

1

3,431,322

**DYEABLE POLYOLEFIN COMPOSITIONS AND PRODUCTS THEREFROM**

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This invention relates to dyeable poly- $\alpha$ -olefin compositions adapted for formation into fibers, filaments, films and other shaped objects. More particularly the invention relates to polypropylene fibers containing an additive which renders them susceptible of permanent dyeing by disperse dyes.

It is well known that various polyolefins, particularly polypropylene in the partially or completely crystallized form, can be employed in the production of fibers, filaments, films and other shaped objects which will have valuable properties such as high strength and elongation, resistance to the action of chemicals such as acids, alkalies, and various other agents. However, because high molecular weight fiber-forming crystalline polyolefins are relatively insoluble and water resistant, as well as being chemically inert, several serious problems arise in the dyeing and processing of textile fibers and filaments produced therefrom. Polypropylene fibers, for example, cannot be dyed to any appreciable extent by conventional dyeing procedures in which dyes are applied from aqueous solutions or suspensions, because of polypropylene's exceptionally high resistance to wetting by aqueous media. Since polypropylene is also relatively chemically inert fibers produced from it cannot be dyed even by the use of hydrocarbon-soluble dye stuffs which might be expected to give satisfactory results. Similarly, polypropylene fibers cannot be permanently dyed by surface chemical action, as is possible with many other synthetic fiber-forming materials, even with the aid of a dye carrier such as butyl benzoate, o-phenylphenol or chlorinated benzenes. In fact, the inability to dye polypropylene and similar poly- $\alpha$ -olefin fibers has been the most serious obstacle to the practical use and commercial acceptance of these otherwise excellent fibers.

Attempts have been made to overcome the above mentioned difficulties by incorporating in the polyolefin material certain additives which are themselves susceptible of taking up a dye-stuff or reacting with it chemically, but it has been found that many of the more promising materials suggested for this purpose are inadequate and impractical because in many cases they are, not only extremely difficult to incorporate in polypropylene and other poly- $\alpha$ -olefin fiber-forming compositions, but also adversely affect physical properties of fibers spun from such compositions. In some cases the additives tend to exude and give the fibers a sticky hand or other undesirable properties which preclude satisfactory processing on textile machinery such as pickers, cards and the like.

It is accordingly the principal object of this invention to overcome the above mentioned difficulties and to pro-

2

vide a practical and satisfactory means of dyeing a poly- $\alpha$ -olefin fiber- and film-forming polymer such as polypropylene or other poly- $\alpha$ -olefin and copolymers thereof.

Another object is to provide polypropylene compositions adapted to be formed into fibers, filaments, films and other shaped objects and susceptible of permanent dyeing by disperse and other dyes.

Another object is to provide polypropylene fibers, filaments and yarns susceptible of being dyed by disperse dyes to shades which are gas fast, light fast and wash fast and show no tendency to crock or bleed.

A further object is to provide polypropylene and other poly- $\alpha$ -olefin fibers, filaments and yarns susceptible of permanent dyeing with disperse dyes and readily processible on pickers, cards and other textile machinery.

A still further object is to provide modified polypropylene textile fibers having improved physical properties, good hand and processability as compared to fibers produced from unmodified polypropylene.

Other objects will appear hereinafter.

These objects are accomplished by the following invention which, according to one embodiment thereof, comprises mixing with polypropylene or other poly- $\alpha$ -olefin or copolymers thereof, in pellet or other finely divided form, pellets of a copolyester derived by condensing 1 or more dicarboxylic acids with one or more glycols, in such an amount that the resulting pellet mixture will contain 1-20 percent and preferably 10-15 percent by weight of the copolyester. In accordance with the invention the mixture of polypropylene and copolyester pellets is subjected to a temperature sufficient to melt both materials and the resulting molten mass is then subjected to a mixing operation which causes the copolyester additive or modifier to be thoroughly distributed in the molten polypropylene. The molten mixture can then be forced through the orifices of a spinneret to form filaments by the well known melt spinning process or can be extruded through the orifice of an extrusion machine to form sheets, films or other shaped objects as may be desired. Such products are readily and permanently dyeable by disperse dyes by the usual dyeing procedures.

The process of forming the dyeable polypropylene or other polyolefin compositions of our invention may form a part of a continuous operation as, for example, in the melt spinning of dyeable polypropylene fibers as just described. When operating in this manner pellets of polypropylene, which may conveniently be in the form of small rods approximately 1/8 inch in diameter and approximately 1/8 inch in length, are fed from a suitable container at a predetermined rate to the feed hopper of an extruder provided with a screw conveyor adapted to rotate within a hollow cylinder or casing and provided with appropriate regulatable internal heating means to occasion melting of the polymeric material and maintain it in a molten condition during extrusion. The copolyester pellets which may be of the same or of a different size as the polypropylene pellets, are metered at a predetermined rate as a side stream into the descending stream of polypropylene pellets by a so called Vibra Screw which is a tubular or cylindrical feeding device provided in-

ternally with a rotating helical screw which conveys the pellets longitudinally through the tube and also provided with a mechanism which causes the tube to shake or vibrate, thus insuring a constant volume feed of the additive to the main stream of polypropylene pellets. The feed rates of both the polyethylene pellet and the additive pellet streams are so regulated as to deliver into the hopper of the extruder a mixture which will contain preferably 1 to 20 percent on the weight of the total mixture of the additive or modifier.

As indicated above, the pelletized materials are melted together in the extruder as the internal screw rotates and are thus mixed and dispersed one within the other. The extruder may be fitted with a suitable head at the delivery end to which may be attached a spinneret or other shaping device. In the manufacture of filaments the molten mass will be forced through the spinneret orifices and will emerge therefrom in the form of filaments which may be solidified by passing cooling air over them or by other means. Film, sheets and other shaped objects may be similarly produced by employment on the extruder head of a suitable shaping orifice so that the emerging molten material will take the desired form.

In accordance with our invention the copolyester modifier is distributed throughout the polyolefin mass in the form of minute particles which may have a stringy, striated, rod-like or other conformation. The resulting composition, whether in filament or sheet form, is a physical mixture of the two components in which the copolyester particles are relatively uniformly distributed and can, in accordance with our invention, function as dye receptors. In other words our invention is based upon the discovery that a copolyester additive or modifier, which itself is readily and permanently dyeable by dyes such as disperse dyes, can be so distributed throughout an undyeable polypropylene mass that when fibers or other objects produced therefrom are dyed the color is permanently retained by the copolyester particles and held within the body of the fiber material, with the result that the dyed polyolefin fibers themselves display the same color effect as if the polypropylene material of the fiber itself were dyed.

The poly- $\alpha$ -olefins which are susceptible of being rendered permanently dyeable by our invention are crystalline poly- $\alpha$ -olefins and polypropylene, poly-4-methyl-1-pentene, polystyrene, poly-1-butene, poly-3-methyl-1-butene, polyallyl benzene and polyvinylcyclohexane. The poly- $\alpha$ -olefins modified in accordance with the invention to render them dyeable are those of the fiber- and film-forming variety and having an inherent viscosity of 0.8–2.5 in Tetralin at a temperature of 145° C.

The copolyesters employed as dye receptors in this invention are high molecular weight linear copolyesters derived by condensing one or more aromatic dicarboxylic acids with one or more glycols. In the case where two or more acids are employed to produce the copolyester the major proportion of the acid component should preferably be an aromatic dicarboxylic acid.

Among aromatic acids which may be employed as terephthalic acid, isophthalic acid, the isomeric diphenic acids such as 4,4'-diphenic and 2,4'-diphenic acids, the isomeric naphthalene dicarboxylic acids such as 2,6-naphthalene dicarboxylic acid, 1,5-naphthalenedicarboxylic acid, etc., methylenedibenzoic acid and oxydibenzoic acid. Among aliphatic acids which may be satisfactorily used in minor amount are succinic, dimethylmalonic, glutaric, adipic, pimelic, azelaic, sebacic, 2-ethyladipic, dodecanedioic, dimethyl linoleic acid, and 4,4'-oxydibutyric. Among alicyclic acids are 1,2-, 1,3-, and 1,4-cyclohexanedicarboxylic acids; norcamphanedicarboxylic acids; and dodecahydrodiphenic acids.

Among glycols which may be employed to prepare the copolyesters employed as dye receptors in the invention are aliphatic and alicyclic glycols of 2–10 carbon atoms, including ethylene glycol, diethylene glycol, 1,2-propylene glycol, 2,2-dimethyl, 1,3-propanediol, 1,3-cyclohexane-

dimethanol, 1,4-cyclohexanedimethanol, and 2,2,4,4-tetramethylcyclobutane-1,3-diol. Also suitable for this purpose are polyoxyalkylene glycols such as polyethylene glycols and polypropylene glycols with molecular weight of 106–6000.

The above described copolyesters may be prepared by known processes as for example those disclosed in U.S. patent to Kibler, Bell and Smith, No. 2,901,466, and will have softening points falling within the range of 110–300° C., and an I.V. of 0.3 or above and preferably within the range of 0.4–1.5 in 60/40 phenol: tetrachloroethane. In the production of these copolyesters, by adjusting the component ratio and I.V. of the copolyester produced, it is possible to obtain materials with melting points and melt flow characteristics which will mix well with the selected polypropylene or other poly- $\alpha$ -olefins to be employed in producing modified fibers, filaments and other shaped objects by the melt extrusion process. The copolyesters thus employed as modifiers or dye receptors in the manufacture of polypropylene yarns and other products should be susceptible of melting or becoming fluid under the temperatures employed in the melt extrusion of the polypropylene fibers, filaments or other shaped articles. In other words the particular copolyester employed will be prepared by judicious selection among the many suitable glycols and the ratio of the mixture of glycols used, as well as of the acids to be employed in the production of these copolyesters as above enumerated.

In the following examples and description we have set forth several of the preferred embodiments of our invention but they are included merely for purposes of illustration and not as a limitation thereof.

#### EXAMPLE 1

A 500-ml. flask was charged with 194 g. (1.0 mole) of dimethyl terephthalate, 72 g. (0.5 mole) of 1,4-cyclohexanedimethanol (68 percent trans-isomer), 62 g. (1.0 mole) of ethylene glycol and 0.30 ml. of titanium tetraisopropoxide. The mixture was stirred under nitrogen at 200° C. for ninety minutes. During this interval, methanol was evolved and allowed to distil from the reaction mixture. At the end of this time, the temperature was raised over a fifty minute period to 280° C. A vacuum was then applied so that within five minutes the pressure was less than 1 mm. of mercury. The molten mass is stirred under vacuum at 280° C. for sixty minutes. At the end of this time, the material is cooled and removed from the flask. The copolyester product, namely, poly(ethylene/1,4-cyclohexylenedimethylene)terephthalate, 50/50 (that is, a compound containing 50 mole percent of poly(ethylene terephthalate) and 50 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate) was a clear, almost colorless resin with an inherent viscosity in 60:40 phenol:tetrachloroethane of 0.62. An analysis of the polymer demonstrated that it contained 50 mole percent of 1,4-cyclohexylenedimethanol, showing that all of this glycol enters the polymer, only the excess ethylene glycol being lost. The copolyester product in the form of pellets  $\frac{1}{8}$  inch in diameter and  $\frac{1}{8}$  inch long was mixed with similar pellets of polypropylene in such proportions that the mixture contained 15 percent by weight of the copolyester and 85 percent by weight of polypropylene. This mixture was fed to an extrusion apparatus provided with heating means and the mixture melted to form a blend which was then extruded through the orifices of a spinneret to produce polypropylene fibers which had excellent dyeability with Eastman Polyester Blue GLF. Light-, wash- and crock-fastness of these dyed fibers were excellent.

#### EXAMPLE 2

Employing the same general procedure of Example 1 a copolyester was prepared from a mixture of 11,640 grams (30 moles) of dimethyl terephthalate, 2,790 grams (45 moles) of ethylene glycol, and 1,295 (9 moles) of 1,4-cyclohexanedimethanol (68 percent trans), and 30 ml. of

21 percent solution of  $Mg[HTi(OC_4H_9)_6]_2$  in n-butanol. This is fed at the rate of 15 pounds per hour into a reactor which is operated at 210° C. and 15–20 p.s.i. The product from this reactor is fed into a second reactor which is operated at 280° C. and less than 1 mm. of mercury. The final copolyester product formed had an inherent viscosity of 0.6 to 0.7 in 60:40 phenol:tetrachloroethane. This copolyester product, namely, poly(ethylene/1,4-cyclohexylenedimethylene)terephthalate, 70/30, (that is, a compound containing 70 mole percent of poly(ethylene terephthalate) and 30 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate) was added to polypropylene as in Example 1 to produce a blend containing 15 percent by weight of the copolyester product and 85 percent by weight of polypropylene. This blend was then melt spun into 12 denier per filament filaments and these were tufted into a rug. The rug was dyed by the usual procedure using Eastman polyester dyes except that no carrier was employed. The dye formulation in this case was the following: 0.11 percent Eastman Polyester Red FFBL, 1.1 percent Eastman Polyester Blue B-GL, 0.8 percent Eastman Fast Yellow 2R-GLF, 1 percent Calgon, 0.5 percent monosodium phosphate. The resulting dark green fabric was tested for crocking, light fastness and wet fastness. The light fastness test showed no fade after 40 hours in the Fade-O-meter and the crock and wash fastness results were also excellent.

#### EXAMPLE 3

The copolyester product, namely poly(ethylene/1,4-cyclohexylenedimethylene)terephthalate, 40/60 (that is, a compound containing 40 mole percent of poly(ethylene terephthalate) and 60 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate) was prepared by mixing 300 grams of poly(ethylene terephthalate) and 700 grams of poly(1,4-cyclohexylenedimethylene terephthalate), both in powder form, and extruding the mixture in an extrusion screw at 302° C. with a hold-up time of 20 minutes. The resulting copolyester had an I.V. of 0.56 in 60:40 phenol:tetrachloroethane and a flow point of 226° C.

1 a copolyester was prepared from 58.2 g. (0.3 mole) of dimethyl isophthalate, 38.8 g. (0.2 mole) of dimethyl terephthalate, and 108 g. (0.75 mole) of 1,4-cyclohexanedimethanol. The catalyst used was  $Mg[HTi(OBu)_6]_2$  in an amount equivalent to 0.015% of the metal content of the catalyst complex based on the weight of ester monomers. The polymer melt was stirred from ninety minutes in the vacuum stage at 280° C. The inherent viscosity of the copolyester obtained was 0.93.

This product was granulated to a particles size of 2 mm. or less and 15 parts by weight were tumble blended with 85 parts by weight of similarly granulated crystalline polypropylene (inherent viscosity of 1.13 as measured in Tetralin at 145° C.) The mixture was melt spun at 290° C., into fibers which were subsequently drafted 8.5 times in steam at 140° C. The drafted fibers had a denier of 138 per 50 filaments. The tenacity of the fibers was 5.67 g./den. and the elongation was 21%. The sticking temperature of the copolyester modified polypropylene fibers was 150° C. The fibers had excellent dyeability with the disperse dye, Eastman Polyester Blue GLF. The light, wash, and crock fastness of the dyed fibers were excellent. Examination of a cross section of a filament of the modified polypropylene by means of an electron microscope showed that the copolyester was well dispersed in the polypropylene. There was no tendency for the modifier to separate from the polypropylene during processing and dyeing.

#### EXAMPLE 5

Copolyesters were prepared by the ester interchange technique as described in Example 1 in which the methyl ester(s) of the dicarboxylic acid(s) were reacted with the glycol(s) and subsequently built up by melt polymerization. These copolyesters were used to blend with a crystalline polypropylene (inherent viscosity of 1.13 as measured in Tetralin at 145° C.) to prepare modified polypropylene fibers which dyed to deep shades with disperse dyes. The copolyester composition, polymerization conditions, inherent viscosity, and percent modification are listed in the following table:

COPOLYESTER

Composition		Vacuum Stage of Polymerization		Inherent Viscosity	Percent in Modified Polypropylene
Acid Component	Glycol Component	Temp. (° C.)	Time (min.)		
(1) 50 mole percent isophthalic acid +50 mole percent terephthalic acid.	1,4-cyclohexanedimethanol.....	280	90	0.88	10
(2) 70 mole percent 2,6-naphthalene dicarboxylic acid +30 mole percent isophthalic acid.	Ethylene glycol.....	275	110	0.68	12.5
(3) 80 mole percent terephthalic acid +20 mole percent adipic acid.	1,4-cyclohexane-dimethanol.....	270	60	0.71	10
(4) 90 mole percent terephthalic acid +10 mole percent isophthalic acid.	Ethylene glycol.....	275	120	0.65	15
(5) Terephthalic acid.....	80 mole percent 1,4-cyclohexane-dimethanol+20 mole percent diethylene glycol.	260	70	0.57	12.5
(6) Terephthalic acid.....	60 mole percent 2,2,4,4-tetramethyl-1,3-cyclobutanediol+40 mole percent 1,4-butanediol.	260	45	0.48	15
(7) 75 mole percent 4,4'-diphenic acid+25 mole percent terephthalic acid.	80 mole percent 1,4-butanediol+20 mole percent 2,2-dimethyl-1,3-propanediol.	250	140	0.86	10

This product was blended with polypropylene to produce a blend containing 15 percent by weight of the copolyester and 85 percent by weight of polypropylene and melt spun into fibers of 9.1 den./f. and having a tenacity of 5.5 g./den. The fibers were processed successfully into staple and dyed using normal dyeing procedures recommended for polyester fibers and dyeing procedures in which no carrier auxiliary was utilized. A full range of shades of excellent light fastness, crock fastness and wet fastness were obtained using Eastman polyester dyes.

#### EXAMPLE 4

Following the general procedure outlined in Example

#### EXAMPLE 6

A crystalline polypropylene with an inherent viscosity of 1.19, as measured in Tetralin, was modified with the following polyoxyalkylene glycol copolyesters in the proportion listed in the following table. These copolyesters were prepared according to the general method described in Example 1. The two components were blended in the form of particles or pellets 1/8 inch or less in diameter. The mixture was preextruded at 290° C., into a rod which was chopped into pellets approximately 1/8 inch in diameter. These pellet blends were then spun into fibers by melt extrusion.

## POLYOXYALKYLENE GLYCOL COPOLYESTER

Composition: Monomer Reactants'	Weight percent Polyoxyalkylene glycol in Copolyester	Copolyester Inherent Viscosity	Weight percent in modified Polypropylene
(1) Dimethyl terephthalate+ethylene glycol+Carbowax 1000.....	30	-----	15
(2) Dimethyl terephthalate+tetramethylene glycol+Carbowax 1000..	30	-----	15
(3) Dimethyl terephthalate+1,4-cyclohexanedimethanol+Dow polyglycol P-4000.....	25	0.42	12
(4) Dimethyl terephthalate+70 mole percent ethylene glycol+30 mole percent 1,4-cyclohexanedimethanol+Carbowax 600.....	20	0.45	15
(5) Dimethyl isophthalate+1,4-cyclohexanedimethanol+Pluronic L-44.....	30	0.30	10
(6) Dimethyl terephthalate+2,2,4,4-tetramethyl-1,3-cyclobutanediol+polyoxytetramethylene glycol (molecular wt. 2,700)....	45	0.87	12
(7) Dimethyl terephthalate+1,4-cyclohexanedimethanol+polyoxytetramethylene glycol (molecular wt. 2,000).....	60	1.1	10
(8) Dimethyl trans-cyclohexane-1,4-dicarboxylate+2,2-dimethyl-1,3-propanediol+Pluronic L-62.....	25	0.53	12
(9) Dimethyl 4,4'-methylenedibenzoate+1,4-cyclohexanedimethanol+Dow polyglycol B1000.....	20	0.27	15
(10) Dimethyl 4,4'-ethylenedibenzoate+ethylene glycol+Dow polystyrene glycol.....	25	0.30	15
(11) 70 mole percent Dimethyl terephthalate+30 mole percent dimethyl glutarate+1,4-cyclohexanedimethanol+Carbowax 4000....	25	0.61	15
(12) 50 mole percent Dimethyl terephthalate+50 mole percent dimethyl isophthalate+1,4-cyclohexanedimethanol+Carbowax 6000.....	20	0.58	18

Carbowax 1000 is a polyoxyethylene glycol of molecular weight 1000.

Dow polyglycol P-4000 is a polyoxypropylene glycol of molecular weight 4000.

Carbowax 600 is a polyoxyethylene glycol of molecular weight 600.

Pluronic L-44 and L-62 are polyoxy (ethylene-propylene glycol) copolymers.

Dow polyglycol B-1000 is a polyoxybutylene glycol of approximate 1000 molecular weight.

Dow polystyrene glycol is a polyoxyphenylethylene glycol.

Carbowax 1540 is a polyoxyethylene glycol of 1500 molecular weight.

Carbowax 4000 is a polyoxyethylene glycol of 4000 molecular weight.

Carbowax 6000 is a polyoxyethylene glycol of 6000 molecular weight.

The modified polypropylene fibers described in the preceding table had tenacities between 4 and 8 g. per denier. In general, elongations were between 20 and 30 percent. Knit tubes were made from these fibers and dyed with a disperse dye such as Eastman Blue GLF. Deep shades which were light-, gas-, and wash-fast were easily obtained.

## EXAMPLE 7

Crystalline polystyrene, poly-4-methyl-1-pentene, poly-1-butene, poly-3-methyl-1-butene, polyvinylcyclohexane, and polyallylbenzene were each modified with several of the copolyester compositions listed in the table of Example 6 so as to contain the concentration shown in the table. Fibers were spun from each of the modifications by melt extrusion. Skeins of the fibers were dyed with a disperse dye. In each case, deep shades were obtained. The dyed fibers had good fastness to light, gas, and washing.

It will be noted that in the above examples and description a method of blending the modifier with the polypropylene is disclosed which involves mixing pellets of each polymeric materials in the desired proportions. However, the particular method of blending is not critical to the invention and any conventional procedure which will result in thoroughly mixing the two polymers may be employed. For example, powdered or granulated modifier and powdered or granulated polypropylene may be mechanically mixed in the desired proportions and the mixture melt spun directly to produce dyeable fibers. Films or sheets may likewise be produced in this manner. In a variation of this technique, a master batch containing, for example, 50 percent by weight of finely divided polypropylene and 50 percent of the modifier (or other pro-

portions of the two polymers) may be formed by mixing in a Banbury mixer. The resulting blend is then solidified and granulated. A predetermined amount of the granulated material may then be thoroughly mixed with finely divided polypropylene in such proportions as to produce a composition containing 1-20 percent of the modifier and 99-80 percent of polypropylene and this mixture melted and melt spun into fibers or extruded to produce other shaped objects as may be desired. In operating by either of these methods the material to be blended should preferably be in a finely divided form such as powder, granules, pellets or the like. Other methods of blending the two polymers will be apparent to those skilled in the art to which this invention relates. Regardless of the method selected proportioning of the two materials will be such as to give a mix and an ultimate product which contains 1-20 percent, and preferably 5-15 percent by weight of the modifier.

The utility of our invention speaks for itself inasmuch as there is thereby provided a means of solving one of the most difficult and long standing problems in the manufacture of commercially acceptable polypropylene filaments, fibers and other products, namely, the permanent dyeing of such material with disperse and other types of dyes by the dyeing procedures commonly employed in the textile industry. Specifically our invention provides a means of obtaining deep shades in polypropylene and other poly- $\alpha$ -olefin yarns and fibers which are light fast, gas fast and wash fast. Our invention also provides a means of obtaining polypropylene fibers, filaments and yarns having improved physical properties as compared to yarns produced from unmodified polypropylene including crisp dry hand, high tenacity, good elastic modulus and other properties which render such fibers readily processible on textile machinery.

Although the invention has been described in considerable detail with particular reference to certain preferred embodiments thereof, variations and modifications can be effected within the spirit and scope of the invention as described hereinabove, and as defined in the appended claims.

We claim:

1. A dyeable polyolefin fiber and film-forming composition susceptible of permanent dyeing by disperse dyes which comprises a poly- $\alpha$ -olefin containing from 1 to about 20% by weight distributed therein as a dye receptor of a high molecular weight polymer selected from the group consisting of the copolyester of terephthalic acid, isophthalic acid, and 1,4-cyclohexanedimethanol, the copolyester of ethylene glycol, 1,4-cyclohexane-

9

dimethanol, and terephthalic acid, wherein in each said copolyester the acid component may contain a minor amount of aliphatic dicarboxylic acid.

2. The composition of claim 1 in which the polyolefin is propypropylene and the copolyester is composed of 50 mole percent of poly(ethylene terephthalate) and 50 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate).

3. The composition of claim 1 in which the polyolefin is polypropylene and the copolyester is composed of 70 mole percent of poly(ethylene terephthalate) and 30 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate).

4. The composition of claim 1 in which the polyolefin is polypropylene and the copolyester is composed of 40 mole percent of poly(ethylene terephthalate) and 60 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate).

5. The composition of claim 1 in which the polyolefin is polypropylene containing 1-20 percent by weight of a copolyester composed of 50 mole percent of poly(ethylene terephthalate) and 50 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate).

6. The composition of claim 1 in which the polyolefin is polypropylene containing 1-20 percent by weight of

10

a copolyester composed of 70 mole percent of poly(ethylene terephthalate) and 30 mole percent of poly(1,4-cyclohexylenedimethylene terephthalate).

7. A fiber of the composition of claim 2.

8. A fiber of the composition of claim 3.

9. A fiber of the composition of claim 4.

10. A fiber of the composition of claim 5.

11. A fiber of the composition of claim 6.

12. A dyeable composition comprising fiber-forming crystalline polypropylene and from 1 to 20 percent based on the weight of the polypropylene of a polyester of terephthalic acid and isophthalic acid and 1,4-cyclohexylene dimethylene glycol.

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WILLIAM H. SHORT, *Primary Examiner*.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

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John R. Caldwell et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 38, "dheld" should read -- held --. Column 5, line 21, "Blue B-GL," should read -- Blue B-GLF, --. Column 8, line 75, "anol, the copolyester" should read -- anol, and the copolyester --. Column 9, line 5, "propypropylene" should read -- polypropylene --.

Signed and sealed this 7th day of April 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents