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(54) Title: NATURAL FEEL POLYMERS

(57) Abstract: Natural feel polymers exhibit an advantageous blend of flexibility and a strong affinity to natural fibers imparting a natural feel when applied to keratinbased fibers, e.g. hair, skin, or textiles, e.g. cotton, wool, and are watersoluble and water-resistant. The polymers include repeat units of a monomer (e.g. a-olefin) maleic anhydride alkyl half-ester or full acid, maleamic acid and maleimide, which are derivatized with a polyether amine, optionally, in admixture with a carboxylic acid-containing compound or polymer.



WO 2004/019858 A2

NATURAL FEEL POLYMERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to polymers useful in personal care products, and, particularly to hair styling polymers, referred to herein as "natural feel" polymers, which possess the desirable physical attributes of flexibility and a smooth feel, as well as water-solubility and water-resistance.

2. Description of the Prior Art

Hair styling polymers which feel stiff on hair are rather brittle under a high applied stress; accordingly, these polymers will shatter easily when strained appreciably. On the other hand, highly flexible polymers when used in hair styling will bend under both high and low stress but they are generally considered by the user to be too soft for desirable hair styling.

Accordingly, it is an object of this invention to provide polymers which have the desirable attributes of stiffness and flexibility, and have a strong affinity for hair imparting a natural feel for the user, and are also water-soluble and water-resistant.

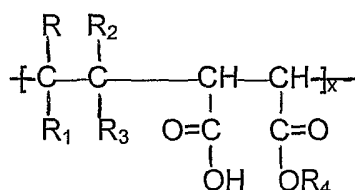
Another object herein is to provide natural feel polymers which can be easily removed from a substrate such as hair or skin, or a textile fiber, by simple washing.

These and other objects and features of the invention will be made apparent from the following description thereof.

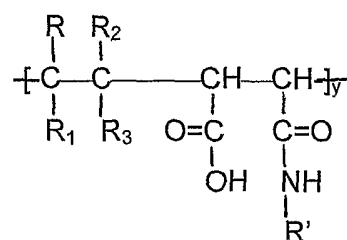
SUMMARY OF THE INVENTION

Natural feel polymers, referred to as "A" polymer, have defined amounts of repeat units of (a) a monomer (e.g. α -olefin) -maleic anhydride alkyl half-ester or full acid, (b) maleamic acid, and (c) a maleimide, as shown below:

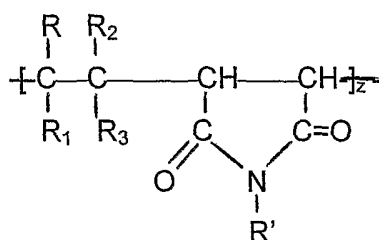
NATURAL FEEL POLYMERS



(a) half-ester or full ester



(b) maleamic acid



(c) maleimide

where:

R, R₁, R₂ and R₃ are selected from H, alkyl, alkoxy, cycloalkyl, aryl, ester, acid, hydroxy, hydroxyalkyl, amido, fluoro, halo and silyl, and R₄ is H or alkyl; and

R' is a derivatizing group selected from X, a hydrophobic amine; Y, a hydrophilic amine; and Z, a polyether amine; and suitable mixtures thereof;

x, y and z are present, in mole %, of 0-99.9, 0-50 and 0.1-100, respectively; preferably 0-50, 0-5 and 50-100; and X, Y and Z are present in mole ratios of 0-20:0-99:0.1-20; preferably, 0-10:40-98:1-10.

Mixtures of "A" polymer and "B", a compound or polymer with a carboxylic acid functionality, produces useful polymers with advantageous properties.

DETAILED DESCRIPTION OF THE INVENTION

The natural feel polymers (A) of the present invention are particularly characterized by repeat units which contain an abundance (by weight) of polyether amine derivatizing groups which can hydrogen-bond with itself or other repeat units in the polymer to form an intra- or inter-molecular polymer resulting in a pseudo-network polymer. This polymer thus acts as if it is crosslinked. Cohesion between such hydrogen-bonded molecules provides the polymer with water-resistance, but also with water solubility because, once the polymer is flooded with water, it will admit sufficient amount of water for solubilization. The polymers show good adhesion to natural substrates but can be removed easily if desired. Some polyether derivatizers may also crystallize upon dry-down, resulting in enhanced properties such as water resistance.

Representative structural components of the natural feel polymers of the invention are given below.

Reactants for Natural Feel Polymers

Polymer Backbone

Monomer-Maleic Anhydride Copolymer

Alkyl vinyl ether-maleic anhydride copolymer, e.g. methyl vinyl ether-maleic anhydride copolymer, or isobutyl vinyl ether-maleic anhydride copolymer; and derivatives thereof, including alpha-olefin-maleic anhydride copolymer, e.g. ethylene-maleic anhydride copolymer, or isobutylene-maleic anhydride copolymer; styrene-maleic anhydride copolymer, etc.

Derivatizers

Hydrophobic Amine (X)

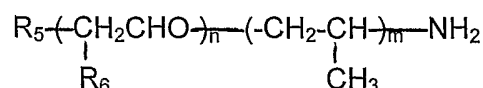
Monofunctional α -unsubstituted primary or secondary monoamines, unsubstituted or substituted with alkyl, aryl, heterocyclic, aromatic, fluoro, silyl amino, carboxy and halogen; e.g. C₁-C₄₀ alkyl NH₂; butylamine, isobutyl amine, and octadecylamine. These amines may be included in the polymer to alter the solubility of the polymer.

Hydrophilic Amine (Y)

Hydroxy α -unsubstituted amines e.g. ethanolamine, isopropylamine, n-propanolamine, 3-amino-1-propanol; methoxyethyl amine, and diglycol amine; and alkyl diamines, e.g. 3-(dimethylamino)propylamine, dimethylethylene diamine, N-aminopropyl pyrrolidone, N-aminoethyl pyrrolidone, and 1-(3-aminopropyl)imidazole. These amines are included in the polymer to modify the adhesive/cohesive balance in the polymer, and to increase compatability with other components in system.

Polyether Amine (Z)

Polyoxyalkylene amine, having the formula:



where R₅ and R₆ are selected from H and alkyl; e.g. R₅ is CH₃ and R₆ is H; and R₅ is CH₃ and R₆ is CH₃; and n and m are integers from 1-50; e.g. n = 32 and m = 10. These amines are obtainable as Jeffamine® M Monoamines (Huntsman Corp), with various molecular weights and ethylene oxide (EO)/propylene oxide (PO) ratios. These amines are present to provide natural feel properties in the polymer, i.e. softness and flexibility, as well as the desired adhesive/cohesive balance.

Another feature of the invention is the provision of products which are made by mixing the natural feel polymers, (A), with (B), a compound or polymer having a carboxylic acid functionality. Carboxylic acid functionality includes the free acid and the neutralized acid. A particularly preferred (B) polymer is a linear or crosslinked acrylic acid polymer, e.g. Carbopol®, preferably which is neutralized before mixing with (A). The result of mixing (A) and (B) is a complexed, synergistic product particularly suitable for hair care application because it has high humidity curl retention, and has an increased solution viscosity, as compared to (A) or (B) alone. The viscosity of the product can be predetermined by the relative amounts of (a), (b) and (c) in polymer (A). For example, 100 mole % in the (c) repeat unit will provide an opaque product, while dilution of the polymer with more (a) repeat units will form a more desirable clear, and less viscous product, upon mixing with (B).

The polymers strongly interact and upon dry down result in films with increased toughness and cohesiveness than individual polymer systems.

When these synergistic systems are used in a personal care hair styling application the resultant formulations have improved high humidity and curl retention (HHCR) when compared to similar formulations containing the individual polymers alone.

The degree of complexation between (A) and (B) can be predetermined by adjusting the mole ratio of maleimide in (A) to the carboxylic units in (B). Complexation is strongest for products in which the maleimide:carboxylic mole ratio approaches 1:1.

However, complexation is not as pH sensitive as typical acid-base complexed systems, e.g. PVP and acrylic acid; in fact, complexation can occur at a neutral pH. Thus personal care formulations at or around a neutral pH still possess synergistic complexation of (A) and (B), with its resultant desirable properties and physical attributes.

The invention will now be described with reference to the following examples.

EXAMPLE 1

Preparation of Polymer (A)

The following were charged into a 2-liter, stainless steel high pressure reactor.

P(maleic anhydride/isobutene) (Man)	72.94 g
3-(dimethylamino) propylamine (50 mol % based on Man)	24.17 g
Jeffamine® M-2070 (2 mol % based on Man) (M.W. 2,000, 70/30 EO/PO) (water soluble)	20.73 g
Triethylamine (43 mol % based on Man) (Neutralizer)	20.59 g
Methanol	257.07 g

The reactor was sealed, purged 3 times with N₂ gas, and heating was initiated according to the following heating profile.

- Ambient → 90°C, 1½ hr.
- 90°C → 90°C, 2 hr.
- 90°C → 130°C, 1½ hr.
- 130°C → 130°C, 8 hr.
- 130°C → 35°C, 1 hr.

At the end of the heating cycle, the polymer product was obtained as a lightly viscous, yellow, clear solution; then it was flooded with water to give a viscous, hazy, yellow-colored solution. The solution was mixed with neutralized Carbopol® in an amount present in a typical styling gel formulation. A thick, clear gel was obtained after an hour. The gel formulation was applied to hair and the resultant film was stressed. The film showed a natural feel, combining firm and flexible characteristics, water-resistance and water-solubility, and excellent high humidity curl retention.

Mixing Polymer (A) with Carboxylic Acid Containing Polymer (B)

The polymer solution (A) was mixed with neutralized Carbopol®, a crosslinked acrylic acid polymer, in amounts of 2 and 0.5 wt.%, respectively, and in an amount present in a typical styling gel formulation. A thick gel having a viscosity greater than (A) or (B) was obtained after an hour. The gel formulation was applied to hair and the resultant film was stressed. The film showed a natural feel, combining firm and flexible characteristics, water-resistance and water-solubility, and excellent high humidity curl retention.

EXAMPLE 2

The following reactants were added to a 2-liter pressure reactor:

Poly(isobutylene/maleic anhydride)	119.22 g
Dimethylaminopropylamine	39.51 g
Jeffamine M-2005 (M.W. 2,000, 5/95 EO/PO (water-insoluble))	42.35 g
Jeffamine M-2070 (M.W. 2,000, 70/30 EO/PO (water-soluble))	42.35 g
Triethylamine	31.30 g
Ethanol	510.20 g

The reactor was sealed and purged with an inert gas. The following heating profile was initiated:

Heat to 125°C	-	4 hours
Hold at 125°C	-	12 hours
Cool to 35°C	-	1 hour

After the heating profile was complete, the polymer solution was discharged from the reactor. The resultant material was a viscous, clear yellow solution. This material was laid down as a film and allowed to dry. A non-brittle film resulted which was water soluble. Exchanging water for ethanol gave a water-based solution having similar properties to the ethanol-based material.

The carboxylic acid-containing polymer can be formed as above.

EXAMPLE 3

The following reactants were added to a 2-liter pressure reactor:

Poly(isobutylene/maleic anhydride)	119.22 g
Dimethylaminopropylamine	39.51 g
Jeffamine M-2005	84.70 g
Triethylamine	31.30 g
Ethanol	510.20 g

The reactor was sealed and purged with an inert gas. The following heating profile was initiated:

Heat to 125°C	-	4 hours
Hold at 125°C	-	12 hours
Cool to 35°C	-	1 hour

After the heating profile was complete, the polymer solution was discharged from the reactor. The resultant product was a viscous, clear yellow solution. This material was laid down as a film and allowed to dry. A non-brittle film resulted. Exchanging with water gave a water-based solution having similar properties to the ethanol-based material.

The carboxylic acid polymer can be reacted as above, if desired, to produce new and useful polymers, as described in Example 1.

EXAMPLE 4

The following reactants were added to a 2-liter pressure reactor:

Poly(isobutylene/maleic anhydride)	119.22 g
Dimethylaminopropylamine	39.51 g
Jeffamine M-2005	84.70 g
Jeffamine M-2070	33.90 g
Triethylamine	31.30 g
Ethanol	573.17 g

The reactor was sealed and purged with an inert gas. The following heating profile was initiated:

Heat to 125°C	-	4 hours
Hold at 125°C	-	12 hours
Cool to 35°C	-	1 hour

After the heating profile was complete, the polymer solution was discharged from the reactor. The resultant material was a viscous clear yellow solution. This material, when laid down as a film and allowed to dry, resulted in a flexible film. This same material can be exchanged with water to give a water-based solution having similar properties to the ethanol-based material.

The carboxylic acid-containing polymer can be formed as in Example 1.

EXAMPLE 5

The following reactants were added to a 2-liter pressure reactor:

Poly(isobutylene/maleic anhydride)	119.22 g
Dimethylaminopropylamine	39.51 g
Jeffamine M-2005	101.70 g
Jeffamine M-2070	84.70 g
Triethylamine	31.30 g
Ethanol	699.08 g

The reactor was sealed and purged with an inert gas. The following heating profile was initiated:

Heat to 125°C	-	4 hours
Hold at 125°C	-	12 hours
Cool to 35°C	-	1 hour

After the heating profile was complete, the polymer solution was discharged from the reactor. The resultant material was a viscous clear yellow solution. This material, when laid down as a film and allowed to dry, resulted in a very-flexible film. This same material can be exchanged with water to give a water-based solution having similar properties to the ethanol-based material.

The carboxylic acid-containing polymer can be formed as in Example 1.

The natural feel polymers of Examples 1-5 were formulated into typical hair care products designed for use in the modes of styling, mousse, gel and spray hair care products. These products performed well in practice giving the user the advantages of the natural feel polymers therein, particularly a firm and flexible characteristic, water-resistance and water-solubility, and excellent high humidity curl retention.

More particularly, the compositions described herein are useful in products for personal care, including, but not limited to, gels, lotions, glazes, glues, mousses, sprays, fixatives, shampoos, conditioners, 2n1 shampoos, temporary hair dyes, semi-permanent hair dyes, permanent hair dyes, straighteners, permanent waves, relaxers, creams, putties, waxes and pomades. The compositions can be used alone or in combination with anionic, nonionic and cationic hair styling polymers, thickeners, film formers, surfactants, reducing agents, oxidizers and other ingredients typically found in personal care products. Specific examples follow:

Gels: Hair and/or skin care compositions wherein the compositions comprise an aqueous or hydroalcoholic gel. Gels can be in the form of spray gels, fluid gels, tube gels and thick viscous tub gels. The compositions can be used preferably at use levels of 0.1 – 10% by weight in anionic, nonionic or cationic gellants (clear, translucent or opaque), or combinations thereof, such gellants preferably being present in amounts of 0.1-5% by weight.

Anionic gellants include, but are not limited to, carbomer, Acrylates/C10-30 Alkyl Acrylate Crosspolymer, Acrylates Copolymer, Acrylates/Beheneth-25 Methacrylate Copolymer, Acrylates/Steareth-20 Methacrylate Copolymer, PVM/MA Decadiene Crosspolymer, Xanthan Gum, sodium polyacrylate, polyacrylamide, copolymers of sodium acrylates, and copolymers of polyacrylamide.

Nonionic gellants include, but are not limited to, guar and their derivatives and celluloses and their derivatives. Examples are hydroxyethyl cellulose, hydroxypropyl cellulose, hydroxymethyl cellulose, hydroxypropyl guar.

Cationic thickeners include, but are not limited to, Polyquaternium 32 (and) mineral oil, and Polyquaternium 37 (and) mineral oil (and) PPG-1 Trideceth-6.

Hair and skin care gel formulations with the compositions using crosslinked homopolymers of acrylic acid, e.g., carbomer and/or Acrylates/C10-30 Alkyl Acrylate Crosspolymer as the gellant result in synergistic performance in moisture resistance. In particular, hair styling gels with the above listed combinations show synergistic high humidity resistance on hair.

Complexation of the compositions with carbomer and/or Acrylates/C10-30 Alkyl Acrylate Crosspolymer results in clear films upon draw down. The resultant viscosity, yield value and suspension capabilities are unaffected or increased by the addition of such compositions into the gellant.

Formulation Examples:

Hair Styling Gel Formulation 1

Water- QS to 100%

Carbomer - 0.5%

Triethanolamine(99%) - 0.5%

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer (30%)- 6.66

Benzophenone-4 – 0.05

Disodium EDTA – 0.10

Triethanolamine(99%) – adjust to pH 7

Propylene Glycol (and) diazolidinyl Urea (and) Iodopropynyl butylcarbamate – 0.5

Hair Styling Gel Formulation 2

Water – QS to 100%

Isoceteth-20 – 0.5

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer(30%) – 6.66

Aminomethyl propanol – 0.25%

Acrylates/Beheneth-25 Methacrylate Copolymer(20%) – 4.7

Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate – 0.5

Hair Styling Cream

Water – QS to 100%

Sodium Polyacrylate(and) Hydrogenated polydecene (and) Trideceth-6 – 2.0%

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer (30%) – 6.7%

Glycerin – 2.0%

Cetyl PEG/PPG-15/15 Butyl Ether Dimethicone – 1.0%

Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate – 0.5%

Mousses: The compositions can be incorporated into aerosol and non-aerosol hair and skin mousse formulations, as well as spray mousses which utilize an aerosol valve with a dip tube and a mechanical break-up actuator to deliver an atomized spray foam. They are also compatible in aerosol and non-aerosol shave foam applications. Preferred use levels of the compositions are 0.1-10.0% by weight.

Shampoos and Body Washes: The compositions described are compatible with anionic, amphoteric, cationic and nonionic surfactants. The compositions can be incorporated into cleansing formulations for hair and body. The compositions described can be used preferably at use levels of 0.1 to 10% by weight with anionic, amphoteric, cationic, and nonionic surfactants, or combinations thereof, such surfactants preferably being present in amounts of 0.1 to 20% by weight.

Clear Shampoo Formulation Example:

Water - QS to 100%

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer – 5.0

Cocamidopropyl Betaine (34.5%) – 10.00%

Cocoamphodiacetate (50%) – 5.00%

Sodium Laureth Sulfate (25.6) – 17.5%

Ammonium Lauryl Sulfate (29.2%) – 17.5%

Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate – 0.30

Citric Acid – 0.25%

Oil-in-Water Emulsions and Hair Conditioners (including both leave-in and rinse-out): The compositions can be incorporated in hair and skin oil-in-water emulsions. In hair conditioners, the compositions described are compatible with quaternary ammonium compounds. The use level of surfactants/emulsifiers preferably is from 0.1 to 10% by weight.

Conditioner Formulation Example

Phase A:

Water – QS to 100%

Citric Acid – 0.25

Hydroxyethyl cellulose – 0.5%

Disodium EDTA – 0.1%

Phase B:

Cetearyl Alcohol – 4.0

Steareth-10 – 1.0

Glyceryl Stearate (and) PEG-100 Stearate – 2.5%

Dicetyldimonium Chloride(68.2%) – 2.0%

Phase C:

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer(30%) – 6.6

Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate – 0.5

Wheat Amino Acid – 0.5

Process: Heat Phase A and B separately to 75C. Add Phase B to Phase A with agitation. Mix until uniform and cool to 45C. Continue mixing and add ingredients in Phase C one at a time with mixing until homogenous.

Oxidative Hair Dyes: The compositions may be incorporated in oxidative hair dye formulations including semi-permanent and permanent hair dye products, preferably at use levels of 0.1-10% by weight.

Formulation Example:

Water – QS to 100%

Oleic Acid –5%

C11-15Pareth-9 – 3%

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer(30%) – 3.0

Ammonium hydroxide –2%

Steareth-21 – 2%

Propylene Glycol – 2%

Cetyl alcohol – 2%

PEG150/Stearyl/SMDI Copolymer –3%

Stearyl Alcohol – 1%

Sodium Sulfite – 1%

Iron Oxides – 0.5%

Mica – 0.2%

1-Naphitol – 0.2%

P-phenylendiamine – 0.2%

Titanium Dioxide – 0.1%

Relaxers and Permanent Waves: The compositions can be used in relaxer and permanent wave formulations preferably in amounts of 0.1% - 10% by weight. They may be combined with hair reducing agents, including, but not limited to, ammonium thioglycolate, guanidine hydroxide, sodium bisulfite and the like. The compositions can also be incorporated in the flow lotion (treatment phase before oxidation/hardening of the hair) or in the neutralizer/oxidizer phase.

Formulation Example:

Crème Hair Relaxer Base: To be mixed with Guanidine Carbonate Activator Solution

Water – QS to 100%

Petrolatum – 10%

Paraffin Wax – 8%

Mineral Oil – 6%

Isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer (30%) – 5.0

Cetearyl Alcohol – 3%

Calcium Hydroxide – 3%

Polysorbate 80 – 2%

Laneth-15 – 2%

PEG-75 Lanolin Oil – 1%

Cocamphodipropionate – 1%

Hair Sprays: The compositions can be incorporated in hair sprays, both non-aerosol and aerosol, preferably at use levels of 0.1 – 10% by weight. Aerosol hair sprays can include up to 60% hydrocarbon, 70% dimethyl ether, 50% Hydrofluorocarbon 152a, or combinations thereof. Hair spray formulations include, but are not limited to, alcohol-free pump hair spray, 55%-95% VOC pump and aerosol hair sprays.

Formulation Example:

Clear Alcohol Free Pump Hair Spray

Water – QS to 100%

Sodium Lauryl Sulfate (25%) – 0.25%

isobutylene/dimethylaminopropylmaleimide/ethoxylated maleimide/maleic acid copolymer(30%) – 13.33

Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate – 0.5%

Pump – Calmar Mark VI WL-31

Personal Care Applications: The compositions can be blended with anionic, nonionic and cationic hair styling polymers, thickeners, and film formers; and with anionic, nonionic and cationic surfactants. Clarity in water is increased with low levels of charged surfactants (0.1-2% by weight).

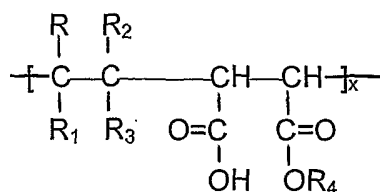
Performance on Hair: The compositions can be formulated into bodifying leave-on or rinse-off hair preparations. They also can be formulated into flexible hold styling products which render smooth continuous films on hair that have strength and will bend under both high and low stress.

Skin Care Applications: The compositions can be used as a film former (a) for the enhancement of antiperspirants to either increase overall wetness protection or reduction in amount of conventional AP active while holding equivalent efficacy, (b) to increase the substantivity of a deodorant active for better and longer acting deodorancy, (c) in an anti-bacterial liquid hand soap to increase efficacy and for longer lasting claim, (d) for holding products on skin, and (e) to increase contact time of a therapeutic skin products containing actives, including, but not limited to, Betulin, vitamin E, A, C, ceramides, Allantoin, lycopenes, bisabolol, retinol, etc.

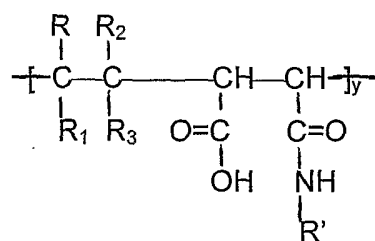
The compositions can be used in make-up products, (foundation, mascara, bronzers, eyeliners) for film formation, improved wear resistance and pigment dispersion. They can also be used in mascaras for curl retention.

WHAT IS CLAIMED IS:

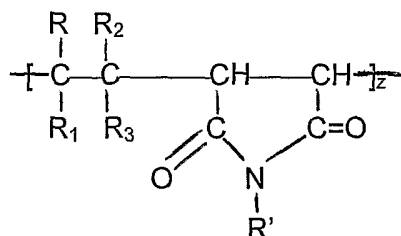
1. A natural feel polymer, "A", which shows an advantageous blend of stiffness and flexibility, a strong affinity to natural fibers, water-solubility and water-resistance, characterized structurally by repeat units of (a) a monomer-maleic anhydride alkyl half-ester or full acid, (b) maleamic acid, and (c) maleimide, of the formulas:



(a) half-ester or full ester



(b) maleamic acid



(c) maleimide

where:

R, R₁, R₂ and R₃ are selected from H, alkyl, alkoxy, cycloalkyl, aryl, ester, acid, hydroxy, hydroxyalkyl, amido, fluoro, halo and silyl, and R₄ is H or alkyl; and

R' is a derivatizing group selected from X, a hydrophobic amine; Y, a hydrophilic amine; and Z a polyether amine; and suitable mixtures thereof; wherein:

x, y and z are present, in mole %, of 0-99.9, 0-50 and 0.1-100, respectively; and X, Y and Z are present in mole ratios of 0-20:0-99:0.1-20.

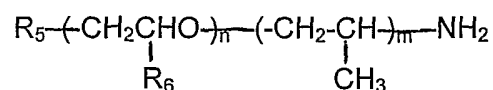
2. The product of mixing the natural feel polymer (A) according to claim 1 with (B), a compound or polymer having a carboxylic acid functionality.

3. A natural feel polymer according to claims 1 or 2 wherein X, Y and Z are presenting a mole ratio of 0-10:40-98:1-10.

4. A natural feel polymer according to claims 1 or 2 wherein:
X is a monofunctional α -unsubstituted primary or secondary monoamine;
Y is a hydroxy α -unsubstituted amine or alkyldiamine; and
Z is a polyoxyalkylene amine.

5. A natural feel polymer according to claim 1 wherein
X is a monofunctional α -unsubstituted primary or secondary monoamines, unsubstituted or substituted with alkyl, aryl, heterocyclic, aromatic, fluoro, silyl amino, carboxy and halogen; selected from C₁-C₄₀ alkyl NH₂; butylamine, isobutyl amine, and octadecylamine;
Y is a hydroxy α -unsubstituted amines selected from ethanolamine, isopropylamine, n-propanolamine, 3-amino-1-propanol; methoxyethyl amine, and diglycol amine; and alkyl diamines, selected from 3-(dimethylamino) propylamine, dimethylethylene diamine, N-aminopropyl pyrrolidone, N-aminoethyl pyrrolidone, and 1-(3-aminopropyl)imidazole, and

Z is polyoxyalkylene amine, having the formula:



where R_5 and R_6 are selected from H and alkyl; and n and m are integers from 1-50.

6. A natural feel polymer according to claim 5 wherein R_5 is CH_3 and R_6 is H.

7. A natural feel polymer according to claim 5 wherein both R_5 and R_6 are CH_3 .

8. A natural feel polymer according to claim 5 wherein $n = 32$ and $m = 10$.

9. A natural feel polymer according to claims 1 or 2 wherein, in (a), said monomer is an α -olefin.

10. A natural feel polymer according to claim 2 wherein (B) is a crosslinked acrylic acid polymer.

11. A polymer according to claim 2 wherein (B) is a linear carboxylic acid containing polymer.

12. A polymer according to claim 2 wherein (B) is an acrylic acid containing polymer.

13. A personal care formulation including the natural feel polymer of claims 1 or 2.

14. A personal care formulation according to claim 13 which is a hair care product.

15. A personal care formulation according to claim 13 which is a hair care product exhibiting excellent high humidity curl retention.

16. A personal care formulation according to claim 13 which is a shampoo, body wash, conditioner, relaxer, permanent wave, leave-on or rinse-off hair care formulation.

17. A hair care formulation according to claim 13 which is a styling, mousse, gel or spray hair care formulation.

18. A hair care formulation according to claim 13 which is an oxidative hair dye formulation, permanent wave, bleach or other treatment product.

19. A personal care formulation according to claim 13 which is a skin care formulation.

20. A product according to claim 2 wherein the mole ratio of maleimide in (A) to the carboxylic units in (B) is about 1:1.

21. A personal care formulation according to claim 13 which is a make-up product.