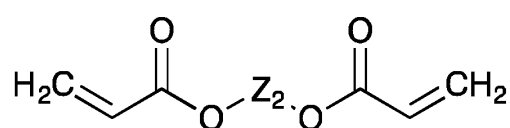


CLAIMS:

1. A hyperbranched polymer made by reacting together:

5 (i) a four-branching monomer;

(ii) a diacrylate component of formula (I)



(I)

wherein Z2 is a linear or branched carbon chain of 1 to 30 carbon atoms, a linear or branched heteroatom-containing carbon chains of 1 to 30 atoms, a carbocycle containing 3 to 30 carbon atoms, or a heterocycle containing 3 to 30 atoms;

wherein Z2 is unsubstituted or substituted with at least one of a halogen, a

hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a halo C1-C5 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -OC(0)NR'R', -

N(R')C(0)NR'R', -N(R')C(0)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6 heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently selected, from the group consisting of hydrogen and C1-C6 alkyl;

(iii) a first amine component comprising 3 to 20 atoms,

wherein said amine component is unsubstituted or substituted with at least one of a

halogen, a hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a halo C1-C6 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -OC(0)NR'R', -N(R')C(0)NR'R', -N(R')C(0)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6

heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently selected, from the group consisting of hydrogen and C1-C6 alkyl; and

(iv) a second amine component comprising 3 to 20 atoms,
wherein said amine component is unsubstituted or substituted with at least one of a
halogen, a hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a
thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6
5 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a
halo C1-C6 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -
OC(0)NR'R', -N(R')C(0)NR'R', -N(R')C(0)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6
heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently
selected, from the group consisting of hydrogen and C1-C6 alkyl.

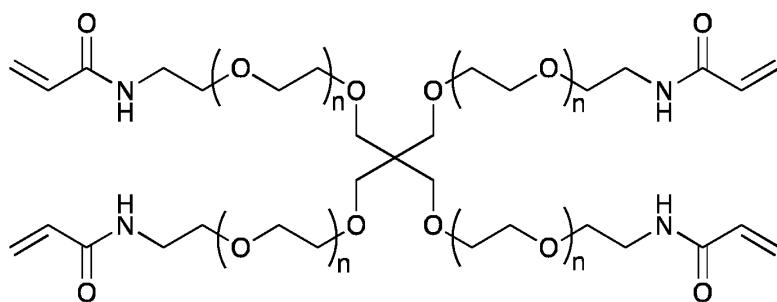
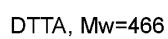
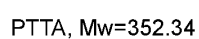
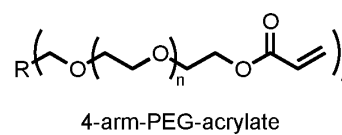
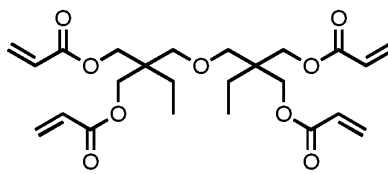
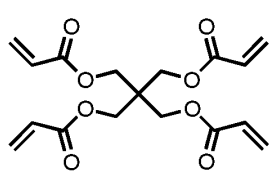
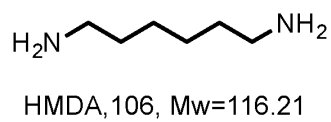
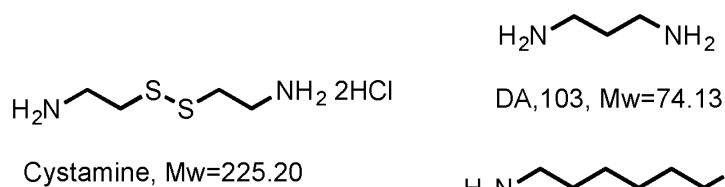
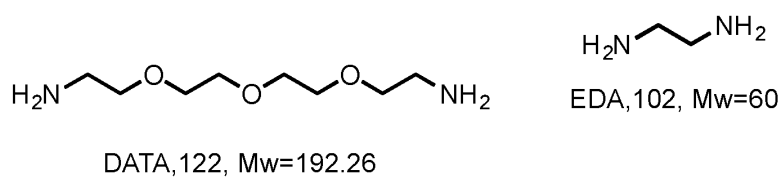
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2. A hyperbranched polymer according to Claim 1, in which the diacrylate and first amine
components are reacted together to form a first oligomer, the first oligomer and second
amine component are reacted together to form a second oligomer, and the second
oligomer and four branching monomer are reacted together to form the hyperbranched
15 polymer.

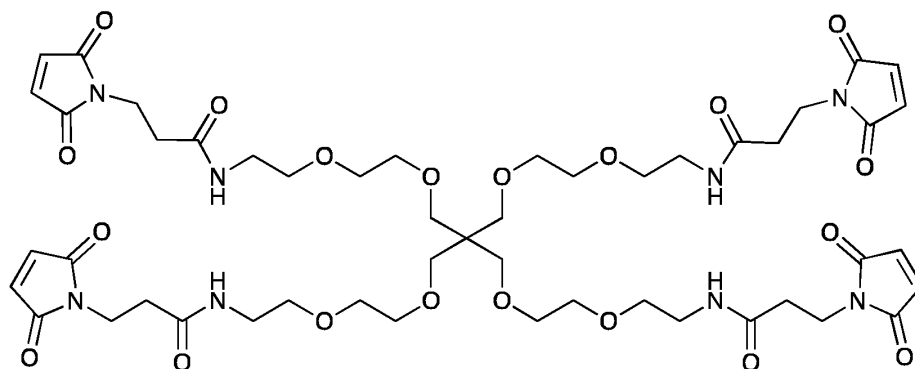
3. A hyperbranched polymer according to Claim 1, in which the four-branching monomer,
diacrylate component, and first amine are reacted together in a Michael addition reaction to
form a first polymer, and the first polymer and second amine component are reacted
20 together in a Michael addition reaction to form the hyperbranched polymer.

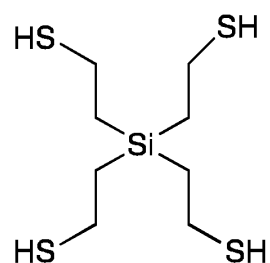
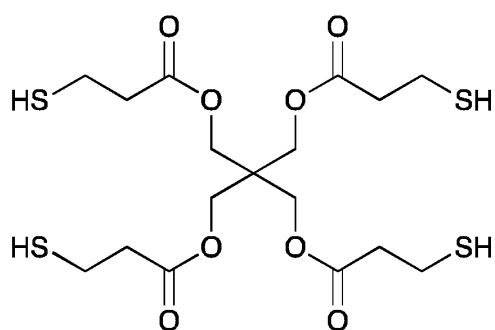
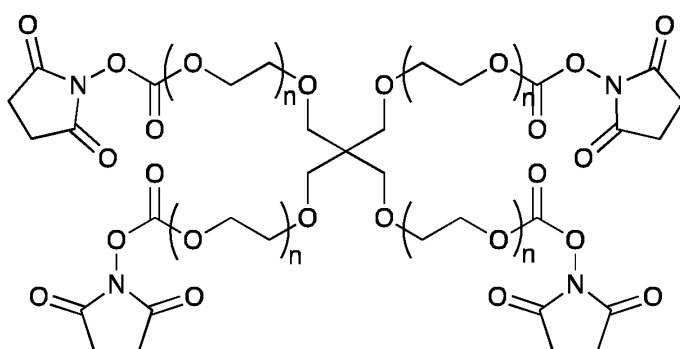
4. A hyperbranched polymer according to any preceding Claim, in which the four-branching
monomer is selected from a diamine component, a tetraacrylate component, a tetra
acrylamide component, a tetrathiol component, a tetraepoxy component, and a tetra-
25 substituted silane.

5. A hyperbranched polymer according to Claim 4, in which the four-branching monomer is
selected from the group consisting of:

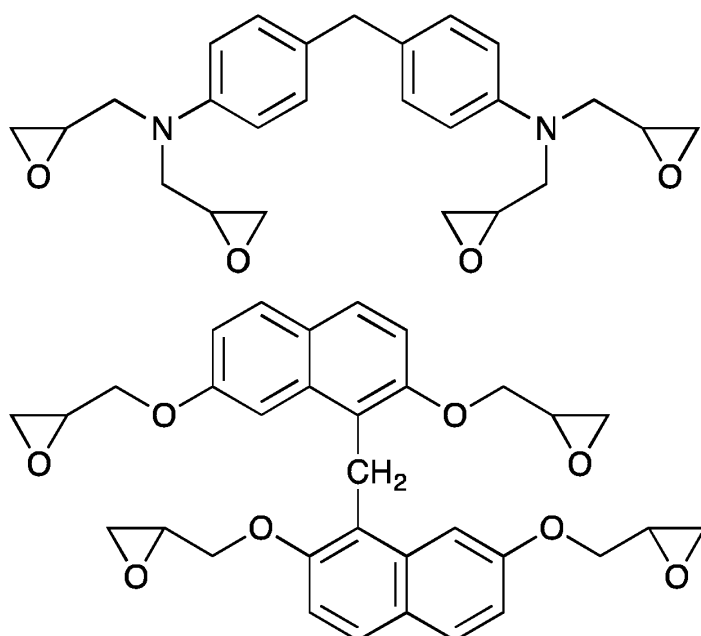


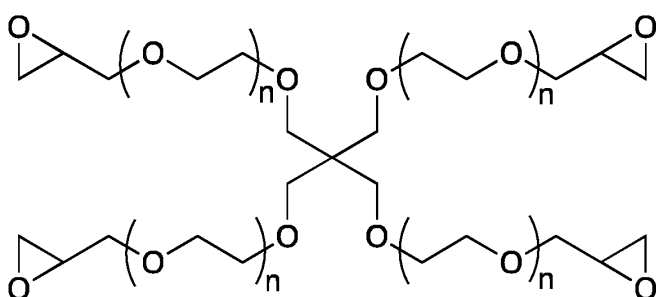
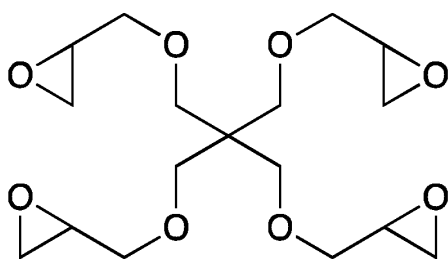
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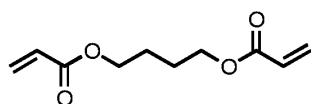
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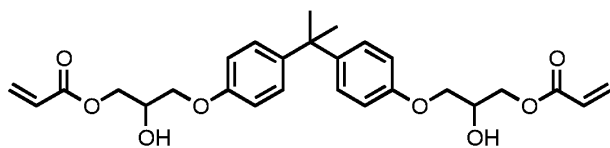


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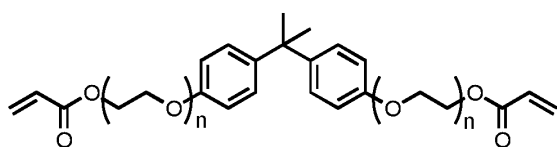
6. A hyperbranched polymer according to any preceding Claim, in which the diacrylate component of formula (I) is selected from



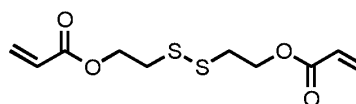
BDA, Mw=198.22



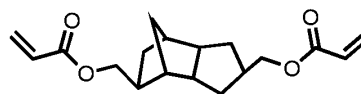
BPGDA, Mw=484.54



BPEDA, E/P=1.5, Mn=468

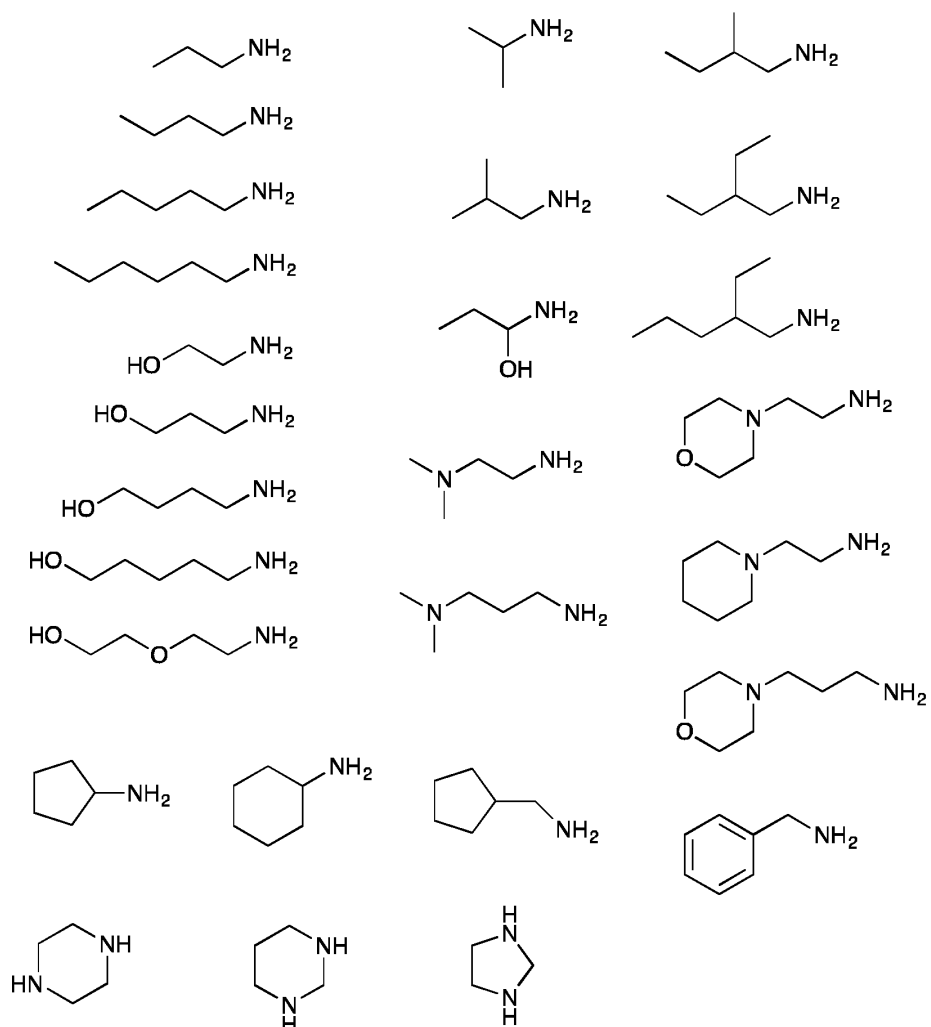


DSDA, Mw=262.34

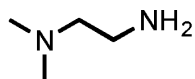


NPGDA, Mw=304.39

10



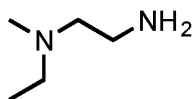
9. A hyperbranched polymer according to any preceding Claim, in which the second amine component is selected from:



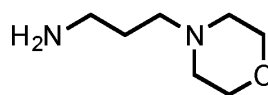
DMDA, Mw=88.15



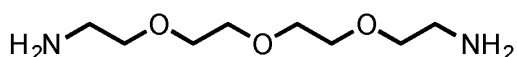
DA, 103, Mw=74.13



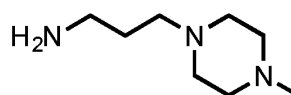
DAP, Mw=102.18



MPA, Mw=144.22



DATA, 122, Mw=192.26



E7, Mw=157.26

10. A polyplex composition comprising a hyperbranched polymer of any preceding Claim
5 and a nucleic acid component complexed together.

11. A polyplex composition according to Claim 10, in which the nucleic acid component is
selected from a nucleic acid, a nucleic acid expression system, a plasmid, a nanoplasmid,
a minicircle, and a ribonucleoprotein gene editing system.

10

12. A polyplex composition according to Claim 10 or 11, in which the nucleic acid
component is a ribonucleoprotein gene editing system.

13. A polyplex composition according to any of Claims 10 to 12, in which the composition
15 has a particle size of 100-500 nm.

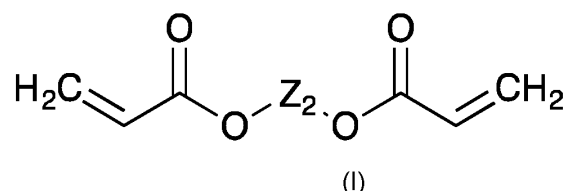
14. A polyplex composition of any of Claims 10 to 13, for use as a medicament.

15. A method of forming a polymer comprising a step of reacting together:

20

(i) a four-branching monomer;

(ii) a diacrylate component of formula (I)



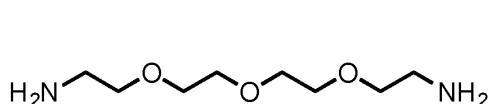
5 wherein Z2 is a linear or branched carbon chain of 1 to 30 carbon atoms, a linear or branched heteroatom-containing carbon chains of 1 to 30 atoms, a carbocycle containing 3 to 30 carbon atoms, or a heterocycle containing 3 to 30 atoms; wherein Z2 is unsubstituted or substituted with at least one of a halogen, a hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a halo C1-C5 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -OC(0)NR'R', -N(R')C(0)NR'R', -N(R')C(0)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6 heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently selected, from the group consisting of hydrogen and C1-C6 alkyl

(iii) a first amine component comprising 3 to 20 atoms, wherein said amine component is unsubstituted or substituted with at least one of a halogen, a hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a halo C1-C6 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -OC(0)NR'R', -N(R')C(0)NR'R', -N(R')C(0)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6 heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently selected, from the group consisting of hydrogen and C1-C6 alkyl; and

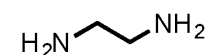
(iv) a second amine component comprising 3 to 20 atoms, wherein said amine component is unsubstituted or substituted with at least one of a halogen, a hydroxyl, an amino group, a sulfonyl group, a sulphonamide group, a thiol, a C1-C6 alkyl, a C1-C6 alkoxy, a C1-C6 ether, a C1-C6 thioether, a C1-C6 sulfone, a C1-C6 sulfoxide, a C1-C6 primary amide, a C1-C6 secondary amide, a halo C1-C6 alkyl, a carboxyl group, a cyano group, a nitro group, a nitroso group, -

OC(O)NR'R', -N(R')C(O)NR'R', -N(R')C(O)O-C1-C6 alkyl, C3-C6 cycloalkyl, C3-C6 heterocyclyl, C2-C5 heteroaryl and C6-C10 aryl; wherein each R' is independently selected, from the group consisting of hydrogen and C1-C6 alkyl.

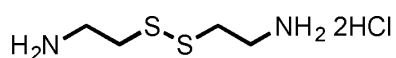
- 5 16. A method according to Claim 15, in which the diacrylate and first amine components are reacted together to form a first oligomer, the first oligomer and second amine component are reacted together to form a second oligomer, and the second oligomer and four branching monomer are reacted together to form the hyperbranched polymer.
- 10 17. A method according to Claim 15, in which the four-branching monomer, diacrylate component, and first amine are reacted together in a Michael addition reaction to form a first polymer, and the first polymer and second amine component are reacted together in a Michael addition reaction to form the hyperbranched polymer.
- 15 18. A method according to any of Claims 15 to 17, in which the four-branching monomer is selected from a diamine component, a tetraacrylate component, a tetra acrylamide component, a tetrathiol component, a tetraepoxy component, and a tetra-substituted silane.
19. A method according to Claim 18, in which the four-branching monomer is selected from
- 20 the group consisting of:



DATA, 122, Mw=192.26



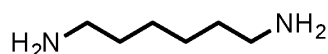
EDA, 102, Mw=60



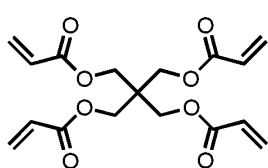
Cystamine, Mw=225.20



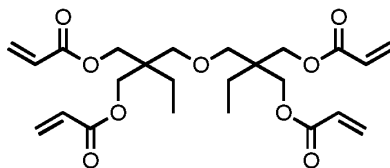
DA, 103, Mw=74.13



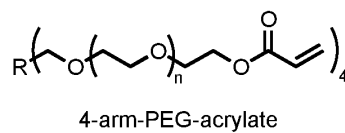
HMDA, 106, Mw=116.21



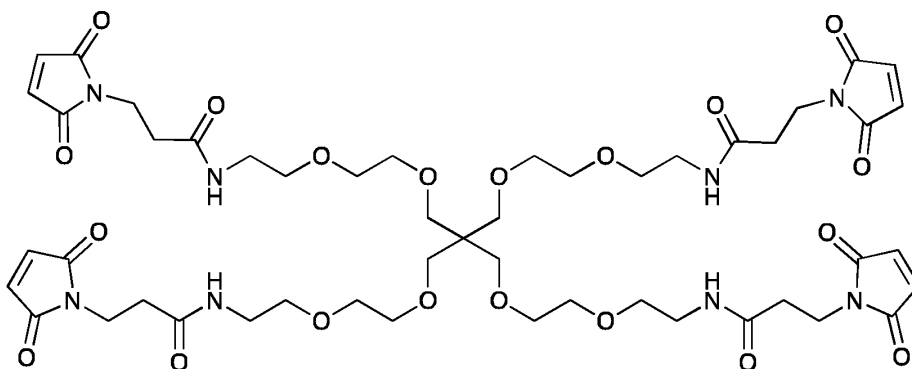
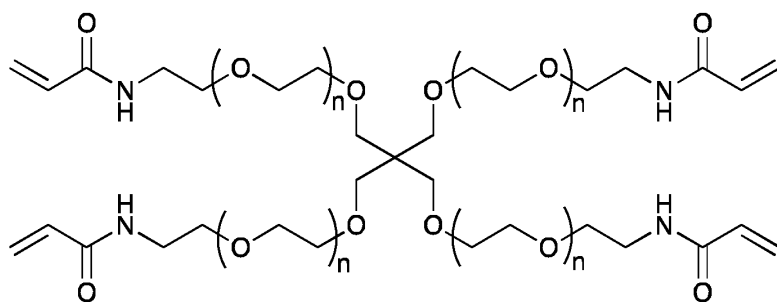
PTTA, Mw=352.34



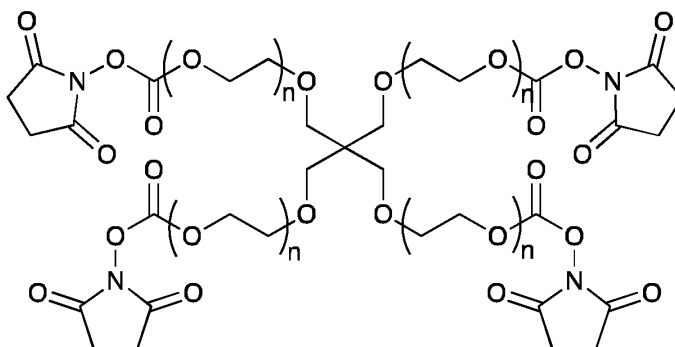
DTTA, Mw=466

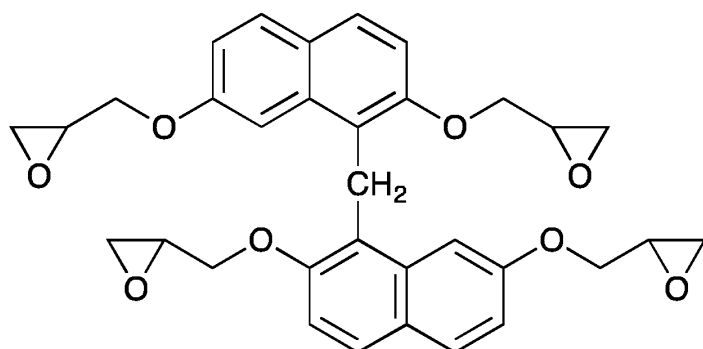
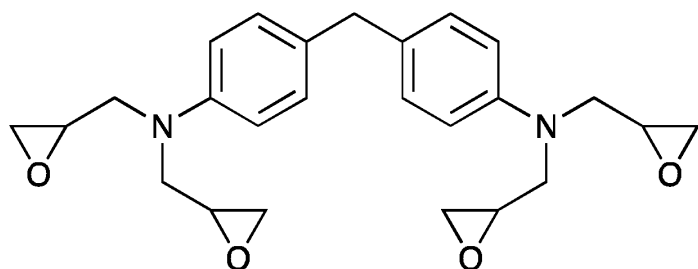
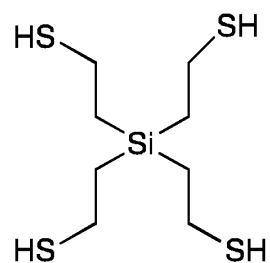
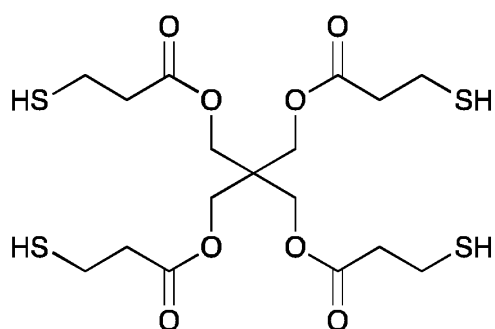


4-arm-PEG-acrylate

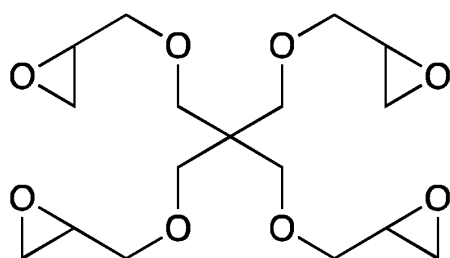


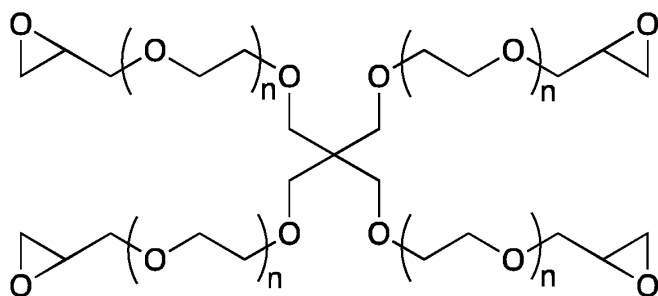
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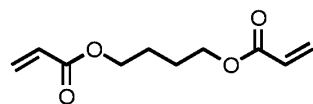


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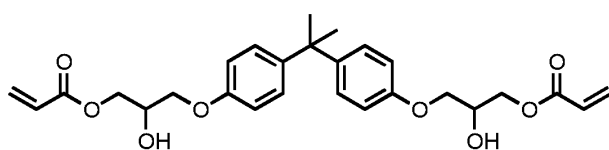




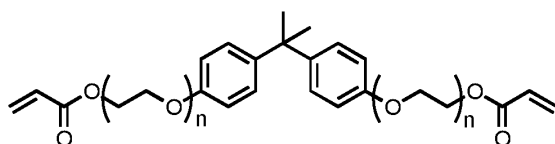
20. A method according to any of Claims 15 to 19, in which the diacrylate component of
 5 formula (I) is selected from



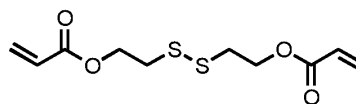
BDA, Mw=198.22



BPGDA, Mw=484.54



BPEDA, E/P=1.5, Mn=468



DSDA, Mw=262.34



NPGDA, Mw=304.39