C_8 cycloalkyl, phenyl or benzyl.
- 20 **9.** A mulch film according to claim 1 wherein
component (III) is one or more sterically hindered amine compounds selected from the group
consisting of the compounds of the formulae
(A-1-a), (A-2-a), (A-2-b), (A-3-a), (A-4-a),
(B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),
25 (B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),
(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a
product (C-6-a);



wherein n_1 is a number from 2 to 20;



wherein n_2 and n_2^* are a number from 2 to 20;



(A-3-a)

wherein the variables n_3 independently of one another are a number from 1 to 20;

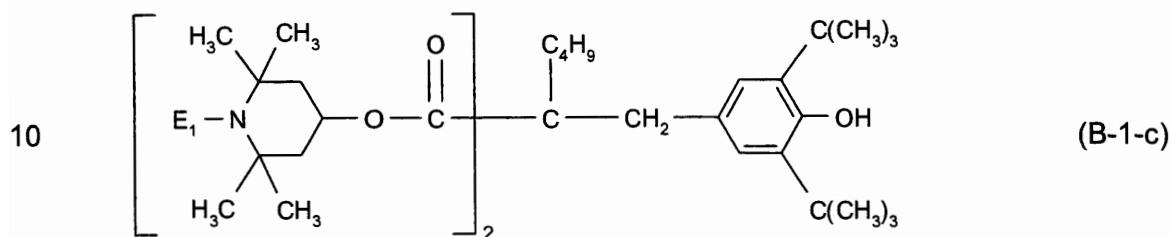
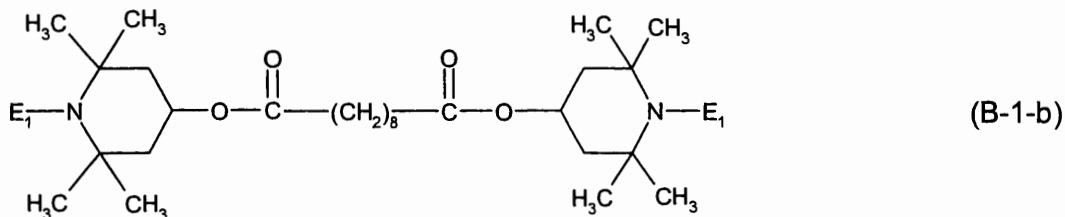
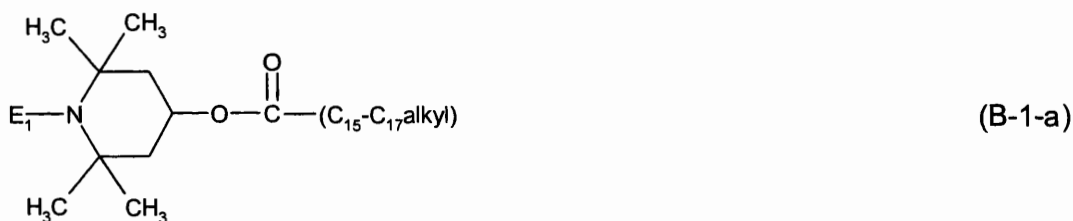


wherein n_4 is a number from 2 to 20, and

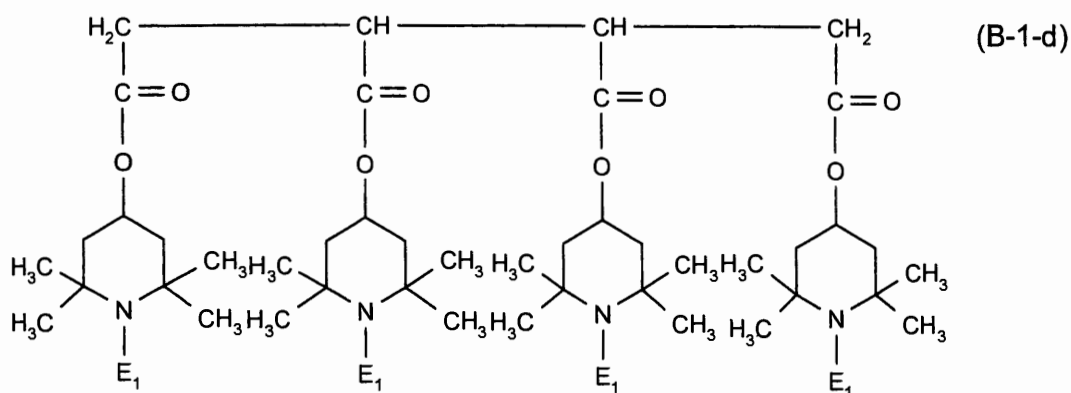
at least 50 % of the radicals A_7 are a group of the formula (a-I)



- wherein A_8 is hydrogen, C_1 - C_8 alkyl, O^- , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl,
 5 and the remaining radicals A_7 are ethyl;



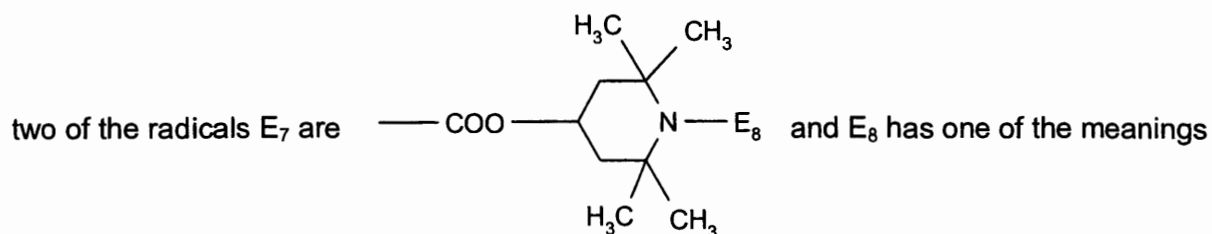
- 84 -



wherein E_1 is hydrogen, C_1 - C_8 alkyl, O^- , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl;



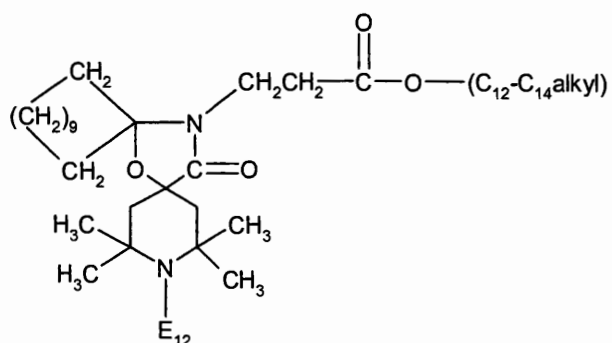
in which two of the radicals E_7 are $-\text{COO}-\text{C}_{13}\text{H}_{27}$ and



of E_1 ;

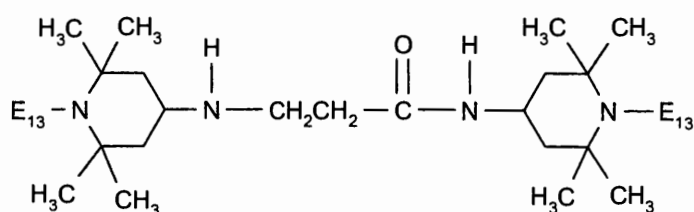


- 85 -

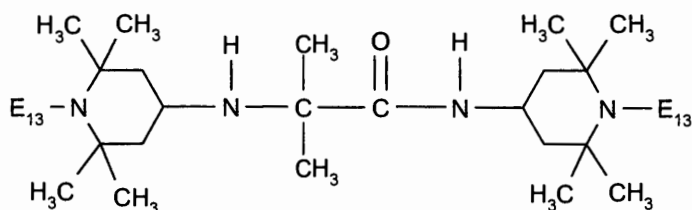


(B-3-b)

wherein E_{12} has one of the meanings of E_1 ;

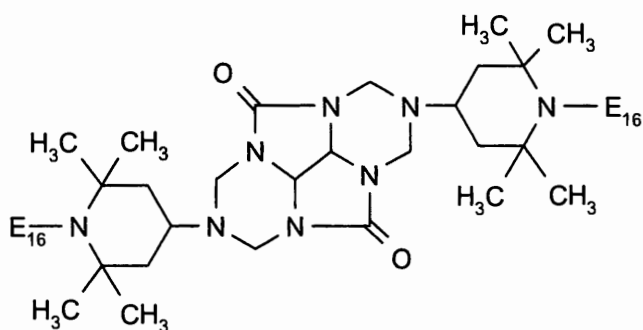


(B-4-a)



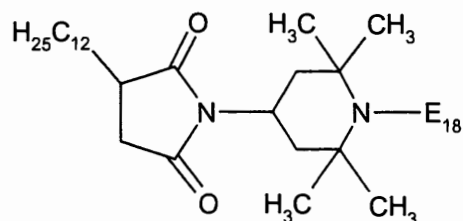
(B-4-b)

5 wherein E_{13} has one of the meanings of E_1 ;



(B-5)

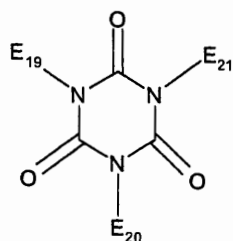
wherein E_{16} has one of the meanings of E_1 ;



(B-6-a)

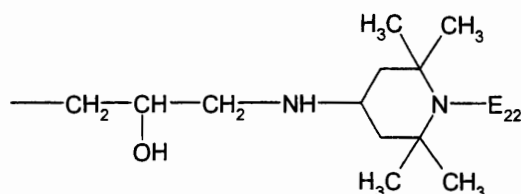
wherein E_{18} has one of the meanings of E_1 ;

- 86 -



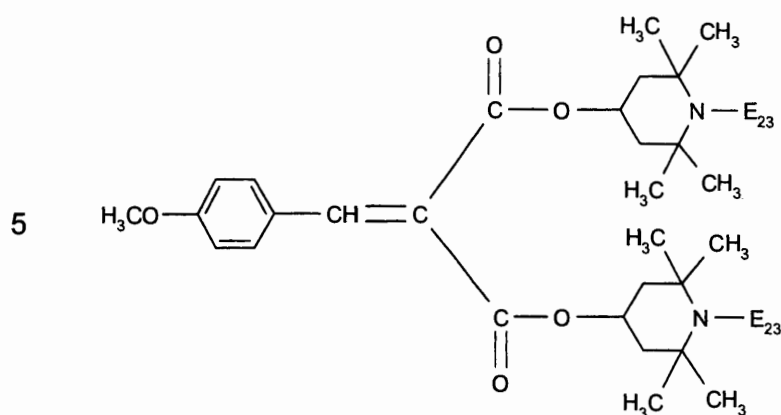
(B-7)

in which E_{19} , E_{20} and E_{21} independently of one another are a group of the formula (b-III)



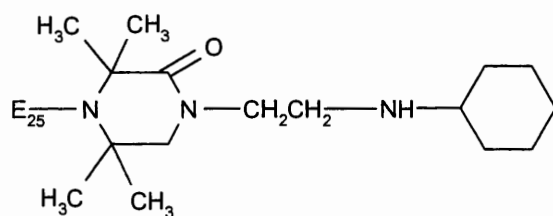
(b-III)

wherein E_{22} has one of the meanings of E_1 ;

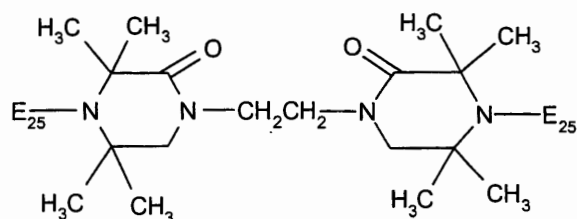


(B-8-a)

wherein E_{23} has one of the meanings of E_1 ;

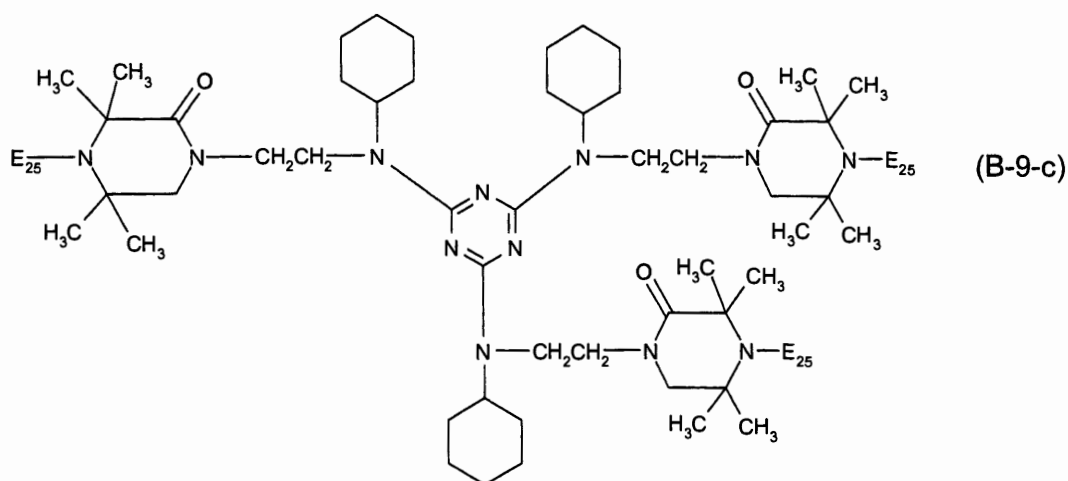


(B-9-a)

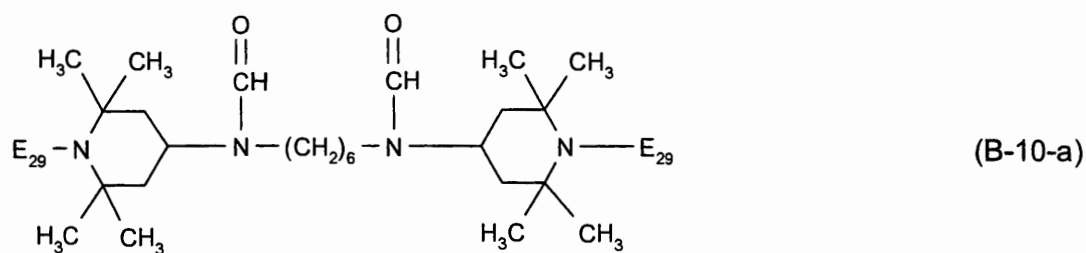


(B-9-b)

- 87 -

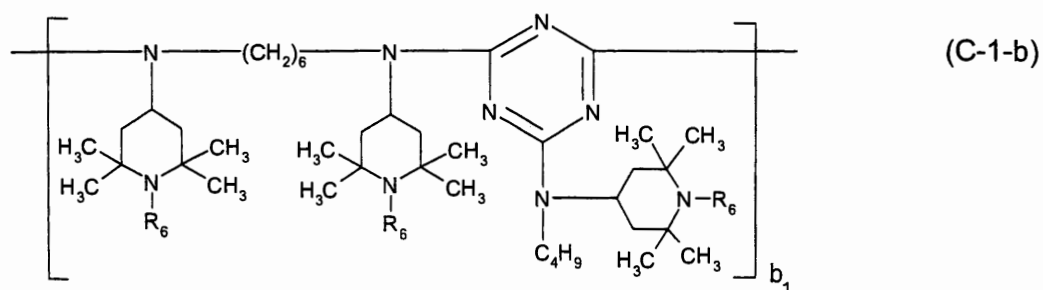
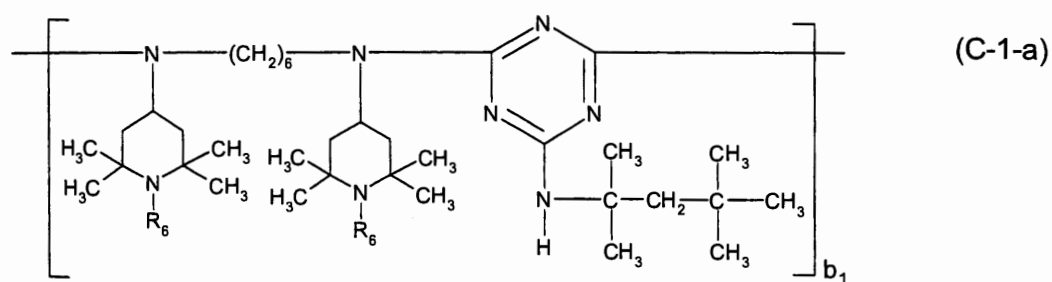


wherein E₂₅ has one of the meanings of E₁;

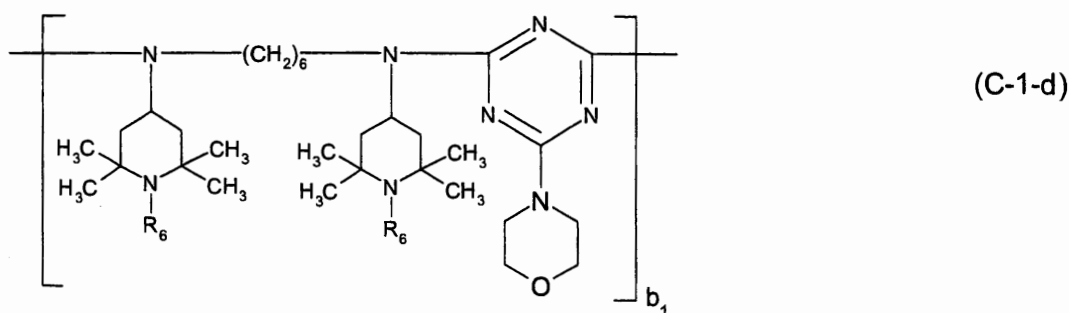
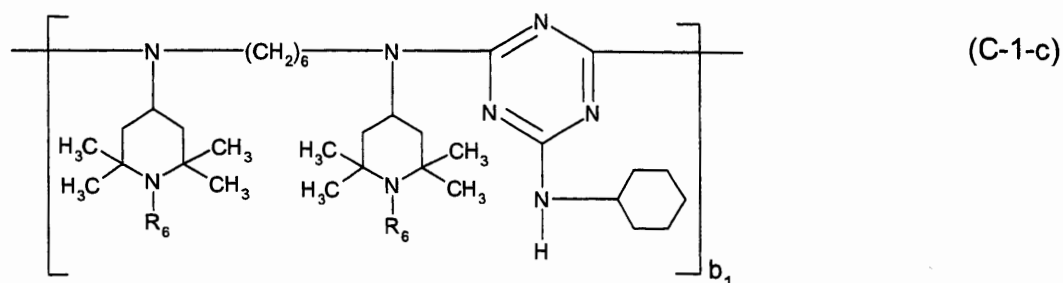


wherein E₂₉ has one of the meanings of E₁;

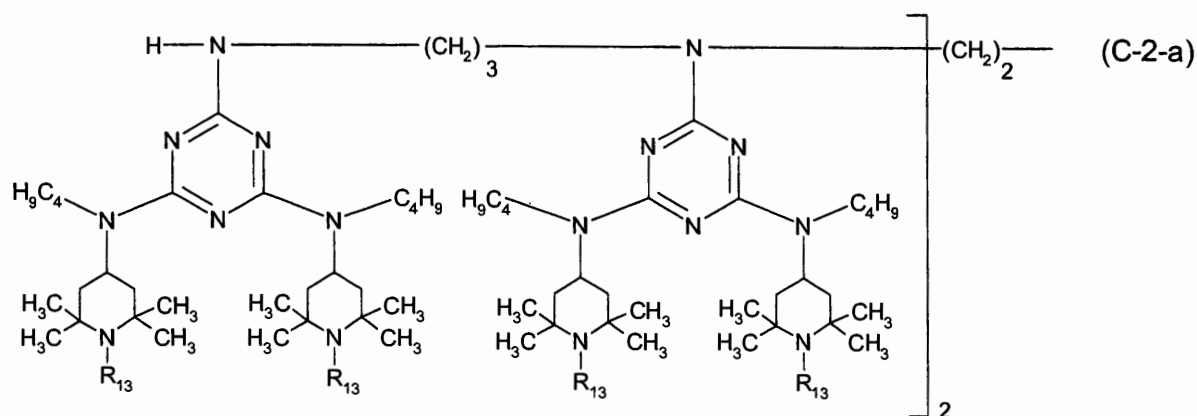
5



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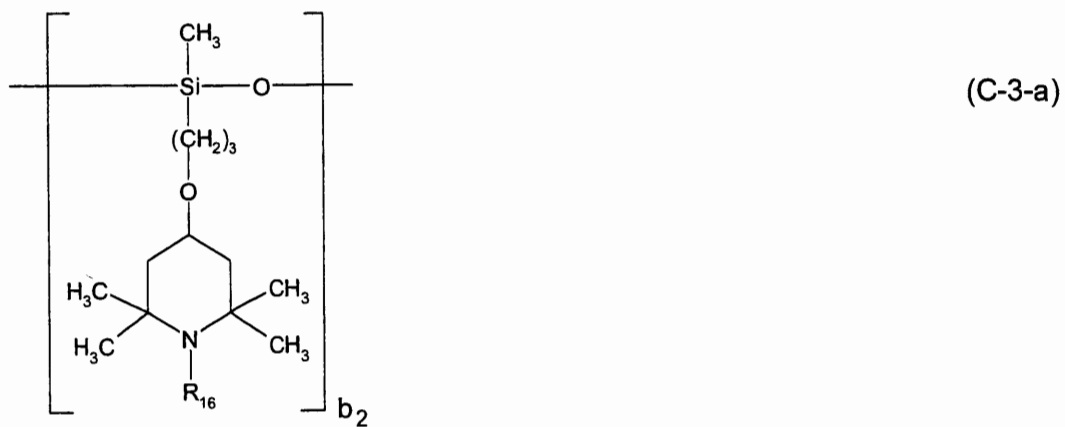


wherein b_1 is a number from 2 to 20 and R_6 is hydrogen, C_1 - C_8 alkyl, O^- , $-OH$, $-CH_2CN$, C_1 - C_{18} alkoxy, C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl;

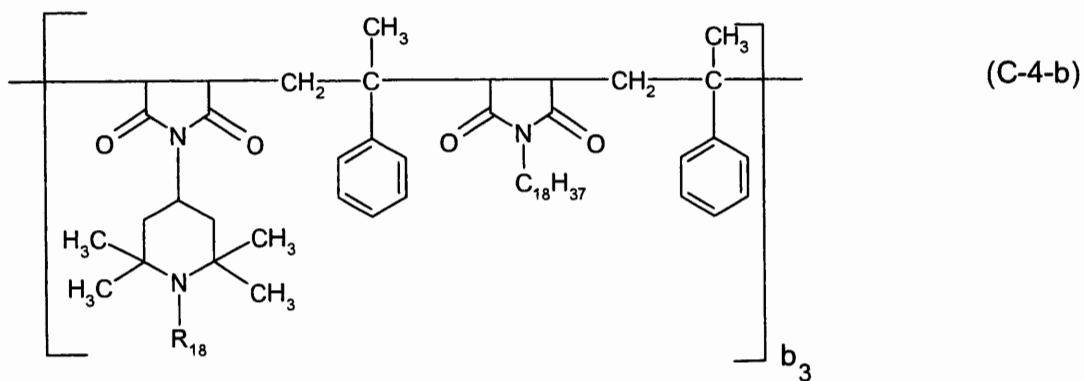
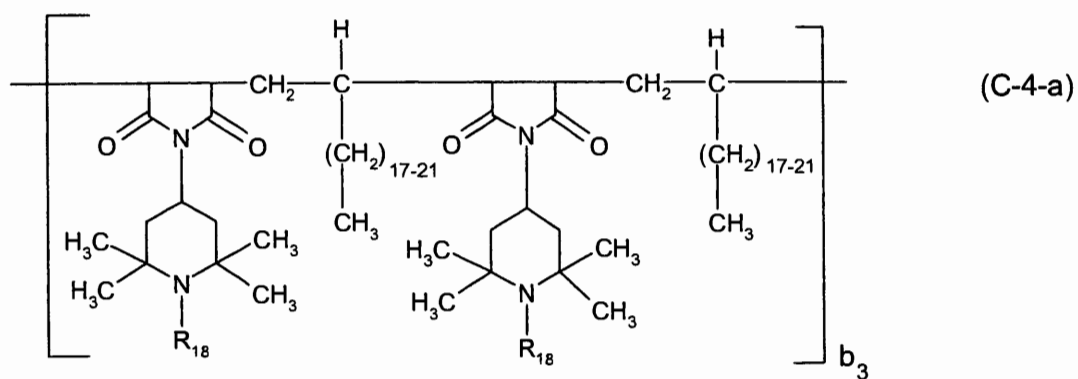


wherein R_{13} has one of the meanings of R_6 ,

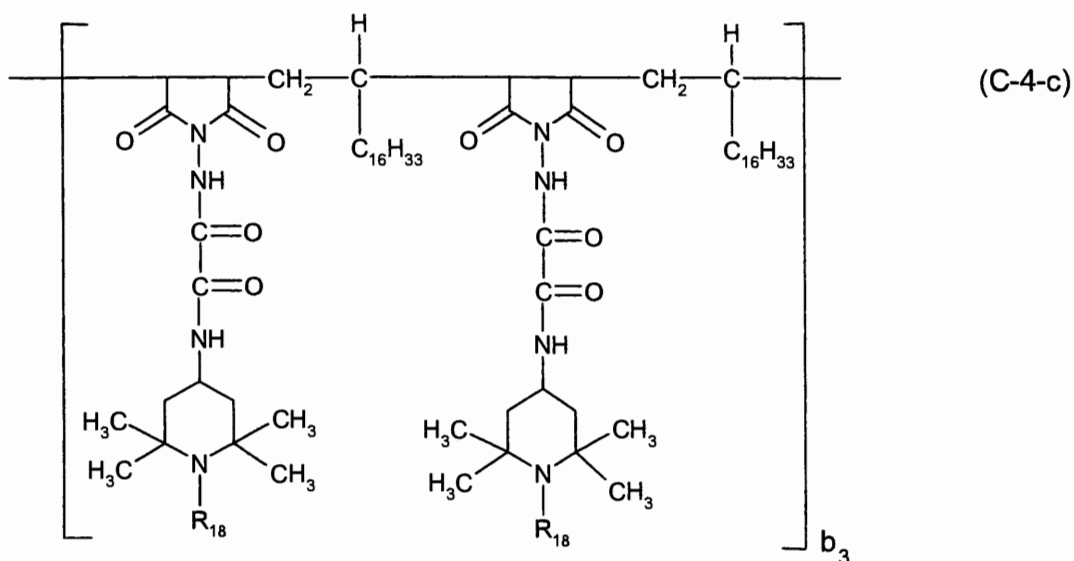
- 89 -



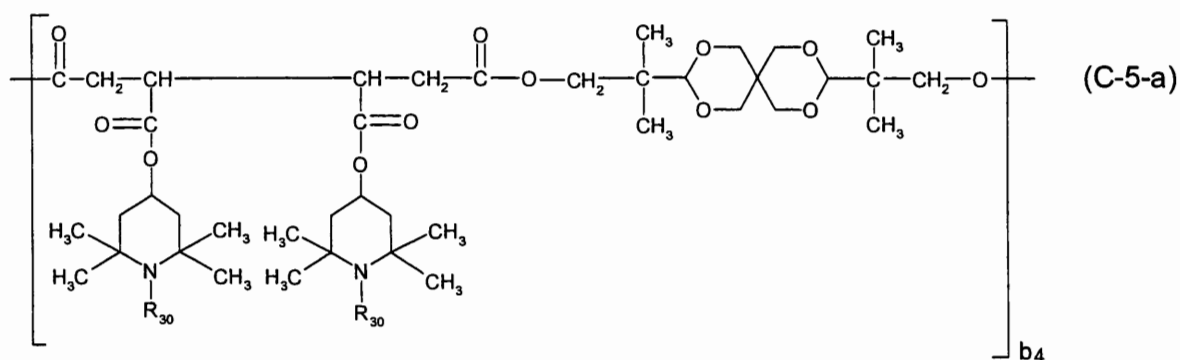
wherein b_2 is a number from 2 to 20 and R_{16} has one of the meanings of R_6 ;



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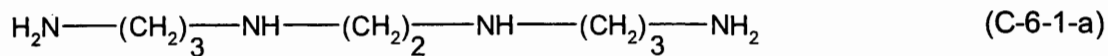
wherein b_3 is a number from 1 to 20 and R_{18} has one of the meanings of R_6 ;



wherein b_4 is a number from 1 to 20 and R_{30} has one of the meanings of R_6 ;

5

a product (C-6-a) obtainable by reacting a product, obtained by reaction of a polyamine of the formula (C-6-1-a) with cyanuric chloride, with a compound of the formula (C-6-2-a)



10



in which R_{32} has one of the meanings of R_6 .

10. A mulch film according to claim 1 wherein

A₈ is hydrogen, C₁-C₄alkyl, C₁-C₁₀alkoxy, cyclohexyloxy, allyl, benzyl or acetyl;

5 E₁, E₈, E₁₂, E₁₃, E₁₆, E₁₈, E₂₂, E₂₃, E₂₅ and E₂₉ are hydrogen, C₁-C₄alkyl, C₁-C₁₀alkoxy, cyclohexyloxy, allyl, benzyl or acetyl;

R₆, R₁₃, R₁₆, R₁₈, R₃₀ and R₃₂ are hydrogen, C₁-C₄alkyl, C₁-C₁₀alkoxy, cyclohexyloxy, allyl, benzyl or acetyl.

10 **11.** A mulch film according to claim 9 wherein

A₈, E₁, E₈, E₁₂, E₁₃, E₁₆, E₁₈, E₂₂, E₂₃, E₂₅, E₂₉, R₆, R₁₃, R₁₆, R₁₈, R₃₀ and R₃₂ are hydrogen or methyl and E₁ and R₆ additionally are C₁-C₈alkoxy.

12. A mulch film according to claim 9 wherein

15 component (III) is a compound of the formula

(A-1-a), (A-2-a), (A-2-b),

(B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),

(B-8-a), (B-9-b), (B-10-a),

(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a) or (C-5-a) or a product (C-6-a).

20

13. A mulch film according to claim 9 wherein

component (III) is a compound of the formula

(A-1-a), (A-2-a), (A-2-b),

(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a) or (C-5-a) or a product (C-6-a).

25

14. A mulch film according to claim 9 which contains as component (III) two different

sterically hindered amine compounds selected from the group consisting of the compounds of the formulae

(A-1-a), (A-2-a), (A-2-b), (A-3-a), (A-4-a),

30 (B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),

(B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),

(C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a product (C-6-a);

with the proviso that the two different sterically hindered amine compounds are not selected from the same generic formula.

- 15.** A mulch film according to claim 1 wherein
- 5 component (III) is a compound of the formula (A-1-a), or
a compound of the formula (C-1-a) wherein R_6 is hydrogen, or
a combination of a compound of the formula (A-1-a) with a compound of the formula (C-1-a)
wherein R_6 is hydrogen, or
a combination of a compound of the formula (A-1-a) with a compound of the formula (C-2-a)
10 wherein R_{13} is methyl, or
a combination of a compound of the formula (B-1-b) wherein E_1 is hydrogen with a
compound of the formula (C-1-a) wherein R_6 is hydrogen.

- 16.** A mulch film according to claim 1 which contains in addition one or more of the following
- 15 components
(IV) an antioxidant,
(V) an UV absorber,
(VI) a filler,
(VII) a pigment,
20 (VIII) an inorganic or organic salt of Ca, Mg, Zn or Al.

17. A mulch film according to claim 1 which additionally contains an aliphatic poly hydroxy-carboxyl acid.

- 25 **18.** A mulch film according to claim 17 wherein the aliphatic poly hydroxy-carboxyl acid is citric acid.

- 30 **19.** A method for controlling the weathering resistance and the degradation of a mulch film, which comprises incorporating into the organic polymer components (II) and (III) as defined in claim 1.

20. The use of a mixture containing components (II) and (III) as defined in claim 1 for controlling the weathering resistance and the degradation of a mulch film.

21. A composition containing components (II) and (III) as defined in claim 1 with the proviso
5 that component (III) relates to two sterically hindered amine compounds.

22. A stabilizer composition containing components (II) and (III) as defined in claim 1 for an agricultural organic polymer article with the proviso that component (III) relates to two sterically hindered amine compounds.

23. A mulch film according to claim 9 wherein component (III) is one or more sterically hindered amine compounds selected from the group consisting of the compounds of the formulae

(A-2-a), (A-2-b), (A-3-a), (A-4-a),

(B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a), (B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),

(C-1-b), (C-1-c), (C-1-d), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a product (C-6-a);

E₁ is hydrogen, C₁-C₈alkyl, -O[•], -OH, -CH₂CN, C₂-C₁₈alkoxy substituted by -OH;

C₅-C₁₂cycloalkoxy, C₃-C₆alkenyl, C₇-C₉phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C₁-C₄alkyl; or C₁-C₈acyl;

E₈, E₁₂, E₁₃, E₁₆, E₁₈, E₂₂, E₂₃, E₂₅ and E₂₉ are hydrogen, C₁-C₈alkyl, -O[•], -OH, -CH₂CN,

C₁-C₁₈alkoxy, C₂-C₁₈alkoxy substituted by -OH; C₅-C₁₂cycloalkoxy, C₃-C₆alkenyl,

C₇-C₉phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C₁-C₄alkyl; or

C₁-C₈acyl;

with the proviso that when the mulch film contains a polyolefin, the presence of an oxidizable unsaturated compound selected from the group consisting of natural rubber, styrene butadiene resin, fat or oil is disclaimed.

24. A mulch film according to claim 9 wherein

component (III) is one or more sterically hindered amine compounds selected from the group consisting of the compounds of the formulae

(A-2-a), (A-2-b), (A-3-a), (A-4-a),

5 (B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a), (B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),

(C-1-b), (C-1-c), (C-1-d), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a) and a product (C-6-a);

E_1 is hydrogen, C_1 - C_8 alkyl, $-O^-$, $-OH$, $-CH_2CN$, C_2 - C_{18} alkoxy substituted by $-OH$;

C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl, C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl

10 by 1, 2 or 3 C_1 - C_4 alkyl; or C_1 - C_8 acyl;

E_8 , E_{12} , E_{13} , E_{16} , E_{18} , E_{22} , E_{23} , E_{25} and E_{29} are hydrogen, C_1 - C_8 alkyl, $-O^-$, $-OH$, $-CH_2CN$,

C_1 - C_{18} alkoxy, C_2 - C_{18} alkoxy substituted by $-OH$; C_5 - C_{12} cycloalkoxy, C_3 - C_6 alkenyl,

C_7 - C_9 phenylalkyl unsubstituted or substituted on the phenyl by 1, 2 or 3 C_1 - C_4 alkyl; or

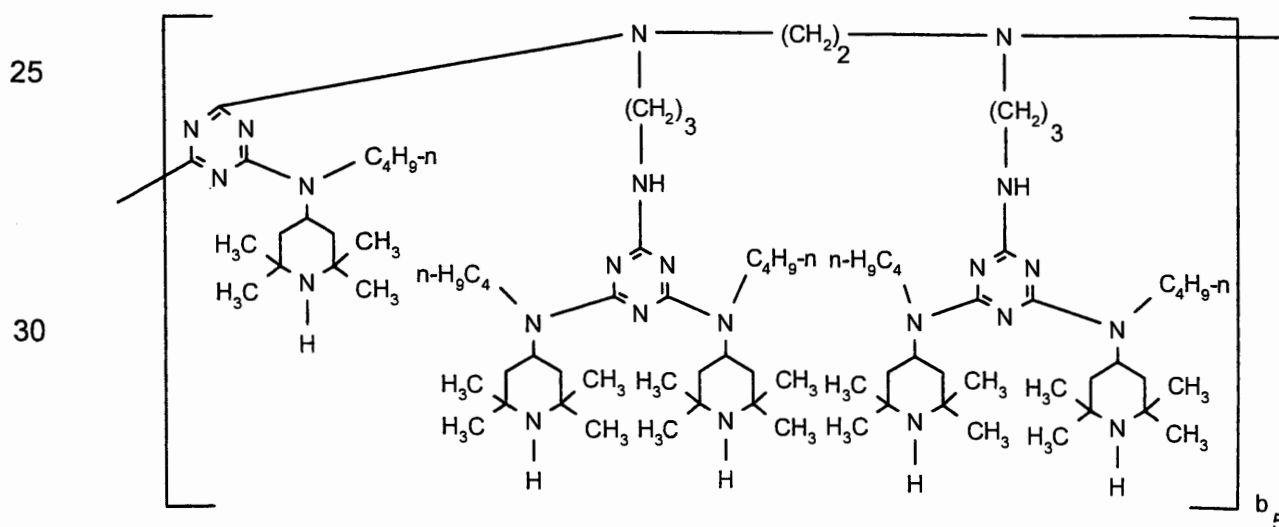
C_1 - C_8 acyl;

15 with the proviso that when the mulch film contains a polyolefin, the presence of an oxidizable unsaturated compound is disclaimed.

25. A mulch film according to claim 1 which is a multi layer mulch film.

20 **26.** A mulch film according to claim 1 which has a thickness from 10 to 60 microns.

27. A mulch film according to claim 1 wherein the product (C-6) corresponds to the formula



wherein b_5 is 2 to 20.

- 5 **28.** An agricultural article comprising the components
- (I) a biopolymer selected from the group consisting of polycaprolactone, polylactic acid, polyglycolic acid, polyhydroxybutyrate-valerate, polybutylene succinate, polyvinyl alcohol, polyhydroxyalcanoate and polyethylene adipate,
- (II) an organic salt of Fe, Ce, Co, Mn, Cu or V, and
- 10 (III) one or more sterically hindered amine compounds as defined in claim 1.

- 29.** An agricultural article comprising the components
- (I) an organic polymer,
- 15 (II) an organic salt of Fe, Ce, Co, Mn, Cu or V, and
- (III) two different sterically hindered amine compounds selected from the group consisting of the compounds of the formulae
- (A-1-a), (A-2-a), (A-2-b), (A-3-a), (A-4-a),
- (B-1-a), (B-1-b), (B-1-c), (B-1-d), (B-2-a), (B-3-a), (B-3-b), (B-4-a), (B-4-b), (B-5), (B-6-a),
- 20 (B-7), (B-8-a), (B-9-a), (B-9-b), (B-9-c), (B-10-a),
- (C-1-a), (C-1-b), (C-1-c), (C-1-d), (C-2-a), (C-3-a), (C-4-a), (C-4-b), (C-4-c) and (C-5-a)
- and a product (C-6-a) as defined in claim 9;
- with the proviso that the two different sterically hindered amine compounds are not selected from the same generic formula.