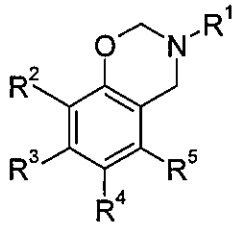
Claims:

1. The use of polycyclic phenolic compounds which have up to 20 benzene rings per molecule and are obtainable by reacting a tetrahydrobenzoxazine of the general formula I



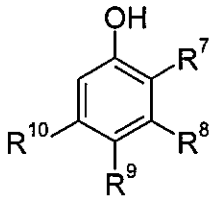
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

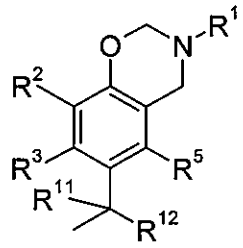


(II)

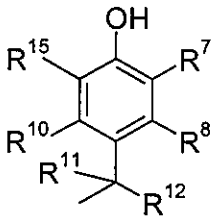
in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



(Z')

in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14} is a polyisobutenyl radical having a number-average molecular weight M_n of from 183 to 42 000, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms

as antioxidants for stabilizing inanimate organic material against the action of light, oxygen and heat.

2. The use of polycyclic phenolic compounds according to claim 1, in which one or two polyisobutenyl radicals having a number-average molecular weight M_n of from 183 to 42 000 occur in the molecule as substituent R^1 and/or R^2 and/or R^4 and/or R^7 and/or R^9 and/or R^{13} and/or R^{14}.

3. The use of polycyclic phenolic compounds according to claim 1 or 2, in which the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} and R^{14} which are not polyisobutenyl radicals having a number-average molecular weight M_n of from 183 to 42 000 are each independently hydrogen

atoms, hydroxyl groups or, when they are hydrocarbyl radicals, linear or branched C_1- to C_4-alkyl radicals.

4. The use of polycyclic phenolic compounds according to claims 1 to 3 and having a number-average molecular weight M_n of from 285 to 25 000.

5. The use of polycyclic phenolic compounds according to claim 1 or 2, wherein the mean polydispersity index PDI for the polyisobutenyl radicals in the polycyclic phenolic compounds is at most 5 times the mean polydispersity index/PDI for the polyisobutenyl radicals in the parent tetrahydrobenzoxazines I and/or phenols II.

6. The use of polycyclic phenolic compounds according to claims 1 to 5 as antioxidants in turbine fuels (jet fuels).

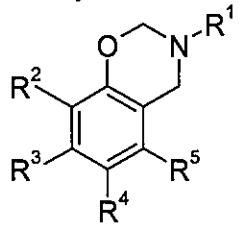
7. The use of polycyclic phenolic compounds according to claim 6 as antioxidants for improving the thermal stability of turbine fuels.

8. A turbine fuel composition comprising a turbine fuel (jet fuel) and at least one polycyclic phenolic compound as defined in any of claims 1 to 5.

9. An additive concentrate for turbine fuels (jet fuels) comprising at least one polycyclic phenolic compound as defined in any of claims 1 to 5, and if appropriate at least one diluent and if appropriate at least one additive.

10. The use of polycyclic phenolic compounds according to claims 1 to 5 as antioxidants for improving the oxidation and aging stability and/or for improving the shear stability of lubricant compositions.

11. A polycyclic phenolic compound having up to 20 benzene rings per molecule, obtainable by reacting a tetrahydrobenzoxazine of the general formula I



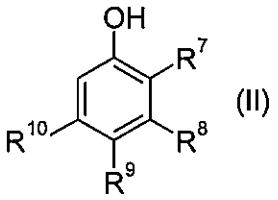
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

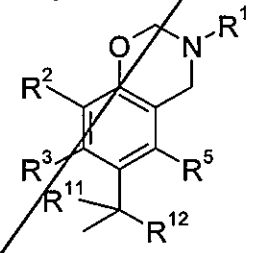


(II)

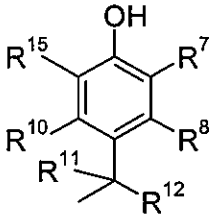
in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



(Z')

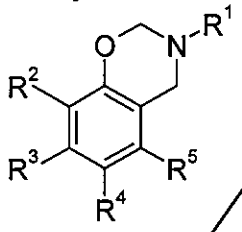
in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5,

together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, R^{10}, R^{13} or R^{14} has from 26 to 3000 carbon atoms, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms.

12. A polycyclic phenolic compounds having up to 20 benzene rings per molecule, obtainable by reacting a tetrahydrobenzoxazine of the general formula I



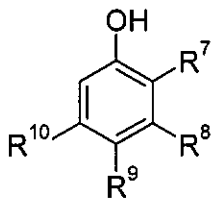
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II



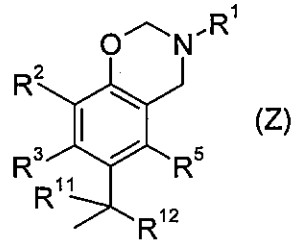
(II)

in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to

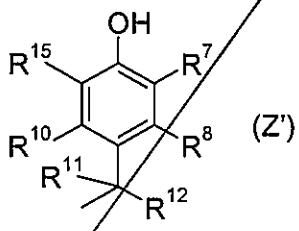
3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



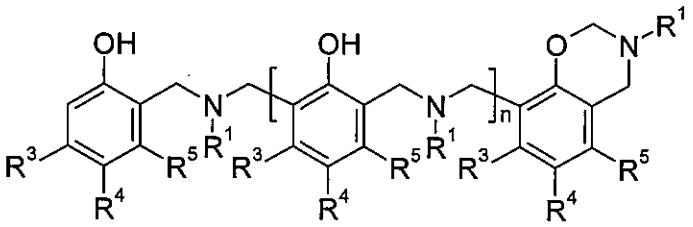
(Z')

in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure $-O-CH_2-NR^{13}-CH_2-$ attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures $-O-CH_2-NR^{13}-CH_2-$ and $-O-CH_2-NR^{14}-CH_2-$ attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, R^{10}, R^{13} or R^{14} has on average from 13 to 3000 carbon atoms and derives from oligomers or polymers of C_2- to C_{12}-olefins, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

13. An oligo- or polytetrahydrobenzoxazine of the general formula III



(III)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

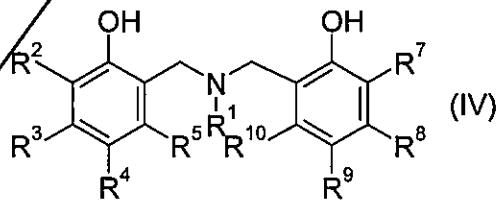
where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above, and

in which n is an integer from 0 to 18,

with the proviso that at least one of the substituents R^1, R^3, R^4 or R^5 has from 13 to 3000 carbon atoms and the remaining substituents from the group of R^1, R^3, R^4 or R^5, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

14. A bicyclic phenolic compound of the general formula IV



(IV)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

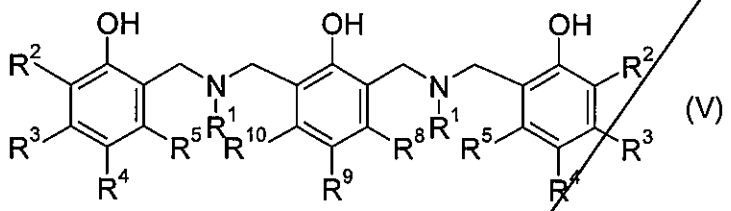
where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4, R^5, R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more

heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, and R^{10} has from 26 to 3000 carbon atoms and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9 and R^{10}, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

15. A tricyclic phenolic compound of the general formula V



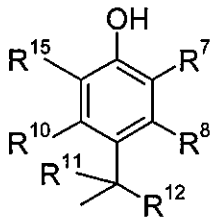
(V)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4, R^5, R^8, R^9 and R^{10} are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

where the substituent R^9 may also be a radical of the formula Z'



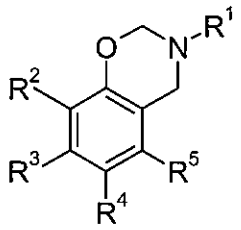
(Z')

in which the substituents R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical, and

with the proviso that at least one of the substituents R^1, R^2, R^3, R^4, R^5, R^8, R^9 and R^{10} has from 13 to 3000 carbon atoms, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^8, R^9 and R^{10}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. The use of polycyclic phenolic compounds which have up to 20 benzene rings per molecule and are obtained by reacting a tetrahydrobenzoxazine of the general formula I



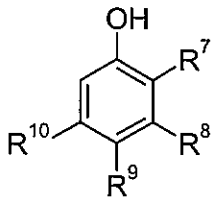
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

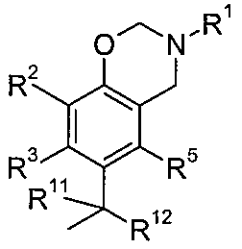


(II)

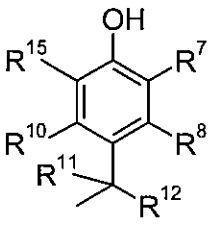
in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



(Z')

in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14} is a polyisobutenyl radical having a number-average molecular weight M_n of from 183 to 42 000, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms,

as antioxidants for stabilizing inanimate organic material against the action of light, oxygen and heat.

2. The use of polycyclic phenolic compounds according to claim 1, in which one or two polyisobutenyl radicals having a number-average molecular weight M_n of from 183 to 42 000 occur in the molecule as substituent R^1 and/or R^2 and/or R^4 and/or R^7 and/or R^9 and/or R^{13} and/or R^{14}.

3. The use of polycyclic phenolic compounds according to claim 1 or 2, in which the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} and R^{14} which are not polyisobutenyl radicals having a number-average molecular weight M_n of from 183 to 42 000 are each independently hydrogen atoms, hydroxyl groups or, when they are hydrocarbyl radicals, linear or branched C_1- to C_4-alkyl radicals.

4. The use of polycyclic phenolic compounds according to any one of claims 1 to 3 and having a number-average molecular weight M_n of from 285 to 25 000.

5. The use of polycyclic phenolic compounds according to claim 1 or 2, wherein the mean polydispersity index PDI for the polyisobutenyl radicals in the polycyclic phenolic compounds is at most 5 times the mean polydispersity index/PDI for the polyisobutenyl radicals in the parent tetrahydrobenzoxazines I and/or phenols II.

6. The use of polycyclic phenolic compounds according to any one of claims 1 to 5 as antioxidants in turbine fuels (jet fuels).

7. The use of polycyclic phenolic compounds according to claim 6 as antioxidants for improving the thermal stability of turbine fuels.

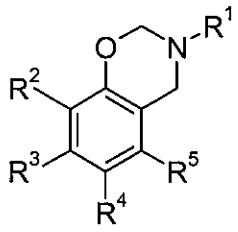
8. A turbine fuel composition comprising a turbine fuel (jet fuel) and at least one polycyclic phenolic compound as defined in any one of claims 1 to 5 when used as an antioxidant.

9. An additive concentrate for turbine fuels (jet fuels) comprising at least one polycyclic phenolic compound as defined in any one of claims 1 to 5, when used as an antioxidant and if appropriate at least one diluent and if appropriate at least one additive.

10. The use of polycyclic phenolic compounds according to any one of claims 1 to 5 as antioxidants for improving the oxidation and aging stability and/or for improving the

shear stability of lubricant compositions.

11. A process for preparing polycyclic phenolic compounds having up to 20 benzene rings per molecule, which comprises reacting a tetrahydrobenzoxazine of the general formula I



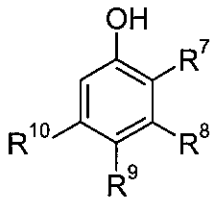
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

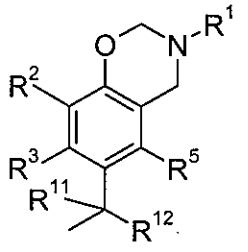


(II)

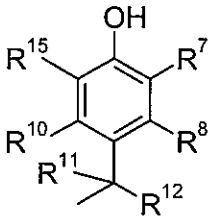
in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



(Z')

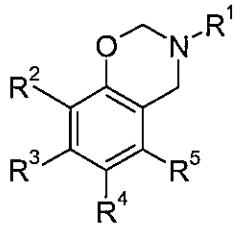
in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14} has from 13 to 3000 carbon atoms, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms,

at temperatures of from 60 to 250°C in the absence or in the presence of an inert solvent.

12. A polycyclic phenolic compound having up to 20 benzene rings per molecule, obtained by reacting a tetrahydrobenzoxazine of the general formula I



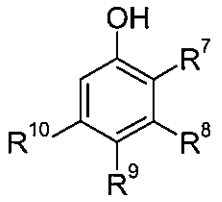
(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

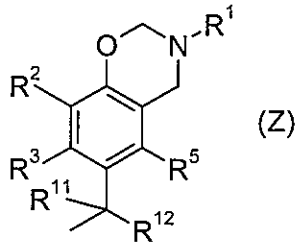


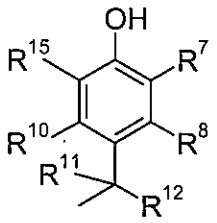
(II)

in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'


(Z)

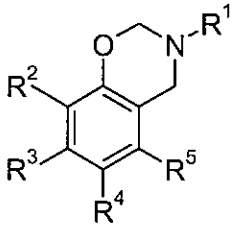

(Z')

in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, R^{10}, R^{13} or R^{14} has from 26 to 3000 carbon atoms, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms.

13. A polycyclic phenolic compounds having up to 20 benzene rings per molecule, obtained by reacting a tetrahydrobenzoxazine of the general formula I

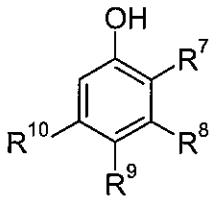

(I)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical, and

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with one or more of the same or different phenols of the general formula II

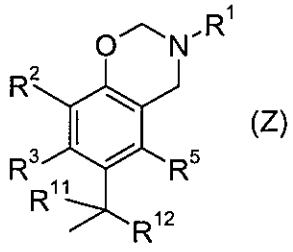


(II)

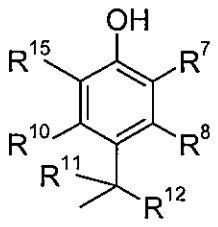
in which the substituents R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms, hydroxyl groups or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

and/or with one or more of the same or different tetrahydrobenzoxazines of the general formula I,

where the substituent R^4 may also be a radical of the formula Z and the substituent R^9 may also be a radical of the formula Z'



(Z)



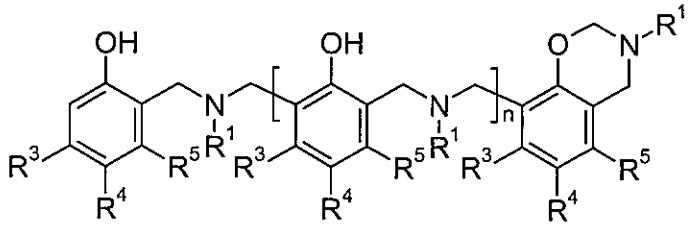
(Z')

in which the substituents R^1, R^2, R^3, R^5, R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical,

and in which the substituents R^2 and R^3 or R^3 and R^4 or R^4 and R^5, together with the substructure -O-CH_2-NR^{13}-CH_2- attached to the benzene ring, may also form a second tetrahydrooxazine ring, or the substituents R^2 and R^3 and R^4 and R^5, together with the substructures -O-CH_2-NR^{13}-CH_2- and -O-CH_2-NR^{14}-CH_2- attached to the benzene ring, may also form a second and a third tetrahydrooxazine ring, where R^{13} and R^{14} are each independently hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, R^{10}, R^{13} or R^{14} has on average from 13 to 3000 carbon atoms and derives from oligomers or polymers of C_2- to C_{12}-olefins, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9, R^{10}, R^{13} or R^{14}, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

14. An oligo- or polytetrahydrobenzoxazine of the general formula III



(III)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

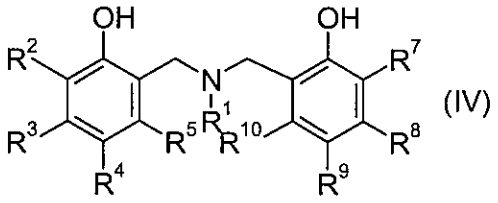
where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4 and R^5 are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above, and

in which n is an integer from 0 to 18,

with the proviso that at least one of the substituents R^1, R^3, R^4 or R^5 has from 13 to 3000 carbon atoms and the remaining substituents from the group of R^1, R^3, R^4 or R^5, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

15. A bicyclic phenolic compound of the general formula IV



(IV)

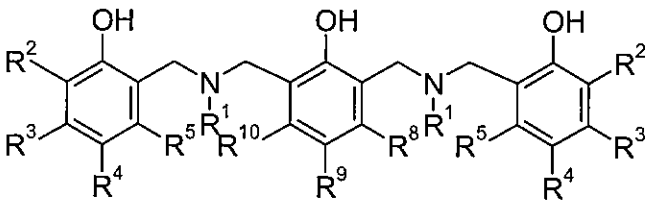
in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4, R^5, R^7, R^8, R^9 and R^{10} are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

with the proviso that at least one of the substituents R^1, R^2, R^3, R^5, R^7, R^8, and R^{10} has from 26 to 3000 carbon atoms and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^7, R^8, R^9 and R^{10}, when they are hydrocarbyl radicals, have in each case from 1 to 20 carbon atoms.

16. A tricyclic phenolic compound of the general formula V



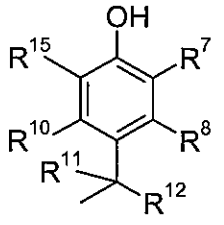
(V)

in which the substituent R^1 is a hydrocarbyl radical which has from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or may be interrupted by one or more NR^6 moieties,

where R^6 is a hydrogen atom or a C_1- to C_4-alkyl radical,

in which the substituents R^2, R^3, R^4, R^5, R^8, R^9 and R^{10} are each independently hydrogen atoms or hydrocarbyl radicals which have in each case from 1 to 3000 carbon atoms and may be interrupted by one or more heteroatoms from the group of O and S and/or by one or more NR^6 moieties, where R^6 is as defined above,

where the substituent R^9 may also be a radical of the formula Z'



(Z')

in which the substituents R^7, R^8 and R^{10} are each as defined above, the substituent R^7 may also be a radical derived from a tetrahydrobenzoxazine of the general formula I, the substituent R^{15} is hydrogen or a radical derived from a tetrahydrobenzoxazine of the general formula I, and the substituents R^{11} and R^{12} may be the same or different and are each hydrogen or a C_1- to C_{10}-alkyl radical, and

with the proviso that at least one of the substituents R^1, R^2, R^3, R^4, R^5, R^8, R^9 and R^{10} has from 13 to 3000 carbon atoms, and the remaining substituents from the group of R^1, R^2, R^3, R^4, R^5, R^8, R^9 and R^{10}, when they are hydrocarbyl radicals, each have from 1 to 20 carbon atoms.