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(54) Title: ARTICLES FORMED OF MULTILAYERED FILM HAVING ANTIFOG PROPERTIES

(57) Abstract

Thermoplastic multilayer film for use as greenhouse film and perishable fruits and vegetable product bags comprising a first layer of nylon and at least a second layer comprising a polyolefin. The nylon layer has a surface innermost of the greenhouse when the film is positioned on the greenhouse, and innermost of the bag. The film in these utilities provides advantageous extended anti-fog properties.

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ARTICLES FORMED OF MULTILAYERED FILM HAVING ANTIFOG PROPERTIES

Field of the Invention

This invention relates to multilayered, polyolefin films having an outer layer of nylon and particularly to multilayered polyethylene films having an outer layer of nylon. The films are of use in greenhouse coverings and modified atmosphere packaging having improved anti-fog properties.

Background of the Invention

A greenhouse by its very nature is required to be closed during cold periods to contain the heat to create its growing environment. At high humidity inside the greenhouse, water condenses on the inside of the greenhouse roof or cover when the temperature of the roof or cover is reduced to the dew point or lower.

One characteristic of a thermoplastic greenhouse film in a humid greenhouse environment is that the water condensate forms on the surface of the film as fine droplets. This condition is known as "fogging" and creates two basis problems for the grower. First, the transmission of sunlight, an essential requirement for plant growth, is reduced. Second, the fine droplets coalesce to form larger droplets which fall onto and may damage the crop below. The damage to the crop may be to the extent that the market value based on crop quality is reduced, and in the case of a speciality crop such as flowers, the damage can render the crop unmarketable.

One way to overcome the above problem of fogging is to spray the surface of the film exposed in the greenhouse environment with a substance which when dry forms a coating which increases the surface tension of the film surface so as to reduce the interfacial tension between the surface and water condensate. The result is that the water vapour condensate wets the film with a clear sheet of water. The

water then runs continually down the curvature of the film, instead of the water droplets "raining" down upon the crop below. The enhanced transmission of light increases the crop growth while preventing crop damage.

However, one problem encountered with the aforementioned spraying of the greenhouse film is that the sprayed substance may itself be harmful to the crop. Although reasonable steps are generally taken to protect the crop during the spraying operation, even with the most careful of application techniques some crop damage is inevitably experienced.

In addition, because the coating substance is sprayed as a solution and the mixing process is generally critical and requires the use of distilled water and/or pH balance control, care by growers must be taken. Further, for successful application the film must be dry, and sunlight to dry the coating is necessary. The grower must not only take great care but must also await the proper weather and time of day to apply the solution.

It can thus be seen that an anti-fog system that does not require the labour intensive spraying of "in-house" film offers an advantage to growers.

Another method used to overcome the anti-fogging problem involves the incorporation of surfactants into the plastics matrix by the manufacturers of the greenhouse film wherein the surfactant "blooms" to the inner surface of the greenhouse covering, i.e., there is a slow release of the surfactant to the film surface over time. In use, the surfactant is absorbed at the film surface into the water condensate and effects a reduction in water surface tension. This causes the water to sheet and prevent the formation of droplets. Unfortunately, the efficiency of the anti-fog properties of the film drops off over time.

Thus, there is a need for a film having an extended effective greenhouse, antifog property lifetime over that given by commercially available greenhouse films.

For related reasons there is also a need for an improved film when used as known in the art as "Modified Atmosphere Packaging". Such packaging is made of a thermoplastic material in the form of sachets, bags, sacks and the like for containing food products such as meat, vegetables and fresh fruits.

While modified atmosphere packaging includes vacuum packaging, such as for sliced meat portions, a major outlet at the retail level is for fresh vegetable salad

mix bags and fresh vegetable portion packs. The bags or packs generally have apertures to allow for air and carbon dioxide permeance or transmission, by having specified hole sizes or porosity.

One of the drawbacks of clear film packaging for the above use is that the film of the bag 'fogs-up' in a cool storage area such as in a cooled retail display shelf or the like in a retail outlet such as a supermarket. This fogging hinders the desired good visibility of the food contents. As in the case of some greenhouse film formulations mentioned hereinabove, surfactants have been incorporated into the thermoplastic matrix to reduce the fogging. Although anti-fogging long life requirements of food packaging is not necessary, as in the case of greenhouse film, release of surfactant to the surface or skin of the food is not desirable. Accordingly, there is a need for an improved anti-fog film and, particularly, for such a film that does not release chemicals to contaminate foods.

Summary of the Invention

It is an object of the present invention to provide a greenhouse having a roof covering of a film having anti-fog properties of extended effectiveness.

It is a further object of the invention to provide modified atmosphere packaging for fresh food produce formed of a surfactant-free anti-fog film.

These and other objects of the present invention will be seen from a reading of this specification as a whole.

Accordingly, the invention provides in one aspect an improved greenhouse assembly comprising in combination greenhouse cover support means and a multilayered thermoplastic film supported by said cover support means, said film having a first layer innermost of the assembly and at least a second layer, the improvement comprising said first layer is a nylon and said second layer comprises a polyolefin.

By the term "nylon" as used in this specification is meant melt-processable thermoplastic polyamides whose chain structure features repeating amide groups, such as, for example, amorphous nylon, nylon-6,6 (polyhexamethylene

adipamide), nylons-6,9, -6,10 and -6,12, nylon 6 (polycapromide), nylon 11, nylon 12, polymers, copolymers and blends thereof.

It is known that nylons absorb moisture from their immediate environment to eventually reach a level that is in equilibrium with the relative humidity of the atmosphere. It is known also that moisture has a plasticizing effect on nylons that increases flexibility and impact resistance.

It will be apparent that in one aspect the invention resides in the discovery that a nylon layer providing the innermost surface of the roof covering of a greenhouse provides satisfactory anti-fog characteristics over an unexpected beneficial period of time. Thus, the nature of the second and, optionally, other layers of the multilayer film of use in the practice of the invention may be suitably selected by the skilled artisan based on the usual desired properties such as weight, ease of manufacture, durability, resistance to sunlight, and the like. It will be, thus, clear that the choice of olefinic material of such subordinate layers is not crucial to this invention and resides within the skill in the art.

Preferably, the subordinate layer is formed of at least one polyolefin.

By the term "polyolefin" as used in this specification and claims is meant the polyethylene, polypropylene and polybutadiene family of olefine polymers and copolymers. As examples, high density, low density and linear low density polyethylenes and 1,2 - polybutadienes may be mentioned. The term "polyethylene" includes ethylene homopolymers, and copolymers of, such as vinyl acetate, acrylic acid, methyl metanylate, butene, n-hexene, 4-methyl-1-pentene and octene polymers with ethylene and blends thereof.

The multilayered film of use in the practice of the invention may comprise (a) a plurality of distinct layers constituted as a plurality of distinct plies, (b) a laminate comprising at least two distinct films or plies adhered to each other, directly, or by means of an adhesive, (c) a co-extruded film produced by the self-adhesion of two or more films to each other under hot process conditions or (d) a co-oriented film, laminate or ply made by the cold drawing of a plurality of thermoplastic films, simultaneously in such close contact together that under the drawing step at the drawing temperature the films become intimately associated and unified into a single resultant film or ply while each undivided film is being uni-axially oriented.

The coextruded film of use in the invention may comprise two or more layers provided that a nylon layer comprises one outer layer. In the case of a typical three layer coextrusion film the layers are nylon, a tie layer, and a polyolefinic plastic material. The tie layer provides the bond strength between the nylon and the polyolefin layers. By use of additives in the polyolefin layer, it is also possible in the alternative to bond the polyolefin to nylon without the use of a special tie layer. Coextrusion of films may be accomplished by the blown tubular film method or the sheet method, both of which are commonly used in industry.

The tie layer may comprise those polymers well-known to industry for bonding olefinic plastic materials and nylon, for example, Primacor™ from Dow Chemicals, Plexar™ from Quantum Chemicals, Surlyn™ from DuPont and Attane™ from Dow Chemical.

The layers of nylon, tie and polyolefin may be, preferably, further stabilized for multiyear service life in a greenhouse environment. Stabilization additives, include, for example, antioxidants, UV stabilizers, UV absorbers and chelating agents in the quantities required for their specific application.

In addition, the coextruded film may contain additives to give light diffusion, alteration of sunlight spectrum, infra-red energy conservation, and barrier properties.

Preferably, the film comprises a nylon having a melting point (Tg) of between 130°C, prefereable 200-230°C.

The nylon layer after equilibration with water in a humid atmosphere to become so-called "wetted", preferably, has a surface tension of greater than 65 dynes/cm and, more preferably, between 70-75 dynes/cm.

A typical multilayered film of use in the invention is a coextrusion of:

Nylon layer	EMS grade XE 3303	1 mil
Tie layer	Primacor™	1 mil
Olefinic layer	LLDPE	2.5 mil

The multilayered films as described aforesaid may be readily made by aforesaid processes known in the art, preferably by blown film extrusion. Film widths range,

typically, from 1m to 15m. 3- and 5-layered coextruded films of a nylon outer layer with layers of LDPE, LLDPE or EVA copolymer blends are most preferred.

The multilayered film is installed and laid to cover the covering supports of a greenhouse structure as is conventional in the art, but with the nylon surface on the inside of the greenhouse. The humidity within the greenhouse condenses on the nylon surface to form a clear sheet of condensate. Freshly installed film takes less than 24 hours to equilibrate with the humid greenhouse atmosphere and become wetted.

The antifog action of the nylon film is very long lasting as to be deemed almost permanent in its antifogging effect, since there are no surfactants or sprayed coatings to be bleached away.

Packaging comprising film of use in the present invention manufactured in the form of sheets, rolls, bags, sachets and the like may also be made by conventional processes known in the art. The packaging is, generally, provided to the food processor for the packing of the vegetable, fruit or meat produce carried out conventionally by hand or machine. The packaged produce may be then, optionally, cooled or refrigerated prior to distribution to retailers.

Accordingly, in a further aspect the invention provides a packaged perishable foodstuff comprising in combination a packaging article as hereinbefore defined containing the foodstuff.

Brief Description of the Drawing

In order that the invention may be better understood preferred embodiments will now be described by way of example only with reference to the accompanying Examples and drawings wherein:

Fig. 1 represents a perspective view of an unrolled, unfolded film positioned on a greenhouse according to the invention; and

Fig. 2 represents a perspective view of a package containing a foodstuff according to the invention.

Detailed Description of Preferred Embodiments of the Invention

Accelerated antifog tests simulating multiyear commercial usage have shown that embodiments of multilayered nylon films of use in the practice of the present invention performed both satisfactorily and continuously long after a commercially available antifog greenhouse film had become "fogged".

Example 1

Accelerated Test for Simulated Longevity of Antifog Performance

Specimens of transparent nylon films (EMS - American Grilon Inc, Sumter, S.C. U.S.A) (304 mm X 600 mm) were arranged to form a plastic inclined roof of a tent-like humidity box enclosing a water bath maintained at 60°C to provide a humid atmosphere at a temperature of about 38°C. The outer layer of the film was exposed to the atmosphere at an ambient temperature of about 22°C. The specimen films were mounted in an inclined position such that condensate continually ran down the length of the inner surface of the specimen films and washed their surfaces. The specimens were observed by visible inspection for an assessment to be made of the longevity of the anti-fogging characteristics.

RESULTS

Sample	Grade	Composition	Length of Antifog Performance (Months)
original	CB62BSE	CoPA 6/6.9	5
Folie 2	blend	75% F34/25% CR9	11+
Folie 3	blend	85% F34/15% CP62BS	11+
Folie 4	blend	85% F34/15% XE3222	11+
Folie 5	XE 3314	MedVis PA6, = Nucleated F34	11+
Folie 6	XE 3398	XE 3222 + amorph CoPA (G21)	11+
Folie 7	FE 4122	PA6 + amorphous CoPA	11+
additional	XE 3303	CoPA 6.6/6.10	11+
93-46	blend	85% CF62BSE + 15% G21	1.5

AT Plastics Dura[R] Film - a commercial antifog greenhouse film has a 1½ months length of antifog performance.

The results show that currently marketed commercial grades of filmable nylon performed well in showing satisfactory antifog properties for up to the lifetime of the test, i.e. 11 months, in contrast to the control commercial greenhouse film's result of 1½ months.

The effect of moisture on nylon is also beneficial, when the nylon is used in articles of the invention, e.g. greenhouse or packaging film by making the nylon layer less brittle. A dry and "wetted" five-layered sample comparison for the sample comprising FE 4122 is given below, as Y:

Y.	Layer			
		1.	Blend LDPE/LLDPE	(100 μm)
		2.	Tie	(5 μm)
		3.	FE4122	(20 μm)
		4.	Tie	(5 μm)
		5.	FE4122	(20 μm)

Physical Properties		Units	Dry as is	Wetted
Elmendorf tear,	MD	N	1.74	3.74
	TD	N	10.6	9.98
Tensile properties MD:				
Yield strength		MPa	20.0	15.9
Break strength		MPa	33.0	32.4
Elongation		%	326	362
Tensile properties TD:				
Yield strength		MPa	20.8	16.6
Break strength		MPa	24.7	17.7
Elongation		%	307	263
Moisture loss, 48h		%		1.2
Light Transmission		%	91.7	91.7

With reference now to Fig. 1, wherein a greenhouse assembly shown generally as 10, has a plurality of roof support members 12 and side support members 14 to which is held a covering film 16. Film 16 is selected from the five-layered films of the following construction:

1.	Order of Material	LDPE + LLDPE	HV	85% F3A + 15% XE3222	HV	85% F3A + 15% XE3222
	Thickness	100 μ	5μ	20μ	5μ	20μ
2.	Order of Material	LDPE + LLDEP	HV	XE 3398	HV	XE 3398
	Thickness	100 μ	5μ	20μ	5μ	20μ
3.	Order of Material	LDPE + LLDPE	HV	FE4122	HV	FE 4122
	Thickness	100 μ	5μ	20μ	5μ	20μ
4.	Order of Material	LDEP + LLDPE	HV	XE 3314	HV	XE 3314
	Thickness	100 μ	5μ	20μ	5μ	20μ

wherein HV is a tie layer of ethylene/vinyl acetate copolymer. These films are made on a commercial five-layer co-extrusion line.

Fig. 2 shows generally as 20 a thermoplastic packaging article containing a perishable foodstuff, such as a fruit or vegetable (not shown) formed of the five-layered film 22 described hereinbefore under sample Y. Bag 20 has a plurality of breath holes 24 and contains a plurality of apples 26.

The nylon thermoplastic elastomers have the following properties:

Grilon XE3303 (Nylon 6,6/6,10):

PROPERTIES	TEST METHOD	UNITS	VALUES
General			
Melting Point	DSC	°F/°C	392/200
Specific Gravity	ASTM D792	—	1.09
Melt Flow Index (275°C/10 kg)	DIN 53735	ml/10 min. dry	60
24 hour H_2O Absorption	ASTM D570	%	1.16

Film Properties (measured on a 50 μm film sample)				
O_2 permeability				
73°F(23°C)/50% RH	DIN 53380		$cm^3/m^2 \cdot d \cdot bar$	55
73°F(23°C)/100% RH				75
CO_2 permeability				
73°F(23°C)/50% RH	DIN 53380		$cm^3/m^2 \cdot d \cdot bar$	185
N_2 permeability				
73°F(23°C)/50% RH	DIN 53380		$cm^3/m^2 \cdot d \cdot bar$	12
Water Vapor				
Permeability	DIN 53122		$g/m^2 \cdot d$	14
900 Cycle Gelbo				
Flex Tester	EMS		holes/m^2	190
Puncture Work	DIN 53373		Nm (cond.)	0.5
Shrinkage	EMS		%	30
Gloss (60°)	DIN 67530			120

Mechanical Properties			Dry-As -Molded	Conditioned
Tensile Strength	ASTM D638	psi (MPa)	9,000(62)	3,600 (25)
Elongation @ Yield	ASTM D638		%	525
Elongation @ Break	ASTM D638	%	100	300
Flexural Strength	ASTM D790	psi (MPa)	12,000	3,000(21)
Flexural Modulus	ASTM D790	psi (MPa)	266,000	60,000(414)
Hardness	Shore D	D-Scale	78	68
Izod Impact Strength	ASTM D256	ft-lb/in(J/m)	1.01(59)	

Grilon XE3222 (Nylon 6/6.9):

PROPERTIES	TEST METHOD	UNITS	VALUES
General			
Melting Point	DSC	°F/°C	396/202
Specific Gravity	ASTM D792	—	1.11
Melt Flow Index (275°C/10 kg)	DIN 53735	ml/10 min. dry	140
24 hour H_2O Absorption	ASTM D570	%	2.20

Film Properties (measured on a 50 μm film sample)			
O_2 permeability			
73°F(23°C)/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	35
73°F(23°C)/100% RH			100
CO_2 permeability			
73°F(23°C)/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	70
N_2 permeability			

73°F(23°C)/50% RH	DIN 53380		$cm^3/m^2 \cdot d \cdot bar$	14
Water Vapor Permeability	DIN 53122		$g/m^2 \cdot d$	20
900 Cycle Gelbo Flex Tester	EMS		holes/m^2	400
Puncture Work	DIN 53373		Nm (cond.)	2.5
Shrinkage	EMS		%	25
Gloss (60°)	DIN 67530			100

Mechanical Properties			Dry-As-Molded	Conditioned
Tensile Strength	ASTM D638	psi (MPa)	9,400(65)	4,100 (28)
Elongation @ Yield	ASTM D638		%	1025
Elongation @ Break	ASTM D638	%	270	300
Flexural Strength	ASTM D790	psi (MPa)	13,100 (90)	3,000(21)
Flexural Modulus	ASTM D790	psi (MPa)	304,000 (2098)	65,000(449)
Hardness	Shore D	D-Scale	76	69
Izod Impact Strength	ASTM D256	ft-lb/in(J/m)	.08(43)	N.B.

Grilon G21 (Amphous nylon copolymer):

PROPERTIES	TEST METHOD	UNITS	VALUES
General			
Glass Transition Temp	DSC	°F/°C	257/125
Specific Gravity	ASTM D792	---	1.18
Moisture Absorption 24 hour immersion	ASTM D570	%	1.29
Melt Flow Index (275°C/10 kg)	DIN 53735	ml/10 min.(dry)	90
Refractive Index	DIN 53491	---	1.58
Light Transmission	ASTM D1003		% 91
Heat Deflection Temperature			
66 psi (455 kpa)	ASTM D648	°F/°C	244/118
264 psi (1820 kPa)	ASTM D648	°F/°C	223/106
Mechanical			
Tensile Strength	ASTM D638	psi (MPa)	10,400(72)
Elongation @ Break	ASTM D638		% 15
Flexural Strength	ASTM D790	psi (MPa)	17,200(119)
Flexural Modulus	ASTM D790	psi (MPa)	416,000 (2870)
Izod Impact Strength Notched	ASTM D256	ft-lb/in (J/m)	1.0 (53)
Hardness	Shore	D-Scale	80

Film Properties (measured on a 50 micron film sample)			
O_2 permeability			
73°F(23°C)/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	30
73°F(23°C)/100% RH			8
CO_2 permeability			
73°F(23°C)/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	75
N_2 permeability			
73°F(23°C)/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	10
Water Vapor			
Permeability	DIN 53122	$g/m^2 \cdot d$	7
Gloss (60°)	DIN 67530		140

Grilon F34 Natural 6368 (Nylon 6):

PROPERTIES	TEST METHOD	UNITS	VALUES
General			
Melting Point	DSC	°F/°C	430/220
Specific Gravity	ASTM D792	---	1.14
Moisture Absorption	ASTM D570	%	
24 hr. immersion			230
In Air 73°F(23°C)/50% RH			2-3
In Water 73°F/23°C			≈10
Film Properties			
O_2 permeability	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	
23°C/0% RH			25
23°C/85% RH			100
CO_2 permeability			
23°C/0% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	65
N_2 permeability			
23°C/0% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	10
Water Vapor			
Permeability	DIN 53122	$g/m^2 \cdot d$	20
Gloss (60°)	DIN 67530		100

			Dry-As -Molded	Conditioned
Mechanical				
Tensile Strength	ASTM D638	psi (MPa)	10,600(73)	5,500(38)
Elongation at Yield			5	20
Elongation at Break	ASTM D638	%	265	315
Flexural Strength	ASTM D790	psi (MPa)	16,000(110)	4,500(31)
Flexural Modulus	ASTM D790	10^4psi (MPa)	35(2400)	8(560)

Izod Impact Strength Notched	ASTM D256	ft-lb/in (J/m)	1.9 (1.01)	N.B.
Charpy Impact Strength Notched 73°F/34°C	ASTM D256	ft-lb/in^2 (kJ/m^2)	11(5)	42(20)
-40°F/°C			4(2)	11(5)
Hardness	Shore	D-Scale	80	78

Grilon CF62BSE (Nylon 6/6.9):

PROPERTIES	TEST METHOD	UNITS	VALUES
General			
Melting Point	DSC	°F/°C	273/134
Specific Gravity	ASTM D792	---	1.09
Melt Flow Index (190°C/10 kg)	DIN 53735	ml/10 min. dry	40
24 hour H_2O Absorption	ASTM D570	%	2.53
Film Properties (measured on a 50 μm film sample)			
O_2 permeability	DIN 53380	cm^3/m^2·d·bar	
73°F(23°C)/50% RH			45
73°F(23°C)/100% RH			200
CO_2 permeability 73°F(23°C)/50% RH	DIN 53380	cm^3/m^2·d·bar	125
N_2 permeability 73°F(23°C)/50% RH	DIN 53380	cm^3/m^2·d·bar	10
Water Vapor Permeability	DIN 53122	g/m^2 ·d	20
900 Cycle Gelbo Flex Tester	EMS	holes/m^2	600
Puncture Work	DIN 53373	Nm (cond.)	2
Shrinkage	EMS	%	40
Gloss (60°)	DIN 67530		120

Mechanical Properties			Dry-As -Molded	Conditioned
Tensile Strength	ASTM D638	psi (MPa)	5,900(41)	3,700(26)
Elongation @ Yield	ASTM D638		%	1020
Elongation @ Break	ASTM D638	%	>250	330
Flexural Strength	ASTM D790	psi (MPa)	2,500(17)	2,000(14)
Flexural Modulus	ASTM D790	psi (MPa)	120,000 (828)	75,000(520)
Hardness	Shore	D-Scale	72	59
Izod Impact Strength	ASTM D526	ft-lb/in (J/m)	N.B.	N.B.

Grilon CR9 (Nylon 6/12):

PROPERTY	METHOD	UNIT	VALUE
General			
Melt Point	DSC	°C	200
		°F	392
Specific Gravity	ASTM D792	—	1.10
Melt Flow Index (275°C/10 kg)	DIN 53735	ml/10 min. dry	200
24 hour H_2O Absorption	ASTM D570	%	2.5
Film Properties (measured on a 50 μm film sample)			
O_2 permeability	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	
23°C/50% RH			55
23°C/100% RH			100
CO_2 permeability 23°C/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	170
N_2 permeability 23°C/50% RH	DIN 53380	$cm^3/m^2 \cdot d \cdot bar$	13
Water Vapor Permeability	DIN 53122	$g/m^2 \cdot d$	15
900 Cycle Gelbo Flex Tester	EMS	$holes/m^2$	800
Puncture Work	DIN 53373	Nm cond.	3
Shrinkage	EMS		30
Gloss (60°)	DIN 67530		140
Mechanical			
Tensile Strength @ Yield	ASTM D638	psi	5,800
Tensile Strength @ Break	ASTM D638	psi	7,100
Elongation @ Yield	ASTM D638	%	20
Elongation @ Break	ASTM D638	%	>300*
Flexural Strength	ASTM D790	psi	11,000
Flexural Modulus	ASTM D790	psi	240,000
Hardness	Shore D	—	80
Izod Impact Strength	ASTM D526	ft lb./in.	1.9

While certain preferred embodiments of the invention have been illustrated and described for purposes of the present disclosure, numerous changes in the arrangement and construction of elements thereof may be made by those skilled in the art which changes are encompassed within the scope and spirit of the present invention as defined by the appended claims.

CLAIMS

1. An improved greenhouse assembly comprising in combination greenhouse cover support means and a multilayered thermoplastic film supported by said cover support means, said film having a first layer innermost of the assembly and at least a second layer, the improvement comprising said first layer is a nylon and said second layer comprises a polyolefin.

2. An assembly as claimed in claim 1 wherein said nylon has a surface tension greater than 65 dynes/cm.

3. An assembly as claimed in claim 2 wherein said nylon has a surface tension of between 70-75 dynes/cm.

4. An assembly as claimed in claim 1 wherein said nylon is selected from nylon-6,6; nylon-6, nylon-6,9 and nylon-6,10.

5. An assembly as claimed in claim 1 wherein said polyolefin is a polyethylene polymer, EVA copolymer, or 1,2-polybutadiene, or blends thereof.

6. An assembly as claimed in claim 5 wherein said polyethylene is selected from LDPE, LLDPE and HDPE.

7. A greenhouse film of such dimension as to cover a greenhouse wherein said film is as defined in any one of claims 1 - 6.

8. A produce bag, package, sachet and the like formed of a thermoplastic multilayered film having a first layer innermost of the bag operably in contact with said produce and at least a second layer, the improvement comprising said first layer is a nylon and said second layer comprises a polyolefin.

9. A produce bag as claimed in claim 8 wherein said nylon has a surface tension greater than 65 dynes/cm.

10. A produce bag as claimed in claim 9 wherein said nylon has a surface tension of between 70-75 dynes/cm.

11. A produce bag as claimed in claim 8 wherein said nylon is selected from nylon-6,6; nylon-6, nylon-6,9 and nylon-6,10.

12. A produce bag as claimed in claim 8 wherein said polyolefin is a polyethylene polymer, EVA copolymer or 1,2-polybutadiene or blends thereof.

13. A produce bag as claimed in claim 12 wherein said polyethylene is selected from LDPE, LLDPE and HDPE.

14. A produce bag as claimed in any one of claims 8 - 13 further comprising said produce contained within said bag.

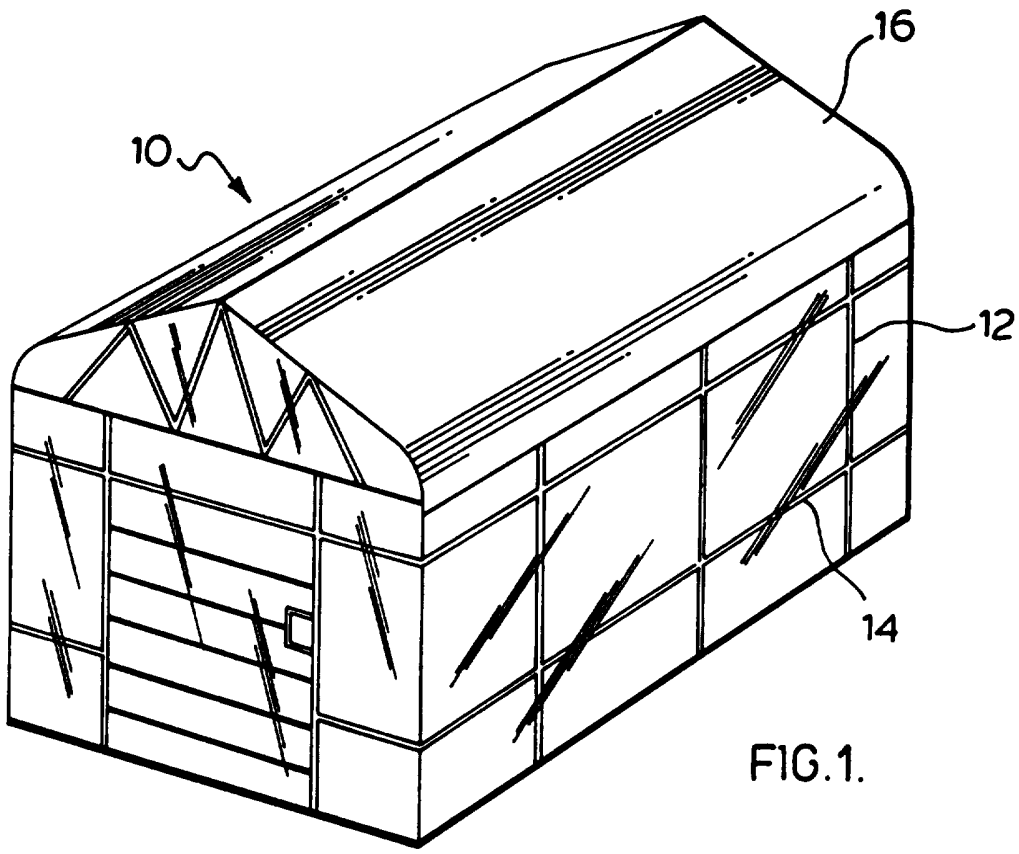

FIG.1.

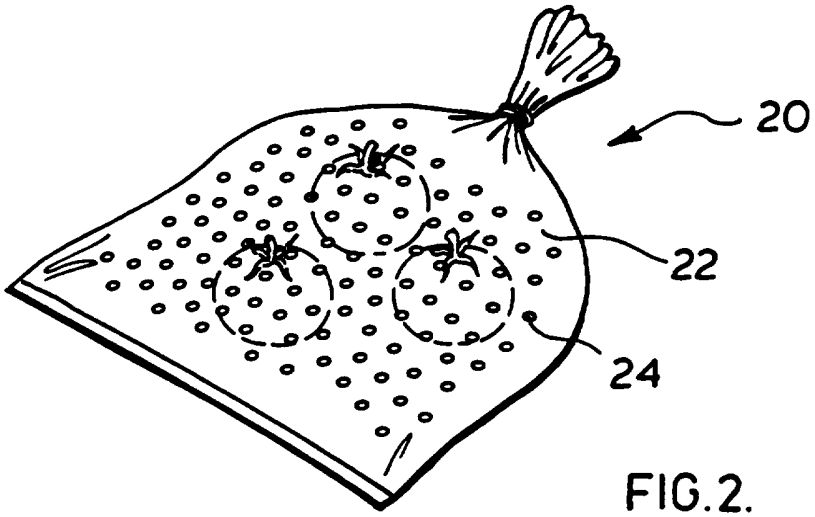

FIG.2.

INTERNATIONAL SEARCH REPORT

Intern al Application No
PCT/CA 95/00564

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B32B27/34 A01G9/14 B65D30/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B32B A01G B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE WPI Section Ch, Week 8906 Derwent Publications Ltd., London, GB; Class A94, AN 89-044741 & JP,A,63 319 148 (NIPPON SYNTH CHEM IND) , 27 December 1988 see abstract	1,5
A	US,A,5 316 825 (NAKAI TAKEYUKI ET AL) 31 May 1994 see column 2, line 47 - line 59 see column 4, line 29 - line 36	1

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 December 1995	22.12.1995

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	McConnell, C

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	EP,A,0 514 548 (SHOWA DENKO KK) 25 November 1992 see claims 1,5 see page 7, line 52 - line 53	8,11,12, 14
X	EP,A,0 603 678 (WOLFF WALSRODE AG) 29 June 1994 see claims 1,2	8,11,12, 14
A	DATABASE WPI Section Ch, Week 8945 Derwent Publications Ltd., London, GB; Class A23, AN 89-328763 & JP,A,01 244 847 (TOYOBO KK) , 29 September 1989 see abstract	8,9
A	PATENT ABSTRACTS OF JAPAN vol. 018 no. 611 (M-1708) ,21 November 1994 & JP,A,06 234196 (MITSUBISHI PETROCHEM CO LTD) 23 August 1994, see abstract	8,12
A	US,A,4 233 367 (TICKNOR WILLIAM G ET AL) 11 November 1980	
A	EP,A,0 518 348 (CONSTAB POLYMER CHEMIE GMBH &) 16 December 1992	

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Intern al Application No
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EP-A-0514548	25-11-92	JP-A-	4176645	24-06-92
		JP-A-	4185431	02-07-92
		AU-B-	642299	14-10-93
		AU-B-	8433991	11-06-92
		WO-A-	9208612	29-05-92
EP-A-0603678	29-06-94	DE-A-	4243800	30-06-94
		JP-A-	6226932	16-08-94
US-A-4233367	11-11-80	NONE		
EP-A-0518348	16-12-92	NONE		