Claims

1. An ophthalmic emulsion, the emulsion comprising:

water forming an aqueous phase;

oil forming an oil phase;

a hydrophilic surfactant having an HLB value from 10 to 18;

a hydrophobic surfactant having an HLB value from 1 to 6;

a charged phospholipid;

borate;

a mucoadhesive galactomannan polymer; and

a preservative;

wherein the mucoadhesive galactomannan polymer is present in the emulsion at a concentration of at least about 0.130.1 w/v % but no greater than 0.50.3 w/v %;

wherein the preservative is substantially free of a benzalkonium chloride; and

wherein the ophthalmic emulsion has a hydration protection against desiccation of at least 10% higher than a control emulsion, wherein the control emulsion has the same composition of the ophthalmic emulsion except of containing 0.05 w/v % of the same galactomannan polymer used in the ophthalmic emulsion.

2. The emulsion as in claim 1 wherein the oil is a hydrocarbon selected from mineral oil, paraffin oil and petrolatum.

3. The emulsion as in claim 1 wherein the oil is at least 0.1 w/v % and no greater than 3 w/v % of the emulsion.

4. The emulsion as in claim 3 wherein the hydrophilic surfactant is present in the emulsion in an amount that is at least 0.08 w/v % and is no greater than about 0.8 w/v %.

5. The emulsion as in claim 4 wherein the hydrophilic surfactant is polyoxyethylene-40-stearate.

6. The emulsion as in claim 4 wherein the hydrophobic surfactant is at least about 0.01 w/v % and is no greater than 2.0 w/v %.

7. The emulsion as in claim 6 wherein the hydrophobic surfactant is a sorbitan tristearate.

8. The emulsion as in claim 1 wherein the mucoadhesive galactomannan polymer is selected from the group consisting of guar and hydroxypropyl guar.

9. The emulsion as in claim 8 wherein the charged phospholipid is an anionic phospholipid named dimyristoyl phosphatidylglycerol ~~mucoadhesive galactomannan polymer is present in the emulsion at a concentration of at least about 0.12 w/v % but no greater than 0.4 w/v %~~.

10. The emulsion as in claim 1 further comprising a borate/polyol buffer system ~~8 wherein the charged phospholipid is an anionic phospholipid named dimyristoyl phosphatidylglycerol~~.

11. The emulsion as in claim 10 wherein the preservative is a polymeric quaternary ammonium compound ~~phospholipid is present in the emulsion in a concentration from about 0.13 to 0.3 percent by weight~~.

12. The emulsion as in claim 1, wherein:

i. the oil phase is in droplets within the aqueous phase and the droplets have a D90 diameter that is no greater than about 700 nm but is at least 10 nm; and

ii. the borate and galactomannan polymer cooperatively act to form a gel upon instillation of the emulsion in an eye of an individual ~~further comprising a borate/polyol buffer system~~.

13. The emulsion as in claim 12, wherein the oil phase is in droplets within the aqueous phase and the droplets have a D90 diameter that is no greater than about 500 nm but is at least 30 nm ~~preservative is a polymeric quaternary ammonium compound~~.

14. The emulsion as in claim 13, wherein the oil phase is in droplets within the aqueous phase and the droplets have a D90 diameter that is no greater than about 300 nm but is at least 50 nm ~~The emulsion as in claim 1, wherein:~~

~~i. the oil phase is in droplets within the aqueous phase and the droplets have a D_{90} diameter that is no greater than about 700 nm but is at least 10 nm; and~~

~~ii. the borate and galactomannan polymer cooperatively act to form a gel upon instillation of the emulsion in an eye of an individual~~.

~~15. The emulsion as in claim 14, wherein the oil phase is in droplets within the aqueous phase and the droplets have a D_{90} diameter that is no greater than about 500 nm but is at least 30 nm.~~

~~16. The emulsion as in claim 15, wherein the oil phase is in droplets within the aqueous phase and the droplets have a D_{90} diameter that is no greater than about 300 nm but is at least 50 nm.~~