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(54) Benævnelse: **ANVENDELSE AF SMELTEKLÆBEMIDDEL TIL SAMLING AF BEHOLDERE OG FLASKER TIL DRIKKEVARER ELLER FØDEVARER I HYLDEKLARE PAKKER AF FORSKELLIGE GENSTANDE**

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DESCRIPTION

1) Field of the invention

[0001] Hot-melt adhesives are widely used for various commercial and industrial applications such as product assembly and packaging. Such hot-melt adhesives are applied to a substrate while in its molten state and cooled to harden the adhesive layer.

2) Background of the invention

[0002] Traditionally the formation of multiple containers for beverages or food to form a pack of various items (in the following abbreviated in "multipack") has only been possible by the employment of a shrink sleeve film, cardboard outer wrap or a mechanical locking / holding arrangement.

[0003] There are inherent problems with the shrink sleeve multipack arrangement in that the individual containers are difficult to remove. Often sharp tools are used to open the secondary packaging with the result that without purpose the product containers are damaged. The cardboard overwrap can also be problematic as the construction can be unstable, particularly with heavier shaped containers.

[0004] Both methods (shrink sleeve and cardboard) or other secondary packaging involve the use of packaging materials in addition to the beverage or food container, leading to higher levels of packaging waste.

[0005] Current commercial hot-melt adhesive formulations do not provide the necessary performance characteristics necessary for application.

[0006] EP 1 566 423 A1 discloses a low viscosity hot-melt adhesive composition for non-wovens.

[0007] EP 1 241 239 A1 discloses an UV-resistant hot melt pressure sensitive additive.

[0008] EP 0 798 358 A1 discloses a styrene-isoprene-styrene-based labeling pressure sensitive adhesive.

[0009] US 2008/306214 A1 discloses a hot-melt adhesive based on styrene-ethylene-ethylenepropylene-styrene copolymer.

[0010] To fulfil this function, the adhesive must display a very high level of cohesive strength, heat resistance and provide good levels of adhesion to the container in transit and storage in a

wide variety of ambient conditions. But when the multipack reaches the consumer, the individual containers have to be relatively easy to be separated allowing individual consumption of the contents of the containers.

[0011] The adhesive mixture herein mentioned has been carefully designed and constructed to provide sufficient durability and adhesion to hold the containers together until the consumer desires separation. The adhesive mixture has to have sufficient adhesion to the substrates to hold the containers together in a broad range of ambient conditions, including high and low temperatures, high and low humidity and environments with high UV exposure. The adhesive mixture must also have sufficient flexibility to allow expansion in the adhesive joint as the container expands and contracts during its exposure to the different prevailing environmental conditions.

[0012] The adhesive must be able to be applied easily in a high speed automated process, concurrent with a modern high speed beverage or food filling or processing line / machine.

3) Detailed description of the invention

[0013] All documents cited herein are incorporated in their entireties by reference.

[0014] The object to be solved by the present invention is to provide adhesive mixtures for adhering containers, such as PET-bottles, cans or glass bottles having sufficient durability and adhesion to hold the container together until the consumer desires separation.

[0015] The adhesive mixture has to have sufficient adhesion to the substrates to hold the containers together in a broad range of ambient conditions, including high and low temperatures high and low humidity and environments with high UV exposure. The adhesive mixture must also have sufficient flexibility to allow expansion in the adhesive joint as the container expands and contracts during its exposure to the different prevailing environmental conditions.

[0016] Further, a hot-melt adhesive mixture for use in the temporary bonding, attachment and collation of multiple containers for beverages or food to form a pack of various items in an automated application process, without the use of secondary / external packaging, overcoming drawbacks of the prior art shall be provided.

[0017] The purpose of this invention is to provide the multipack arrangement but greatly reducing the amount of packaging material used in the formation.

[0018] The above object is achieved in accordance with the subject-matter of claim 1.

[0019] Preferably, the hot-melt adhesive compound is obtainable from the inventive hot-melt adhesive mixture.

[0020] More preferably, the hot-melt adhesive compound is obtainable by blending.

[0021] Most preferably, the hot-melt adhesive mixture and/or the hot-melt adhesive compound have a relatively flat elastic modulus from -20°C to 50°C, extremely good heat stability, Tg of about-32°C, fogging temperature above 100°C, low volatiles content over 0,10% after two hours at 110°C or mixtures thereof.

[0022] The inventive hot-melt adhesive mixture and/or the inventive hot-melt adhesive compound having a high level of cohesive strength, heat resistance, good adhesion to the preferably beverage and/or food containers in transit and storage in a wide variety of ambient conditions. At the same time, when the multipack reaches the consumers the hot-melt adhesive specific properties enables the consumers to separate easily the containers allowing individual consumption of the contents of the containers.

[0023] Surprisingly it was found that the mixtures and compounds described herein have the advantage of greatly reducing the amount of packaging in a multipack construction while providing a stable multipack which is easily separated by the consumer.

[0024] Described herein is a hot-melt adhesive mixture to adhere multiple containers for beverages or food to form a pack of various items in an automated application process, without the use of secondary/ external packaging comprising of:

(a) Polymer component in the range of 7-48% of the composition by weight comprising of a singular polymer or blend of polymers based on Styrenic block co-polymers, Ethylene Butyl Acrylate / Vinyl Acetate, catalysed Elastomers.

(b) Tackifying component in the range of 15-52% comprising of thermoplastic adhesive resins either a singular component or a blend of aliphatic, cycloaliphatic and aromatic hydrocarbons and modified hydrocarbons and hydrogenated versions; terpenes and modified terpenes and hydrogenated versions; and rosins and rosin derivatives and hydrogenated versions.

(c) A plasticizer component in the range of 5-25% comprising of Paraffinic or napthenic oils, Polybutene or dibasic esters and/or Polyols.

d) A stabilizer component in the range of 0.02 - 1.2% comprising of Steric hindered phenolic antioxidant and Hindered amine light stabilizer.

[0025] The resulting compound from the blending of the above mentioned parts a, b, c, and d together, results to form a hot-melt adhesive compound having the following physical characteristics: a density of between 0.790 - 1.2 g/cm3 a melt flow index of 15 - 4000 g/min (@200°C). A Brookfield viscosity @160°C between 200 and 10,000 cPs. The shore hardness of the mixture will be in the range of 15 and 70A at 23°C according to ASTM D2240. The compound will also have a softening point determined by ASTM E28 above 40°C and not

greater than 158°C.

[0026] The hot-melt adhesive preferably provides a relatively flat elastic modulus from -20°C to 50°C, extremely good heat stability, Tg of about -32°C, fogging temperature above 100°C, and low volatiles content over 0,10% after two hours at 110°C.

[0027] The adhesive provides a high level of cohesive strength, heat resistance and good adhesion to the (beverage or food) containers in transit and storage in a wide variety of ambient conditions. At the same time, when the multipack reaches the consumers the hot-melt adhesive specific properties enables the consumers to separate easily the containers allowing individual consumption of the contents of the containers.

[0028] Described herein is a mixture of:

1. (a) polymers comprising of a blend of styrenic block co-polymers including Styrene Ethylene Styrene, Styrene Ethylene Propylene, Styrene isoprene Styrene, Styrene Butylene Styrene, Ethylene Butyl Acrylate/ Vinyl Acetate.
2. (b) tackifying components comprising of adhesive resins namely aliphatic, cycloaliphatic and aromatic hydrocarbons and modified hydrocarbons and hydrogenated versions; terpenes and modified terpenes and hydrogenated versions; rosins and rosin derivatives and hydrogenated versions; and mixtures thereof. These tackifying resins have a ring and ball softening point from 70 °C to 150 °C, and will typically have a viscosity at 350 °F (177 °C) as measured using a Brookfield viscometer, of no more than 2000 cPs (20 grams/cm second).
3. (c) A plasticizer component comprising of Paraffinic or napthenic oils, Polybutene or dibasic esters and/or Polyols.
4. (d) A stabilizer component comprising of Steric hindered phenolic antioxidant and Hindered amine light stabilizer. By common knowledge this mixture is referred to as a hotmelt adhesive.

[0029] Due to the nature of the application each named component may be comprised of a singular component or a blend of components in order to achieve the desired properties. The ratio of each particular component are as follows:

1. (a) polymer segment 7-48% by weight,
2. (b) tackifying component 15- 52% by weight,
3. (c) Plasticizer component 5-25% by weight,
4. (d) Stabilizer component 0.02 % - 1.2 % by weight.

[0030] The homogenous mixture of these components will have a density of between 0.790 - 1.2 g/cm^3 a melt flow index of 15 - 4000 g/min (@160°C). A brookfield viscosity @160°C

between 200 and 10,000 cPs. The shore hardness of the mixture will be in the range of 15 and 70A at 23°C.

[0031] The adhesive blend can be made in a heated mixing vessel of the planetary type, z blade or ribbon type. Heat must be applied to the walls of the vessel evenly to avoid thermal degradation during processing. Processing temperature is in the 100 - 160°C range. A vacuum should be applied during the blending process to avoid the incorporation of air. The mixture can also be prepared using a single screw or twin screw extruder with a heated barrel using moderate shear rates.

[0032] The unique properties of the adhesive mixture described herein are provided by the specific interaction between the specific components herein mentioned.

[0033] Described herein is a mixture of: (a) polymers comprising of a blend of A-B-A Hydrogenated Styrene / butadiene co-polymers, a commercially known example of this product is the Kraton G series of polymers; (b) tackifying component consisting of a blend of Polydicyclopentadiene (PDCPD) polymer resin, formed through opening metathesis polymerisation (ROMP) which have a ring and ball softening point from 70 to 150°C, and will typically have a viscosity of 350°F (177°C) as measured using a Brookfield viscosimeter, of no more then 3000 centipoise (20 grams / cm second), a commercially known example of this product is Escorez 5000 series, (c) a plasticizer component comprising of paraffinic oils, a commercially available example of this product is Primol 352; (d) a end block reinforcing component comprising of steric hindered phenolic antioxidant and hindered amine light stabilizer.

[0034] By common knowledge this mixture is referred to as a hotmelt adhesive.

[0035] The use of A-B-A hydrogenated styrene butadiene block copolymer with a hydrogenated midblock in conjunction with the PDCPD and AMS polymers provides the desired properties.

[0036] The alpha methyl styrene polymer being purely aromatic in nature only has the ability to act upon the styrene domain of the ABA block co-polymers. This effect is greatly enhanced by the fact that this range of block co-polymers has a saturated midblock when compare to a traditional SIS or SBS block co-polymer.

[0037] This has the effect of increasing the cohesive strength and heat resistance of the adhesive product without affecting the other properties of the adhesive. The PDCPD polymers act with the mid block only of the block copolymer, providing the level of tack and adhesion needed to fulfil the application.

[0038] The plasticizer selected acts upon the adhesive to increase the flexibility and reduce the viscosity to a suitable level without reducing the cohesive strength and thermal resistance of the adhesive to undesirable levels.

[0039] This invention relates to the use of a hot-melt adhesive mixture for the temporary bonding, attachment and collation of multiple containers for beverages or food to form a pack of various items in an automated application process, without the use of secondary / external packaging.

[0040] A hot-melt adhesive mixture for the joining and collation of multiple containers for beverages or food to form a pack without the use of a shrink sleeve film, cardboard or any other secondary or external packaging.

[0041] The hot-melt adhesive mixture comprises of:

1. (a) a polymer mixture, which comprises of a mixture of commercially available polymers based on Styrenic block co-polymers, and/or Ethylene vinyl acetate co-polymers.
2. (b) A tackifying component to provide adhesion comprising of aliphatic, cycloaliphatic and aromatic hydrocarbon resins, terpenes and modified terpenes and hydrogenated versions and rosin derivaties and hydrogenated versions and mixtures thereof.
3. (c) A plasticizer component comprising of Paraffinic or napthenic oils, Polybutene or dibasic esters and/or Polyols.
4. (d) A stabilizer element comprising of Steric hindered phenolic antioxidant and hindered amine light stabilizer.

[0042] The adhesive is applied directly or indirectly to the container by means of automatic jet, wheel or any other appropriate method.

[0043] The adhesive mixture has a softening point determined by ASTM E28 above 40°C and not greater than 158°C, a melt flow index of 15 - 4000 g/min (@200°C). A Brookfield viscosity @160°C between 200 and 10,000 cPs A shore hardness determined by ASTM D2240 of between 15 and 70 A.

[0044] Upon reaching the consumer the containers can be separated from each other prior to use. The adhesive on the container surface can be removed by mechanical means to aid recycling.

[0045] The formulation is containing the following substances:

	CAS number	Approximate content
2. C 5 hydrocarbon resins	64742-16-1	33 % - 42%
3. Oil	8042-47-5	16% - 21 %
4. SEBS RUBBERS	66070-58-4	34% - 41%
5. Antioxidant	6683-19-8	1%

[0046] The features disclosed in the foregoing description and/or in the claims may, both separately and in any combination thereof, be material for realizing the invention in diverse forms thereof.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

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Patentkrav

1. Anvendelse af en blanding af smelteklæbemiddel til sammenklæbning af flere beholdere til drikkevarer eller fødevarer for at fremstille en pakke af forskellige genstande i en automatiseret påføringsfremgangsmåde uden anvendelse af sekundær/ekstern emballage, hvilken blanding af smelteklæbemiddel omfatter:

(a) en polymerkomponent i intervallet 7-48 vægtdele med hensyn til den samlede vægt af blandingen der omfatter mindst en styrenblokcopolymer;

(b) en klæbende komponent i intervallet 15-52 vægtdele med hensyn til den samlede vægt af blandingen der omfatter en termoplastisk klæbende harpiks, et alifatisk carbonhydrid, et cycloalifatisk carbonhydrid, et aromatisk carbonhydrid, et modificeret carbonhydrid, hydrogenerede versioner deraf; terpener, modificeret terpen, hydrogenerede versioner; kolofonier, kolofoniumderivater deraf, hydrogenerede versioner deraf eller blandinger deraf; og

(c) en blødgøringsmiddelkomponent i intervallet 5-25 vægtdele med hensyn til den samlede vægt af blandingen der omfatter paraffiniske olier, naphtheniske olier, polybuten, dibasiske estere, polyoler eller blandinger deraf; og

d) en stabilisatorkomponent i intervallet 0,02-1,2 vægtdele med hensyn til den samlede vægt af blandingen der omfatter sterisk hindret phenolisk antioxidant og/eller hindret amin-lysstabilisator,

hvor smelteklæbemiddelforbindelsen har en densitet på mellem 0,790 - 1,2 g/cm^3, et smelteflowindeks på 15 - 4000 g/min (@200 °C), en Brookfield-viskositet ved 160 °C mellem 200 og 10.000 cPs, en Shore-hårdhed i området 15 og 70 A ved 23 °C ifølge ASTM D2240, og et blødgøringspunkt bestemt af ASTM E28 over 40 °C og ikke højere end 158 °C.