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POLY(N-PROPYL-N-VINYLACETAMIDE) IN HAIR SETTING COMPOSITIONS

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This invention relates to hair conditioning preparations and more particularly to compositions in which a homopolymer or a copolymer of an N-vinyl-N-(hydrocarbon substituted)acetamide is employed as the film-forming resin.

Many compositions have been proposed and used to set hair and to give it luster and brilliance. For instance, aqueous colloidal suspensions of tragacanth gum or similar substances have been applied to the hair by combing and brushing in order to accomplish these purposes. Lacquers, such as shellac solutions, have also been employed in this manner. But most of these earlier preparations, in addition to requiring a lengthy and laborious method of application, suffer variously from serious defects such as dullness of the film deposed on the hair, hardness of film which results in cracking at the slightest disturbance of the hair, difficulty in removal because of water insolubility of the film-forming resins, and so on.

Some of these problems have been solved by the advent of aerosol hair sprays using polyvinylpyrrolidone resins as the film-forming agent. This type of preparation can be quickly and easily applied and is free from either the stickiness of natural gum emulsion films or the cracking and breaking of shellac films. Yet the film formed on the hair by polyvinylpyrrolidone resins is still fairly stiff, a disadvantage that is probably due to the rigidity imparted to the polymer molecule by the bulky pyrrolidone ring.

Another type of resin which has gained wide acceptance in the hair spray field and which, in fact, presently dominates it, is the carboxylated type of polymer, especially vinyl acetate-crotonic acid copolymers and methyl vinyl ether-maleic anhydride copolymers. These resins however are not entirely satisfactory in that they are excessively brittle and give rise to container corrosion problems.

An object of this invention is to provide hair setting compositions that can be quickly and easily applied to the hair and leave thereon upon drying a lustrous and flexible film. Another object is to provide resins for hair setting preparations that can yield flexible films with a minimum of plasticization. Another object is to provide resins possessing a range of useful properties wider than that of any material successfully employed for hair setting heretofore. Still another object is to provide non-corrosive resins which have excellent adherence to hair. A further object is to provide compositions yielding films that are removable from the hair by simple washing with aqueous detergent solutions. Still another object is to provide hair-setting compositions that can form films of controlled flexibility and water solubility.

These and other objects have been accomplished by formulating hair spray compositions having as film-forming resins certain homopolymers and copolymers of N-vinyl-N-(hydrocarbon substituted)acetamides. The compositions are formed by dissolving the polymer preferably in an alcohol, adding other desirable ingredients such as perfume to the solution and combining the cooled solution to a liquified fluorinated hydrocarbon propellant.

Satisfactory methods for synthesizing the N-vinyl-N-(hydrocarbon substituted)acetamide polymers have been disclosed in copending applications S.N. 293,276, S.N. 295,528 and S.N. 302,481, filed respectively on July 8, July 16 and August 16, 1963. Of all the polymers described in those applications, the ones that are useful for the practice of the present invention possess the following characteristics:

The hydrocarbon substituent of polymeric unit contains from 1 to about 8 carbon atoms and can be aliphatic or aromatic. In this respect, it has been found that polymers of such compounds as N-vinyl-N-laurylacetamide yield films that are too soft for hair setting under normal atmospheric conditions, although it is conceivable that they could be successfully employed for that use under certain circumstances such as during the practice of outdoor winter sports. The preferred N-vinylacetamide polymers within the class described are the methyl, ethyl and n-propyl derivatives, the most useful being the n-propyl variety. N-propyl-N-vinylacetamide yields polymers that are water soluble without being excessively hygroscopic and that can therefore be used advantageously in atmospheres of high humidity. The higher analogs are also of interest. As the number of carbon atoms increases, the water solubility of the polymers decreases as well as their sensitivity to high humidity, and yet such polymers remain sufficiently water sensitive to be readily removed from hair by aqueous detergent solutions.

The polymers should have a molecular weight sufficiently high for them to be solids at room temperature. In practice, this signifies a molecular weight of at least 5000. Solubility and sprayability characteristics, on the other hand, impose an upper limit on the molecular weight so that in terms of intrinsic viscosity, the usable polymers are limited to those within the range of 0.04 to 1.0 dl./g. in benzene at 25° C. and preferably, for maximum balance of relevant properties, to those within 0.15 to 0.35 dl./g.

The usable polymers may be homopolymers of the above mentioned N-vinyl-N-(hydrocarbon substituted) acetamides or copolymers of said monomers with other copolymerizable ethylenically unsaturated monomers, the actual selection of the comonomer being done with a view to soften, to harden, to improve specific adhesion to the hair, to affect water solubility, water vapor sensitivity and so on. Among the materials that may thus be copolymerized with the N-vinyl-N-acetamides to achieve these desired effects are: the vinyl esters, including vinyl acetate, vinyl propionate, vinyl butyrate, vinyl hexoate and vinyl benzoate; acrylic compounds such as acrylic acid, methacrylic acid and the lower alkyl esters of these acids such as the methyl and ethyl esters; hydrocarbons in the class of ethylene and styrene; polycarboxylic vinyl compounds as maleic and fumaric anhydrides and their lower alkyl esters and nitriles; vinyl chloride and so on.

A preferred copolymer among those just enumerated is that made with N-methyl-N-vinylacetamide and vinyl acetate, in particular one containing about 55 parts by weight of vinyl acetate units and about 45 parts of amide units. This is a water soluble material which yields flexible films. It can readily be understood that in such a copolymer, variation of the ratio of the two monomers yields a series of copolymers differing in water solubility, water sensitivity and flexibility of film. The relationship between the vinyl acetate unit level of the polymer and the important film properties of water solubility and flexibility is such that as the vinyl acetate unit content increases, the flexibility increases while the water solubility decreases. Useful polymers can thus be obtained with a vinyl acetate unit content of up to 80% by weight.

The solvents that may be used to form the hair-setting preparations of this invention are selected from those quick-drying organic liquids that are compatible with fluorinated hydrocarbon propellants. They are, preferably, ethyl alcohol or isopropyl alcohol.

A plasticizer may be added in certain cases to improve

the flexibility of the film formed by certain of the harder and more brittle polymers. Examples of such plasticizers are dimethyl phthalate, glyceryl monoricinoleate and so on. Lanolin derivatives, for instance its lower alkyl esters, will impart higher gloss to the sprayed hair. Also, as intimated earlier, the addition of other ingredients such as perfume and dyes may be desirable.

The hair spray formulations of this invention are prepared by dissolving the selected resin in a non-toxic, quick-drying solvent of relatively low freezing point, preferably ethyl alcohol, at a concentration of 4 to 12% by weight of the resin. Alcohol-solution lanolin and plasticizers are added to this solution at this point, when desired, in concentrations of 10 to 25% by weight based on the resin content. The resulting base solution is mixed thoroughly and cooled to —15° C. A fluorocarbon propellant is then added to yield a final composition containing from 20 to 30% by weight of the base solution. In this respect, a most useful fluorocarbon propellant has been found to consist of mixtures of trichlorofluoromethane and dichlorodifluoromethane. By varying the ratio of the fluorochloromethanes forming the mixture within the general range of 1:3 to 3:1, it is possible to control the volatility and spraying characteristics of the hair spray while accommodating the viscosity of the particular base solution chosen.

In the following examples, which further illustrate but do not limit the present invention, all parts and percentages given are on a weight basis unless otherwise indicated.

Example 1

A solution of poly(N-propyl-N-vinylacetamide) was prepared as the base solution of a hair spray, according to the following formulation:

Components:	Parts
Poly(N-n-propyl-N-vinylacetamide)	32
Ethyl alcohol (SDA No. 40)	360
Lanolin isopropyl ester	8

To 25 parts of this base solution cooled to —15° C., was added a mixture consisting of 52.5 parts of trichlorofluoromethane and 22.5 parts of dichlorodifluoromethane. Thorough mixing gave a finished product that was clear, thus indicating complete compatibility of the ingredients. The product was packed in aerosol cans and tested by application to hair. Comparison with a hair spray based on polyvinylpyrrolidone revealed that the present formulation possesses superior hair holding power, better curl-setting properties and longer-lasting effects.

The resin used in this preparation and an intrinsic viscosity of 0.44 dl./g. in benzene at 25° C.

Example 2

Another hair spray preparation was made according to the following formulation.

Components:	Parts
Poly[(N - methyl-N-vinylacetamide)-co-(vinyl acetate)]	1.8
Ethyl alcohol (SDA No. 40)	22.7
Lanolin isopropyl ester	0.5

These ingredients were mixed in the manner of Example 1 and the resulting solution was combined with 75 parts of a 3:1 mixture of dichlorodifluoromethane and trichlorofluoromethane. This composition when applied to hair yielded a soft, lustrous film which could be removed by simple washing with an aqueous detergent solution.

The interpolymer employed in the preparation had a vinyl acetate unit content of 56.5% and an intrinsic viscosity of 0.23 dl./g. in benzene at 25° C.

We claim:

1. A hair lacquer composition, comprising a homopolymer of N-propyl-N-vinylacetamide having an intrinsic viscosity within the range of 0.15 to 0.35 dl./g. in benzene at 25° C., which is dissolved in a quick-drying subsantially anhydrous alkyl alcohol to give a lacquer composition having a homopolymer content of 4 to 12% by weight based on the total weight of homopolymer and alcohol.

2. A sprayable hair-styling composition comprising poly(N-vinyl-N-propylacetamide) and a fluorocarbon propellant dissolved in a quick drying substantially anhydrous alkyl alcohol wherein the poly(N-vinyl-N-propylacetamide) has an intrinsic viscosity within the range of 0.15 to 0.35 dl./g. in benzene at 25° C. and is present in the hair-styling composition in amounts of from 4 to 12% by weight based on the total weight of the polymer and alcohol and wherein the fluorocarbon propellant is present in the hair-styling composition in amounts of from 70 to 80% by weight based on the total weight of the hair-styling composition.

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