CLAIMS

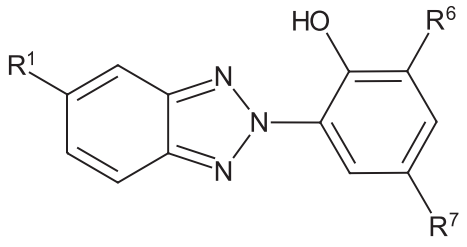
1. A hydrogel contact lens formulation for forming the polymeric body of a hydrogel contact lens comprising:

a first high energy visible light (HEVL) absorber comprising a benzotriazole moiety, wherein a 0.003 wt% solution in ethyl acetate of the first HEVL absorber has an absorbance peak in the range of 360 to 410 nm,

and

a second different high energy visible light (HEVL) absorber comprising a benzotriazole moiety, wherein a 0.003 wt% solution in ethyl acetate of the second HEVL absorber has a peak absorbance at a wavelength between 5 and 25 nm shorter than the absorbance peak of a 0.003 wt% solution in ethyl acetate of the first HEVL absorber that falls in the range 360 to 410 nm,

wherein the first and second HEVL absorbers are each of formula (1):



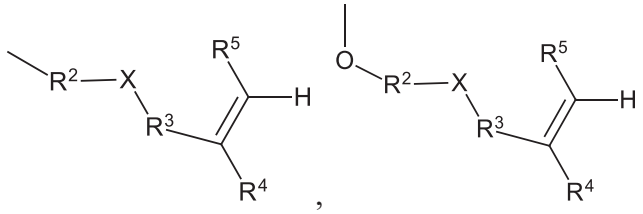
(1),

wherein:

R^1 is a halogen, OH, C_{1-12} alkyloxy, –A-R_9-Y, optionally substituted C_{1-12} alkyl, optionally substituted phenoxy, or optionally substituted napthyloxy, where the optional substituents are halogen, C_{1-6} alkyl, C_{1-6} alkoxy, OH, -$(CH_2CH_2O)_nH$, -$(CH_2CH_2O)_nCH_2CH_3$, -$(CH_2CH(CH_3)O)_nH$ or -$(CH_2CH(CH_3)O)_nCH_2CH_2(CH_3)$;

one of R^6 and R^7 is H or C_{1-12} alkyl optionally substituted with halogen; and

the other of R^6 and R^7 is:



, or –OR^8 in which:

R^2 is a bond, C_{1-12} alkylene optionally substituted with –OH and/or interrupted by an ester group, $(CH_2CH_2O)_n$ or $(CH_2CH(CH_3)O)_n$;

R^3 is a bond, C(O), $C(O)C_jH_{2j}$, C_{1-6} alkylene, phenyl or C_{1-6} alkylphenyl;

X is a bond, O, NR^4, S or $(Si(CH_3)_2O)_mSi(CH_3)_2$;

each R^4 is independently H or methyl;

R^5 is H, C_{1-6} alkyl or phenyl;

m is 0-9;

n is 2-10;

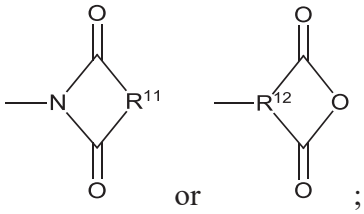
j is 1-6;

A is -S- or $-SO_2-$;

R^8 is H, C_{1-12} alkyl, C_{6-15} arylalkyl or $-R^9-Z$;

each R^9 is independently C_{1-12} alkylene optionally substituted with –OH and/or interrupted by an ester group,

each of Y and Z respectively is -OH, $-OC(O)R^{10}$, $-NH_2$, $-NC(O)R^{10}$, -NCO, $-CO_2H$, $-CO_2R^{10}$,



;

each R^{10} is independently C_{1-10} alkyl or C_{3-10} alkenyl;

R^{11} is C_{3-10} cycloalkenylene; and

R^{12} is C_{1-10} alkylene or 1,2-phenylene.

2. The formulation of claim 1, wherein the total amount HEVL absorbers of formula (1) present does not exceed 2.7% (wt/wt), preferably does not exceed 2.0% (wt/wt).

3. The formulation of any preceding claim, wherein: the first HEVL absorber is 2-[2'-hydroxy-3'-*tert*-butyl-5'-(3"-methacryloyloxypropoxy)phenyl]-5-chloro-2*H*-benzotriazole (UV28).

4. The formulation of any preceding claim, wherein the second HEVL absorber is selected from: 2-(1,1-dimethylethyl)-4-[3-[(4-ethenyl phenyl) methoxy]propoxy]-6-(5-methoxy-2*H*-benzotriazol-2-yl)-phenol (UV1), 2-(5-chloro-2*H*-benzotriazol-2-yl)-6-(1,1-dimethylethyl)-4-ethenyl-phenol (UV5 / UVAM), 2-[2'-hydroxy-3'-*tert*-butyl-5'-(3"-methacryloyloxypropoxy)phenyl]-5-methoxy-2*H*-benzotriazole (UV13), 2-3'-*tert*-butyl-2'-hydroxy-5'-(3"-dimethylvinylsilylpropoxy)-2'-hydroxy-phenyl)-5-methoxybenzotriazole (UV15), especially 2-[2'-hydroxy-3'-*tert*-butyl-5'-(3"-methacryloyloxypropoxy)phenyl]-5-methoxy-2*H*-benzotriazole (UV13).

5. The formulation of any one of claims 1 to 4, wherein the first HEVL absorber is present in an amount of from 0.3% to 0.9% (wt/wt), preferably from 0.4% to 0.7% (wt/wt); and the second HEVL absorber is present in an amount of from 0.5% to 2.2% (wt/wt), preferably from 0.7% to 1.6% (wt/wt).

6. The formulation of any preceding claim, comprising a polymerizable UV absorbing agent comprising a benzophenone moiety, optionally in an amount not exceeding 1.5% (wt/wt), preferably not exceeding 1.0% (wt/wt).

7. The formulation of any preceding claim, wherein the polymerizable UV absorbing agent is 2-(4-benzoyl-3-hydroxyphenoxy)ethyl acrylate (UV416).

8. The formulation of any preceding claim, further comprising a polymerizable blue or blue-green tinting agent comprising an anthraquinone moiety.

9. The formulation of claim 8, wherein the polymerizable blue or blue-green tinting agent is selected from 1,4-bis[4-(2-methacryloxyethyl)phenylamino]-9,10-anthraquinone (RB246) or 1,4-bis[(2-methacryloxyethyl)amino]-9,10-anthraquinone (RB247).

10. The formulation of any preceding claim, which is a thermally cured formulation comprising at least one thermal initiator.

11. The formulation of any preceding claim, further comprising at least one hydrophilic monomer, optionally in an amount of at least 25% (wt/wt).

12. The formulation of claim 11, comprising at least one hydrophilic N-vinyl amide monomer, optionally in an amount of at least 15% (wt/wt).

13. The formulation of claim 12 comprising at least 30% (wt/wt) of hydrophilic N-vinyl amide monomer(s).

14. The formulation of any preceding claim, wherein the formulation is a silicone hydrogel contact lens formulation comprising a polymerizable siloxane component, optionally in an amount of at least 25% (wt/wt).

15. The formulation of claim 14, comprising from 30 to 60% (wt/wt) of a polymerizable siloxane component.

16. The formulation of claim 14 or claim 15, wherein at least 40% (wt/wt) of the polymerizable siloxane content is di-functional siloxanes having a molecular weight of at least 8,000 daltons, and wherein at least 25% (wt/wt) of the polymerizable siloxane content is mono-functional siloxanes having a molecular weight of less than 3000 daltons.

17. The formulation of any one of claims 14 to 16, comprising:
a siloxane component present in an amount of at least 35% (wt/wt) based on the total weight of the formulation, wherein at least 40% of the siloxane content is di-functional siloxanes having a molecular weight of at least 8,000 daltons; and

an N-vinyl amide monomer component present in an amount of at least 37% (wt/wt) based on the total weight of the formulation.

18. The formulation of any preceding claim comprising at least 5% (wt/wt) based on the total weight of the formulation of non-siloxane hydrophobic monomers, especially hydrophobic methacrylate monomers.

19. The formulation of claim 18, wherein the hydrophobic monomers include hydroxybutyl methacrylate, isobornyl methacrylate or a combination of hydroxybutyl methacrylate and isobornyl methacrylate.

20. The formulation of any one of claims 1 to 10 comprising:

a. hydrophilic N-vinyl amide monomer(s) in an amount of at least 30% (wt/wt),

b. a polymerizable siloxane component in an amount of from 35 to 60% (wt/wt) of the total formulation, wherein at least 40% (wt/wt) of the polymerizable siloxane content is di-functional siloxanes having a molecular weight of at least 8,000 daltons, and wherein at least 25% (wt/wt) of the polymerizable siloxane content is mono-functional siloxanes having a molecular weight of less than 3000 daltons, and

c. non-siloxane hydrophobic methacrylate monomers in an amount of at least 5% (wt/wt) based on the total weight of the formulation.

21. The formulation of any one of claims 1 to 10 comprising:

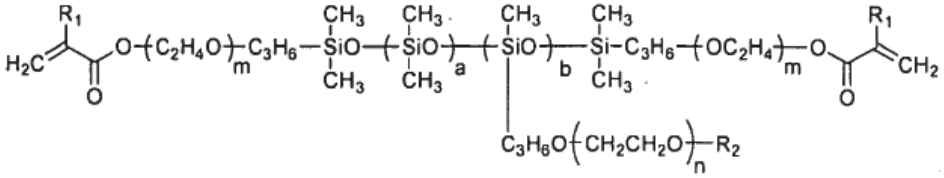
a. N-methyl N-vinyl acetamide in an amount of from 30 to 50% (wt/wt) of the total formulation,

b. di-functional, (meth)acrylate-containing siloxanes having a molecular weight of at least 8,000 daltons in an amount of from 20 to 40% (wt/wt) of the total formulation,

c. mono-functional, (meth)acrylate-containing siloxanes having a molecular weight of less than 3000 Daltons in an amount of from 10 to 30 (wt/wt) of the total formulation,

d. hydroxybutyl methacrylate, isobornyl methacrylate or a combination of hydroxybutyl methacrylate and isobornyl methacrylate in an amount of from 5 to 15% (wt/wt) of the total formulation.

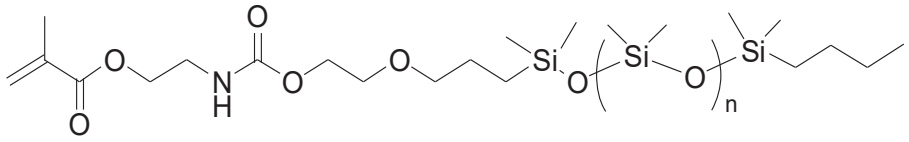
22. The formulation of claim 20 or claim 21, wherein the di-functional siloxane monomer is a (meth)acrylate-containing siloxane monomer represented by formula (III),



(III)

wherein R_1 is selected from either hydrogen or a methyl group; R_2 is selected from either hydrogen or a C_{1-4} hydrocarbon group; m represents an integer of from 0 to 10; n represents an integer of from 4 up to about 15, 25, or 100; a and b represent integers of 1 or more; a+b is equal to 20-500; b/(a+b) is equal to 0.01-0.22; and the configuration of siloxane units includes a random configuration.

23. The formulation of claim 20, claim 21 or claim 22, wherein the mono-functional siloxane monomer is a methacrylate-containing siloxane monomer represented by formula (II),



(II)

where n is an integer from about 10 to 15.

24. A hydrogel contact lens obtained from the polymerisation of the formulation of any preceding claim.

25. The contact lens of claim 24 having the following light transmission characteristics:

Blue light region	Transmission Characteristic	Ranges of Transmission Characteristics*	
		Minimum value	*Maximum value*
Blue-violet cutoff	1%T	410 nm	430 nm
	10%T	420 nm	440 nm
Mid-blue transition region	440 nm	10%T	75%T
	450 nm	28%T	80%T
	460 nm	40%T	85%T
High transmission blue light region	470 nm	55%T	95%T
	480 nm	68%T	95%T
	490 nm	80%T	95%T
	500 nm	85%T	95%T
* determined by UV-Visible measurements in air.			

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26. The contact lens of claim 24 or claim 25 having a yellowness index as determined by the ASTM E313 - 05 method of less than 6.0.