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SYNTHETIC RESIN COMPOSITIONS

The present invention is concerned with a synthetic resin composition and, more particularly, is concerned with a synthetic resin composition comprising a hydrogenated block-copolymer of an aromatic vinyl compound and a conjugated diene compound and polyolefinic compounds which are non-toxic and superior in softness, transparency, high-temperature strength and molding characteristic.

10 Hitherto, various synthetic resin compositions for moulding have been proposed and used in practice to obtain transparent and soft moulded goods for use in the field of food packing materials, medical appliances and the like. However, these known
15 synthetic resin compositions all give rise to problems such as are described hereinafter.

Moulded goods prepared from ethylene/vinyl acetate copolymers, ethylene/acrylate copolymers, polybuta-1,2-dienes, metal salts of ethylene/acrylic acid or methacrylic acid copolymers and the like

5 have a favourable softness and transparency but give rise to problems in that their tensile strength is only 200 kg/cm^2 or less and their thermal resistance is so inadequate that they cannot retain their shape at a temperature of 100°C . or even lower

10 because of softening. Therefore, these moulded goods cannot be sterilised by heating at a high temperature. Although thermoplastic polyurethanes and thermoplastic polyesters have a superior softness, tensile strength and thermal resistance, their transparency

15 is not necessarily sufficient and, in addition, they are expensive to produce and health problems arise if unreacted monomers remain therein. Elastomers of the silicone series also are very expensive, although they have a superior softness, tensile strength and

20 thermal resistance and also have a good transparency.

Furthermore, it is known that moulded goods based on thermoplastic elastomers such as styrene/butadiene block copolymers, styrene/butadiene/styrene block copolymers, styrene/isoprene/styrene block co-

25 polymers and the like have a superior softness and transparency and have a tensile strength of 200 kg/cm^2 or more. However, they also have the disadvantage

that their thermal resistance is inadequate so that they also cannot keep their shape even at a temperature of 100°C. or below because of softening.

To improve these copolymers with regard to this problem, hydrogenated block copolymers of styrene/butadiene/styrene block copolymers or styrene/isoprene/butadiene copolymers have been proposed and recently marketed. These hydrogenated block copolymers have a superior softness, transparency and tensile strength. However, their thermal resistance is still inadequate although it is considerably better than that of the non-hydrogenated copolymers. Furthermore, they have abnormal fluid characteristics in a molten state and have inferior moulding characteristics, especially extrusion moulding characteristics. Therefore, in the field of engineering plastics, they are mainly used for the purpose of improving other resins by adding them thereto in small amounts (cf. U.S. Patent Specifications Nos. 4,081,424; 4,080,357; 4,111,896; 4,080,356; 4,090,996; 4,111,895; 4,088,627 and 4,088,626).

One exceptional example of using these hydrogenated block copolymers as the main component is a composition thereof with polypropylene and ethylene-vinyl acetate copolymer (cf. U.S. Patent Specification No. 4,140,162) which, however, has an

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inadequate softness at low temperatures and an inadequate strength at high temperatures.

Thermoplastic elastomers of the ethylene/propylene copolymer series or those based on ethylene/propylene copolymers and polypropylene are soft and their thermal resistance is relatively good. However, they have a considerably inferior transparency and tensile strength.

In contradistinction thereto, moulded goods prepared from soft polyvinyl chloride have a superior softness and transparency, have a tensile strength of the order of 200 kg/cm^2 and keep their shape even at a high temperature, such as 120°C ., while maintaining a sufficient strength. Therefore, they can be sterilised by heating to a high temperature and are widely used not only in the field of general packing industry but also for food packing, medical appliances and the like. However, soft polyvinyl chloride usually contains a large quantity of plasticiser and is hardened by the slow release of the plasticiser. Thus, there is a danger that health problems can arise by the transfer of the plasticiser to the contents in contact with packing bags, tubes or the like made of such soft polyvinyl chloride. Furthermore, there is a danger of health problems arising unless the amount of vinyl chloride monomer remaining in the moulded goods can be reduced to a minimum.

Thus, there is a need for synthetic resins for moulding purposes which have a sufficient softness, strength, thermal resistance and transparency, which do not contain any highly toxic plasticiser and monomers, such as soft polyvinyl chloride does, and which have good moulding characteristics.

It is an object of the present invention to solve the above-mentioned problems inherent in the previously known resin compositions.

10 We have found that substantially non-toxic synthetic resin compositions which have a sufficient softness, strength, thermal resistance and transparency and have good moulding characteristics can be obtained by using a hydrogenated block copolymer, 15 which has hitherto only been used in relatively small amounts for improving other resins, as the main component of the compositions, in combination with a specific resin of the polypropylene series and also with a specific ethylene/acrylate copolymer.

Thus, according to the present invention, there is provided a synthetic resin composition comprising (a) more than 30% and up to 90% by weight of a block copolymer, both terminal blocks of which comprise a polymer of an aromatic vinyl compound and the intermediate block of which comprises a polymer of the conjugated diene series, said terminal blocks constituting 10 to 40% by weight of the copolymer and being hydrogenated in a ratio of 10% or less and said intermediate block constituting 90 to 60% by weight of the copolymer and being hydrogenated in a ratio of 90% or more:

(b) more than 5% and up to 40% by weight of an isotactic polypropylene or a copolymer comprising an isotactic polypropylene as its main component and having a melting point of 150°C. or higher: and

(c) more than 5% and up to 40% by weight of an ethylene-acrylate copolymer, the acrylate content of which is 5% by weight or more.

The present invention will now be described in more detail with reference to the accompanying drawing which illustrates a triangular coordinate graph showing the composition range of the synthetic resin compositions of the present invention. In this Figure, the apices A, B and C represent single compositions (100% by weight) of the block copolymer of the present invention [constituent (a)], of the polymer of the polypropylene series [constituent (b)] and of the ethylene/acrylate copolymer [constituent (c)], respectively, and D, E, F, G and H represent the composition limits according to the present invention, i.e. D is 90% by weight of constituent (a), 5% by weight of the constituent (b) and 5% by weight of the constituent (c); E is 55% by weight, 40% by weight and 5% by weight; F is 30% by weight, 40% by weight and 30% by weight; G is 30% by weight, 30%

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by weight and 40% by weight; and H is 55% by weight, 5% by weight and 40% by weight, respectively. The compositions in the pentagon area formed by connecting D to H are included in the present invention.

5 The basis of the block copolymers used according to the present invention is a block copolymer comprising the intermediate block (90 to 60% by weight) which comprises a conjugated diene polymer and both the terminal blocks (10 to 40% by weight)
10 which comprise a polymer of an aromatic vinyl compound. The polymer of an aromatic vinyl compound which constitutes both the terminal blocks is, for example, a polymer of styrene series, such as polystyrene, poly- α -methylstyrene, poly-p-methylstyrene,
15 polychlorostyrene and the like, the most preferred being polystyrene. Those polymers of the styrene series having an average molecular weight of 5000 to 125000 can be used. The polymer of the conjugated diene series which constitutes the intermediate block
20 can be, for example, polybutadiene, polyisoprene, polychloroprene and the like, polybutadiene and polyisoprene being preferred. Those polymers of the conjugated diene series having an average molecular weight of 10000 to 30000 can be used.

25 The block copolymers used in the present invention are hydrogenated products of the above-mentioned block copolymers, which are commercially

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available and obtainable by known methods.

The term "ratio of hydrogenation" used herein means a ratio of an observed hydrogenated double bond in a theoretically hydrogenatable double bond in either the terminal block moiety or in the intermediate block moiety. It is necessary that the ratio of hydrogenation of both terminal blocks is 10% or less and the ratio of hydrogenation of the intermediate block is 90% or more.

In particular, it is preferable that the ratio of hydrogenation of the intermediate block is 95% or more. This is because, for example, in the case where the intermediate block is polybutadiene, the hydrogenation product has the constitution of an ethylene/butylene copolymer and, in the case where the intermediate block is polyisoprene, the hydrogenation product has the constitution of ethylene/propylene copolymer, i.e. the high hydrogenation ratio of the intermediate block results in an improvement in the thermal resistance and the weathering resistance of the block copolymer as a whole. In particular, it results in the superior thermal resistance (high temperature strength) of the compositions of the present invention. In the block copolymers used according to the present invention, both terminal blocks act as the hardening component and the intermediate block acts as the softening component.

If the terminal blocks were to constitute less than 10% by weight of the copolymer, the hardness and the strength of the copolymer would be insufficient. If the terminal blocks were to constitute more than 40% by weight of the copolymer, the softness would be insufficient. It is preferable that both the terminal blocks constitute 15 to 25% by weight of the copolymer.

The block copolymers which can be used according to the present invention are available under the Registered Trade Mark "KRATON". One or more of these block copolymers may be used.

As the polypropylene used according to the present invention, an isotactic polypropylene or a copolymer comprising an isotactic polypropylene and having a melting point of 150°C. or higher as the main component, which is generally used as a moulding material, may be used as it is. As the copolymer comprising isotactic polypropylene, there may be used a block or random copolymer of propylene and an α -olefin, such as ethylene, but-1-ene or the like. However, for maintaining the softness of the compositions of the present invention, a soft copolymer and especially a random copolymer is preferred. For maintaining the high temperature strength of the compositions of the present invention, it is necessary that the melting point of the isotactic polypropylene or the copolymer

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comprising it as the main component is 150°C. or higher. Although the effect of this polypropylene constituent in the compositions of the present invention resides mainly in an improvement of the high temperature strength, it is considered that the polypropylene constituent also has the effect of improving the moulding characteristics of the compositions in conjunction with the ethylene/acrylate copolymer constituent described hereinafter. With the block copolymers used according to the present invention alone, it is difficult to prepare pellets, tubes, sheets and the like by extrusion and moulded goods, such as bottles and the like, by blow moulding. However, by the incorporation of the polypropylene constituent and of the ethylene/acrylate copolymer constituent, the moulding characteristics of the compositions are significantly improved. Furthermore, it is also advantageous that the polypropylene constituent has a good compatibility with the block copolymers and polyblends can be obtained with a good transparency.

It is necessary that the ethylene/acrylate copolymer used according to the present invention has an acrylate content of 5% by weight or more. With an acrylate content of less than 5% by weight, the transparency of the compositions is reduced and the softness of the compositions becomes insufficient. As examples of the acrylate in the ethylene/acrylate copolymer

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used according to the present invention, there can be mentioned methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethylhexyl acrylate and the like, and the methacrylates corresponding thereto, the most preferred acrylate being ethyl acrylate. Although it is considered that the effect of the ethylene/acrylate constituent in the compositions of the present invention resides in an improvement of the moulding characteristics, maintenance of the low temperature softness and the like, as described above, an especial effect brought about by the incorporation of this constituent is that the transparency of polyblend systems of the block copolymer constituent is further improved. Furthermore, it is advantageous that the content of the expensive block copolymers in the compositions can be reduced by incorporating the ethylene/acrylate copolymer which has a high degree of softness. The synthetic resin compositions containing the ethylene/acrylate copolymer have a superior low temperature softness and high temperature strength, and are also more resistant to hydrolysis in comparison with similar synthetic resin compositions containing an ethylene/vinyl acetate copolymer.

Although the composition range of the main constituents of the resin compositions of the present invention is shown in the Figure of the accompanying

drawing, it is necessary that the content of the block copolymers is from 30 to 90% by weight. If it is less than 30% by weight, the softness and the transparency would be insufficient. If it is more than 90% by weight, the high temperature strength and the moulding characteristics would be insufficient. The most preferred content is from 40 to 80% by weight. With regard to the polypropylene constituent, it is necessary that the content thereof is from 5 to 40% by weight. If it is less than 5% by weight, the high temperature strength and the moulding characteristics would be insufficient. If it is more than 40% by weight, the softness and the transparency would be insufficient. A content of from 10 to 30% by weight is especially preferred. The content of the ethylene/acrylate copolymer is from 5 to 40% by weight. If it is less than 5% by weight, the moulding characteristics, the softness and the transparency would be insufficient. If it is more than 40% by weight, the high temperature strength and the transparency would be insufficient. A content of from 10 to 30% by weight is especially preferred.

Synthetic resin compositions comprising 40 to 80% by weight of the block copolymer (a), 10 to 30% by weight of the isotactic polypropylene or a copolymer comprising it as the main component (b) and 10 to 30% by weight of the ethylene/acrylate copolymer

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(c) have a good softness and transparency, a superior high temperature strength and superior moulding characteristics. Such a composition range is preferred.

5 The compositions of the present invention have an excellent softness, i.e. a Shore-hardness of 45 or less, and a good transparency, i.e. a light transmission of 70% or more. They also have an excellent high temperature strength and moulding
10 characteristics. The term "excellent high temperature strength" used herein means that a sheet made thereof keeps its shape even when it is left for 15 minutes in an oven at 125°C. and maintains such a strength that it cannot be cut off by applying a
15 load of 1.4 kg/cm² at the same temperature. The term "excellent moulding characteristics" means that injection moulding, extrusion moulding and blow moulding can be carried out with the use of conventional moulding machines.

20 While the resin compositions of the present invention satisfy the various property criteria mentioned above, they also have superior low temperature properties, such as a brittle point temperature of about -70°C., and a high strength, such as
25 a tensile strength of about 300 kg/cm². Furthermore, they do not give rise to any health problems because they do not contain any plasticiser. In addition,

they also have only a small water absorption, undergo almost no weight loss on heating and are subject to less secular change in quality.

Besides the above-mentioned essential main
5 resin constituents, the compositions of the present invention can contain, according to the intended use thereof, various plasticisers, anti-blocking agents, sealing improvers, thermo-stabilisers, anti-oxidants, ultra-violet absorbing agents, lubricants, crystal
10 nucleus agents, colouring agents and the like, in an amount which does not impair the softness, transparency, high temperature strength, moulding characteristics and safeness. When they are used for making food-packing material or medical appliances, it is
15 preferable not to incorporate additives such as plasticisers.

The compositions of the present invention may be moulded in the usual manner, i.e. the various components of the composition are first mixed in a
20 mixer, blender or the like, the mixture is further milled by hot rolling and then sheet is manufactured therefrom by pressing. Sheets, blocks, shaped articles, tubes, nets and the like may be also manufactured by extrusion moulding from pellets which
25 have been prepared by an extruding machine. Various kinds of articles, bottles and the like may also be manufactured by injection moulding or blow moulding

from the pellets. Various kinds of moulded goods prepared or manufactured from the compositions of the present invention may be subjected to a secondary processing, such as cutting, painting, adhesion, printing or the like.

Although the compositions of the present invention, which have the various characteristics mentioned above, can be used in various fields, such as the fields of general industrials, domestic goods and the like, they are exceptionally useful in the fields of food-packing materials and medical appliances where sterilisation at a high temperature is required, by virtue of their excellent high temperature strength and non-toxicity. Furthermore, the compositions of the present invention are especially suitable for manufacturing medical bags, such as blood bags, infusion bags, bags for liquor for artificial dialysis and the like, since they are safe from a health point of view and, in addition, have an excellent softness, transparency and high temperature strength and have excellent moulding characteristics.

The following Examples are given for the purpose of illustrating the present invention:

Example 1.

A blended resin composition having the following constitution was processed through two rolls to

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give a raw sheet. A sheet having a thickness of about 0.4 mm. was produced from the raw sheet by compression moulding and the physical properties thereof were determined.

5 Block copolymer:

KRATON G-1650 (Shell Chemical product)

40% by weight

KRATON G-1657 (Shell Chemical product)

20% by weight

10 Polypropylene:

A random copolymer of isotactic polypropylene and ethylene having a melting point of 165°C., this random copolymer containing about 5% of ethylene. (The same random copolymer was also used in the following Examples).

20% by weight

Ethylene/acrylate copolymer:

NVC-6220 (Nihon Unicar product)

20% by weight

20 KRATON G-1650 and KRATON G-1657 are copolymers, both terminal blocks of which are constituted by polystyrene and the intermediate hydrogenated block of which is constituted by an ethylene/butylene copolymer, the weight ratio of the former to the latter
25 being 28/72 in G-1650 and 14/86 in G-1657. NVC-6220 is an ethylene/ethyl acrylate copolymer having an ethyl acrylate content of 7% by weight.

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Physical data obtained are shown in the following. The tensile strength and the tensile elongation were determined according to JIS K6732, the light transmission (total luminance transmission) percentage and the haze according to ASTM D-1003 or JIS K6714 and the Shore-hardness according to ASTM D-1706. The high temperature strength was determined by the shape-maintenance property observed by leaving a sheet for 15 minutes in an oven at 125°C., the state of deformation being observed by applying a load of 1.4 kg/cm² to the sheet at the same temperature.

	Tensile strength:	310 kg/cm ²
	Tensile elongation:	720%
15	Light transmission percentage:	84%
	Haze:	7%
	Shore hardness:	D-34
	High temperature strength	
	Shape-keeping:	satisfactory
20	Deformation ratio:	45%

Example 2.

Various sheets were prepared according to the process as described in Example 1 but changing the composition or constitution of the resin. Physical data for the sheets were determined. The results obtained are shown in the following Table:

No.	KRATON G-1650	KRATON G-1657	PP	EEA	Tensile Strength (kg/cm ²)	Elonga- tion (%)	Light trans- mission percen- tage (%)	Haze (%)	Shore hard- ness (%)	High-temperature strength	
										Shape- keeping	Deforma- tion ratio
1	35	25	*20	EA 7% 20	300	800	84	7	32	All right	50
2	35	25	*30	10	320	500	78	12	41	"	20
3	35	25	*10	30	290	820	82	8	30	"	70
4	60	0	*10	30	310	700	81	8	38	"	48
5	40	20	**20	20	320	660	82	9	37	"	45
6	40	20	*20	EA 15% 20	300	720	85	6	31	"	55
7	20	30	*25	25	290	760	77	12	35	"	60
8	10	35	*30	25	300	660	72	16	37	"	66
9	10	35	*25	30	250	780	78	11	34	"	80
10	60	20	*10	10	300	620	83	7	33	"	62
11	60	20	*4	16	290	640	85	6	31	"	cut
12	15	30	*10	45	290	630	68	17	38	Considerably deformed	cut
13	65	30	*4	1	300	680	85	5	32	All right	cut
14	0	0	*100	0	350	280	76	11	75	"	58
15	0	0	*0	100	160	800	87	4	33	Completely softened	cut

* Random copolymer was used. ** Homopolymer was used.

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In the above Table, Nos. 1 to 10 are within the range of composition and physical data of the present invention and have satisfactory physical properties, while Nos. 11 to 15 are outside the composition range of the present invention and show unsatisfactory physical data in some regard or other.

Example 3.

A composition having the following formula was blended in a blender and then extruded in an extruder to give pellets:

- | | | |
|-----|---|--|
| (a) | KRATON G-1650 | 25% by weight |
| (b) | KRATON G-1657 | 25% by weight |
| (c) | Isotactic polypropylene random copolymer having a melting point of 165°C. | 25% by weight |
| (d) | DPDJ-6182 (Nihon Unicar product; EEA copolymer having an ethyl acrylate content of 15%) | 25% by weight |
| (e) | Stearic acid | 0.2 parts per 100 parts of the above resin |
| (f) | Synthetic rosin | 3 parts per 100 parts of the above resin |

A sheet having a thickness of about 0.4 mm. was prepared from the pellets by extrusion through a die of coat-hanger type and its properties were determined.

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5 The results are shown in the following Table. The modulus of elasticity is a value determined by means of a Vibron dynamic elasto-viscosimeter at a frequency of 110 cycles. ("VIBRON" is a Registered Trade Mark). As referential example, a sheet of soft polyvinyl chloride containing 52 parts by weight of di-2-ethyl-hexyl phthalate as plasticiser was also prepared and its physical properties were determined. The results are shown in column B of the Table.

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15 The heat-seal strength given in the Table is a value of strength against peeling, which was determined with respect to a sheet heat-sealed by a heat-seal bar with a pressure of 6 kg/cm² for 3 seconds at 200°C. (185°C. for the case B).

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	Unit	A	B
Composition		Example 3	soft polyvinyl chloride
Specific gravity		0.91	1.30
Tensile strength	kg/cm ²	310	210
Elongation	%	680	290
Modulus of elasticity { -30°C 20°C 80°C	kg/cm ²	1.2 x 10 ³	1.2 x 10 ⁴
		7.0 x 10 ²	6.6 x 10 ²
		2.2 x 10 ²	4.0 x 10 ¹
Light transmission percentage	%	83	90
Haze	%	6	3
Shore hardness	D	31	28
High-temperature { strength Shape-keeping Deformation ratio	%	excellent	excellent
		25	76
Weight loss on heating	80°C x 6 hrs., %	0.0	1.0
Water permeability	room temperature, 12 days, %	0.6	2.1
Heat-seal strength	kg/25 m/m	9.8	9.2

A bag made of the sheet A and a bag made of the sheet B were filled with distilled water and sterilised at 121°C. for 1 hour in a steam steriliser. Immediately after being taken out, both bags were not
5 destroyed. Although they were whitened to a certain extent, the bag made of A had recovered within a relatively short time.

Sheet A was also tested according to the Japanese Pharmacopoeia, 10th revision, general exam-
10 ination method 42; examination method for plastic containers for infusion. The results obtained are shown in the following Table. The results were very good.

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Item of examination	Result
Heavy metal	not detected
Lead	"
Tin	"
Cadmium	"
Vinyl chloride	"
Residue on exposing to strong heat (%)	0.04
[Eluate examination]	
Properties	all right
Foaming	"
pH	0.2
Chloride	not detected
Sulfate	"
Phosphate	"
Ammonium	"
Zinc	"
Potassium permanganate- reducing substance	0.2 ml
Evaporation residue	0.1 mg
Ultra Violet absorption { 220 - 241 nm	0.05
spectrum { 241 - 350 nm	0.04

Example 4.

A composition having the following formula was blended in a blender and then extruded in an extruder to give pellets A. For comparison, pellets were prepared by the same process, except that an ethylene/vinyl acetate copolymer with a vinyl acetate content of 15% was used instead of DPDJ-6182. The pellets were called B.

	(a) KRATON G-1650	30% by weight
10	(b) KRATON G-1657	30% by weight
	(c) Polypropylene random copolymer	
	having a melting point of 165°C.	20% by weight
	(d) DPDJ-6182	20% by weight
	(e) Stearic acid	0.2 parts per 100
15		parts of the above
		resin

Sheets having a thickness of about 0.35 mm. were produced from the pellets A and B by extrusion through a die of coat-hanger type and their properties were determined. The results obtained are shown in the following Table.

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	Unit	A	B
Surface condition of extruded sheet		excellent gloss slightly rough	good gloss considerably rough surface
Specific gravity		0.91	0.91
Tensile strength	kg/cm ²	320	280
Elongation	%	740	760
Modulus of elasticity { -30°C 20°C 80°C		1.0 x 10 ³	2.8 x 10 ³
		6.6 x 10 ²	6.8 x 10 ²
		2.0 x 10 ²	1.4 x 10 ²
Light transmission percentage	%	85	81
Haze	%	5	7
Shore hardness	D	30	32
High-temperature strength		excellent	excellent
Deformation ratio	%	32	125
Weight loss on heating	80°C x 6 hrs., %	0.0	0.0
Water permeability	room temp., 12 days, %	0.5	0.8
Oxygen permeability		530	810
Heat-seal strength	kg/25mm	9.6	9.7
Destruction ratio after steam sterilization	*	0/5	2/5

25A

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* 2/5 means that two bags among five were destroyed. Both A and B were whitened to some degree, just after being taken out after steam sterilization. However, A recovered within a shorter time as compared with B.

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As is apparent from the above, A(EEA) is superior to B(EVA) in various respects. Particularly with regard to the surface condition of sheet, low temperature softness, high temperature strength, transparency, water-resisting property, oxygen permeability and the like, A shows a significant superiority to B. The excellent low temperature softness provides the advantage that bags for disposable medical fluids are hardly affected even upon transportation or subjection to cold and medical fluids may be easily poured into the bags at atmospheric pressure. The low oxygen permeability prevents degeneration by oxidation of the contents of bags, such as medical fluids containing amino acids, and the low water permeability prevents degeneration by moisture dispersion of the contents of the bags.

Example 5.

A composition having the following formula was blended in a blender and then extruded in an extruder to give pellets:

- | | | |
|-----|----------------------------------|--------------------|
| (a) | KRATON G-1657 | 40% by weight |
| (b) | Polypropylene random copolymer | |
| | having a melting point of 165°C. | 30% by weight |
| (c) | DPDJ-6182 | 30% by weight |
| (d) | Stearic acid | 0.2 parts per 100 |
| | | parts of the above |
| | | resin |

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A sheet having a thickness of about 0.4 mm. was produced from the pellets by extrusion through a die of the coat-hanger type and its properties were determined. The results are given in the following.

- 5 The sheet had excellent properties except that its percentage light transmission was slightly inferior.
- | | |
|------------------------------------|--------------------------|
| Tensile strength | : 290 kg/cm ² |
| Tensile elongation | : 660% |
| Holophotal transmission percentage | : 80% |
| 10 Haze | : 10% |
| Shore hardness | : D-21 |
| High temperature strength | |
| Shape maintenance | : satisfactory |
| Deformation ratio | : 52% |

- 15 A tube having an outer diameter of 4 mm. and an inner diameter of 2 mm. was also produced from the pellets. The tube was soft, had sufficient transparency and gloss and was scarcely bent or folded.

20 Example 6.

A composition having the following formula was blended in a blender and then extruded in an extruder to give pellets:

- | | | |
|--------|----------------------------------|---------------|
| (a) | KRATON G-1652 | 30% by weight |
| 25 (b) | KRATON G-1657 | 22% by weight |
| (c) | Polypropylene random copolymer | |
| | having a melting point of 165°C. | 25% by weight |

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- (d) PE 2205 (Gulf Oil Chemical
product; ethylene/methyl acrylate
copolymer) 23% by weight
- (e) Stearic acid 0.2 parts per 100
5 parts of the above
resin

Although KRATON G-1652 has a composition
similar to that of KRATON G-1650, its molecular weight
is low and its fluidity is good.

- 10 A sheet having a thickness of about 0.4 mm. was
produced from the pellets and its properties were
determined. The results are shown in the following:

Tensile strength	: 310 kg/cm ²
Tensile elongation	: 740%
15 Holophotal transmission percentage	: 83%
Haze	: 7%
Shore hardness	: D-31
High temperature strength	
Shape maintenance	: satisfactory
20 Deformation ratio	: 38%

- A tube having an outer diameter of 8 mm. and
an inner diameter of 6 mm. was also produced from the
pellets. The tube had a good softness, transparency
and surface gloss and was also satisfactory in other
25 respects.



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CLAIMS

1. A synthetic resin composition comprising
(a) more than 30% and up to 90% by weight of a block
copolymer, both terminal blocks of which comprise a
5 polymer of an aromatic vinyl compound and the inter-
mediate block of which comprises a polymer of the
conjugated diene series, said terminal blocks
constituting 10 to 40% by weight of the copolymer and
being hydrogenated in a ratio of 10% or less and said
10 intermediate block constituting 90 to 60% by weight of
the copolymer and being hydrogenated in a ratio of 90%
or more:
(b) more than 5% and up to 40% by weight of an isotactic
polypropylene or a copolymer comprising an isotactic
15 polypropylene as its main component and having a melting
point of 150°C. or higher, and
(c) more than 5% and up to 40% by weight of an ethylene-
acrylate copolymer, the acrylate content of which is 5%
by weight or more.
- 20 2. A synthetic resin composition according to claim 1,
wherein the content of component (a) is 40 to 80% by
weight, the content of component (b) is 10 to 30% by
weight and the content of component (c) is 10 to 30%
by weight.
- 25 3. A synthetic resin composition according to claim
1 or 2, wherein the component (a) is a hydrogenated
product of a block copolymer, both terminal blocks of
which are polystyrene, poly - α - methylstyrene,

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poly-p-methylstyrene or polychlorostyrene and the intermediate block of which is polybutadiene, polyisoprene or polychloroprene.

4. A synthetic resin composition according to claim 3, wherein the terminal blocks are polystyrene and the intermediate block is polybutadiene.
5. A synthetic resin composition according to any of the preceding claims, wherein the copolymer comprising the isotactic polypropylene is an isotactic random copolymer of propylene-ethylene or butene.
6. A synthetic resin composition according to any of the preceding claims, wherein the ethylene-acrylate copolymer is a copolymer of ethylene with methyl acrylate, ethyl acrylate, butyl acrylate or 2-ethylhexyl acrylate.
7. Synthetic resin compositions according to any of the preceding claims, substantially as hereinbefore described and exemplified.
8. Packing materials for medical appliances and food, whenever produced from a synthetic resin composition according to any of claims 1 to 7.
9. Medical bags, including blood bags, infusion bags and bags for liquors for artificial dialysis, whenever produced from a synthetic resin composition according to any of claims 1 to 7.