Accordingly, there is a need for an ion selective membrane that ameliorates one or more disadvantages mentioned above.

Summary

There is provided an ion selective membrane comprising a polymer matrix and an ionic lipophilic additive covalently bonded to the polymer matrix.

In one aspect, there is provided an ion selective membrane comprising a polymer matrix, an ionic lipophilic additive covalently bonded to the polymer matrix and an ionophore covalently bonded to the polymer matrix.

Advantageously, the ion selective membrane may have an improved lifespan as the components are not readily leached out when in use. Unexpectedly, the improved lifespan of the ion selective membrane may be more than 100 days of continuous usage.

Further advantageously, the ion selective membrane does not have lower or modified selectivity when all components are covalently bonded to the polymer matrix.

There is provided a method of preparing an ion selective membrane, comprising the steps of:

(a) mixing an ionic lipophilic additive monomer and a membrane base to form a mixture; and

(b) casting and curing the mixture of step (a) to form the membrane.

In another aspect, there is provided a method of preparing an ion selective membrane, comprising the steps of:

(a) mixing an ionic lipophilic additive monomer and a membrane base to form a mixture;

(b) adding an ionophore monomer into the mixture of step (a); and

(c) casting and curing the mixture of step (b) to form the membrane.

In another aspect, there is provided an ion selective electrode comprising the ion selective membrane as described herein and an electrode.

There is provided a method of preparing an ion selective electrode, comprising the steps of:

(a) providing a mixture of an ionic lipophilic additive monomer and a membrane base; and

(b) casting and curing the mixture of step (a) on an electrode to form the ion selective electrode.

In another aspect, there is provided a method of preparing an ion selective electrode, comprising the steps of:

(a) providing a mixture of an ionic lipophilic additive monomer, an ionophore monomore and a membrane base; and

(b) casting and curing the mixture of step (a) on an electrode to form the ion selective electrode.

Definitions

The following words and terms used herein shall have the meaning indicated:

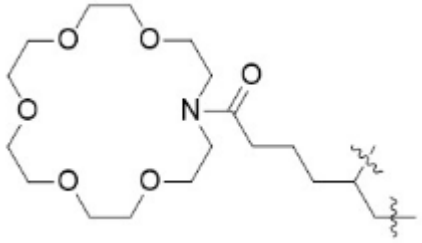
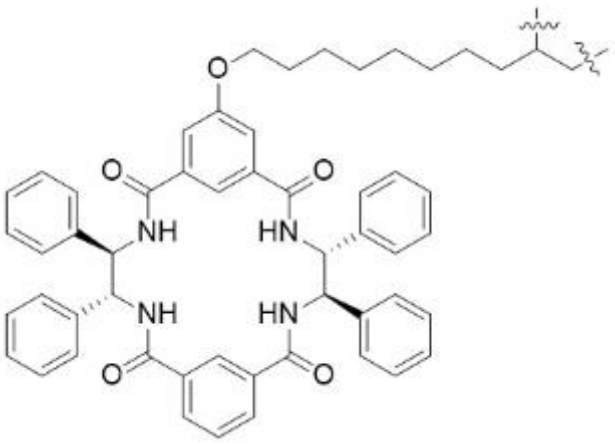
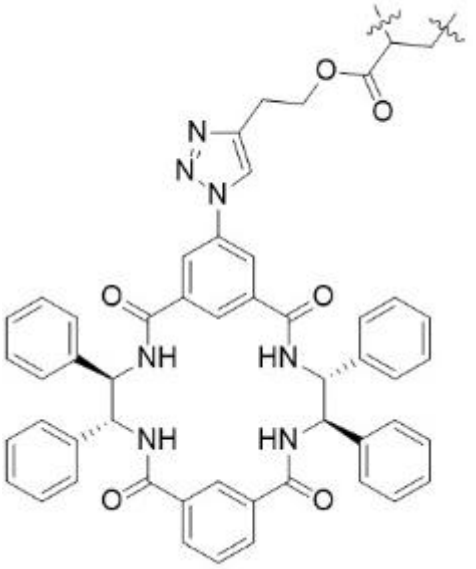
As used herein, the term "alkyl group" includes within its meaning monovalent ("alkyl") and divalent ("alkylene") straight chain or branched chain saturated aliphatic groups having from 1 to 10 carbon atoms, e.g., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10 carbon atoms. For example, the term alkyl includes, but is not limited to, methyl, ethyl, 1-propyl, isopropyl, 1-butyl, 2-butyl, isobutyl, tert-butyl, amyl, 1,2-dimethylpropyl, 1,1-dimethylpropyl, pentyl, isopentyl, hexyl, 4-methylpentyl, 1-methylpentyl, 2-methylpentyl, 3-methylpentyl, 2,2-dimethylbutyl, 3,3-dimethylbutyl, 1,2-dimethylbutyl, 1,3-dimethylbutyl, 1,2,2-trimethylpropyl, 1,1,2-trimethylpropyl, 2-ethylpentyl, 3-ethylpentyl, heptyl, 1-methylhexyl, 2,2-

Claims

1. An ion selective membrane comprising a polymer matrix, an ionic lipophilic additive covalently bonded to the polymer matrix and an ionophore covalently bonded to the polymer matrix.

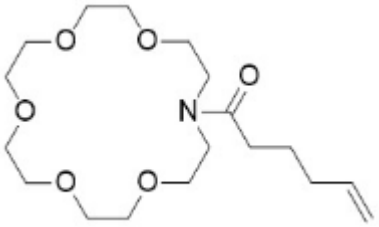
2. The ion selective membrane of claim 1, wherein the ionic lipophilic additive comprises an optionally substituted C_1 to C_{20} alkylene group.

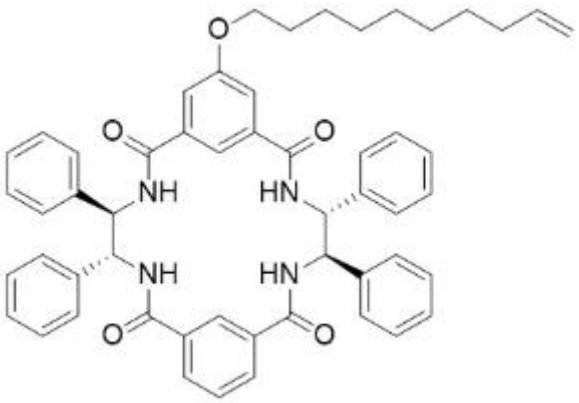
3. The ion selective membrane of claim 2, wherein the C_1 to C_{20} alkylene group comprises a substituent having at least one lipophilic group and at least one charged group that are covalently bonded together.

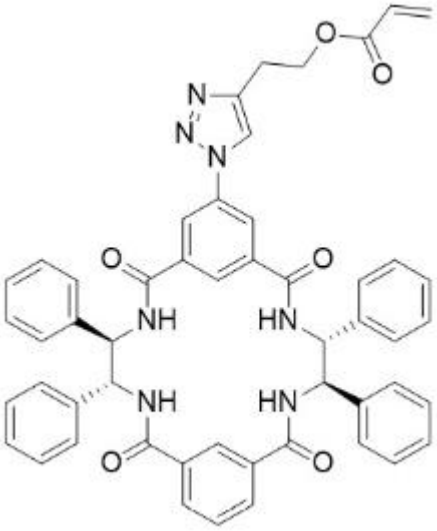
4. The ion selective membrane of claim 1, wherein the ionophore has a formula selected from  ,  ,  or combinations thereof.

5. The ion selective membrane of any one of claims 1 to 4, wherein the ionophore does not comprise metal.

6. A method of preparing an ion selective membrane, comprising the steps of:
(a) mixing an ionic lipophilic additive monomer and a membrane base to form a mixture;
(b) adding an ionophore monomer into the mixture of step (a); and
(c) casting and curing the mixture of step (b) to form the membrane.

7. The method of claim 6, wherein the ionophore monomer is selected from the compounds of formula  ,



or  .

8. The method of claim 6 or 7, wherein the ionophore monomer is added at a weight percentage in the range of 0.5 weight% to 15 weight%, based on the total weight of the mixture of step (a).

9. The method of any one of claims 6 to 8, wherein the ionic lipophilic additive monomer is added at a weight percentage in the range of 0.5 weight% to 20 weight%, based on the total weight of the mixture of step (a).

10. The method of any one of claims 6 to 9, further comprising a step of adding a co-solvent into the mixture of step (a) after step (a) but before step (c).

11. The method of any one of claims 6 to 10, wherein the casting and curing step (c) comprises casting the mixture of step (b) on a substrate and subsequently curing the mixture by irradiation from a light source.

12. The method of any one of claims 6 to 11, wherein the casting and curing step (c) comprises casting the mixture of step (b) on an electrode.

13. The method of any one of claims 6 to 12, wherein the casting and curing step (c) comprises curing the mixture of step (b) by irradiation from a light source that emits light at a power in the range of 20 mW/cm^2 to 250 mW/cm^2.

14. An ion selective electrode comprising the ion selective membrane of any one of claims 1 to 5 and an electrode.

15. The ion selective electrode of claim 14, which is an all-solid-state ion selective electrode.

16. A method of preparing an ion selective electrode, comprising the steps of:
(a) providing a mixture of an ionic lipophilic additive monomer, an ionophore monomer and a membrane base; and
(b) casting and curing the mixture of step (a) on an electrode to form the ion selective electrode.

17. The method of claim 16, further comprising a step (c) of conditioning the ion selective electrode after step (b).