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(54) **PACKAGING FOR A PRODUCT COMPRISING AT LEAST ONE HYGROSCOPIC FLOWABLE SOLID**

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(57) **ABSTRACT**

In packaging (**1**) for a product (**3**) comprising at least one hygroscopic flowable solid, a drying wrapping (**10**) made from a moisture-impermeable material which surrounds a product bag (**2**) filled with the product (**3**) is arranged in a transport container (**4**), and in which the desiccant (**14**) is arranged on an inside (**11**) of the drying wrapping (**10**) facing the product bag (**2**). The desiccant (**14**) is arranged in at least one, preferably in a plurality of desiccant bags (**13**). The at least one desiccant bag (**13**) is covered and fixed by a moisture-permeable perforated covering (**16**) on the inside (**11**) of the drying wrapping (**10**).

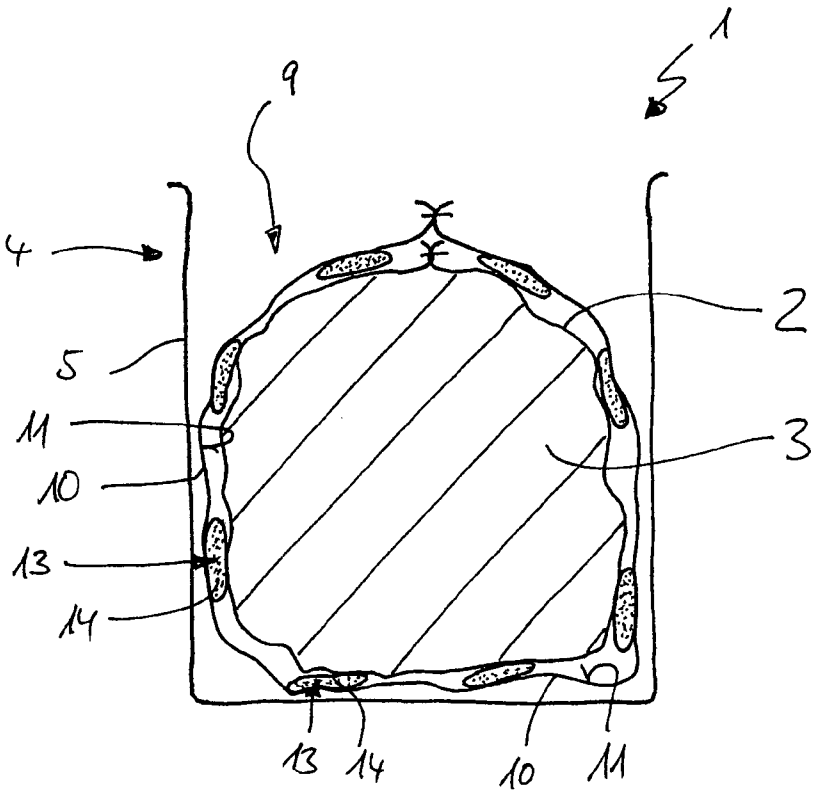


FIG. 1

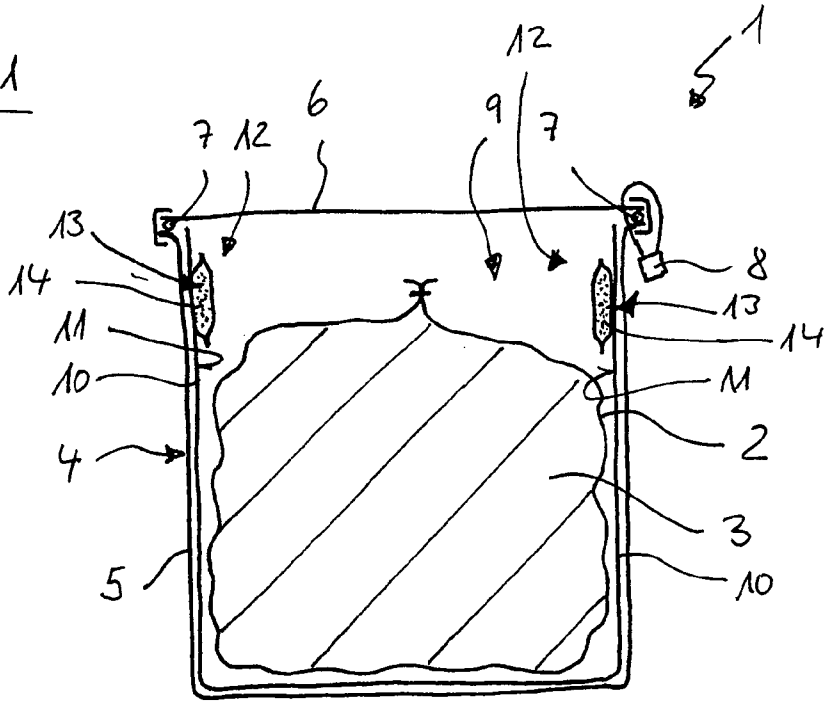

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FIG. 2

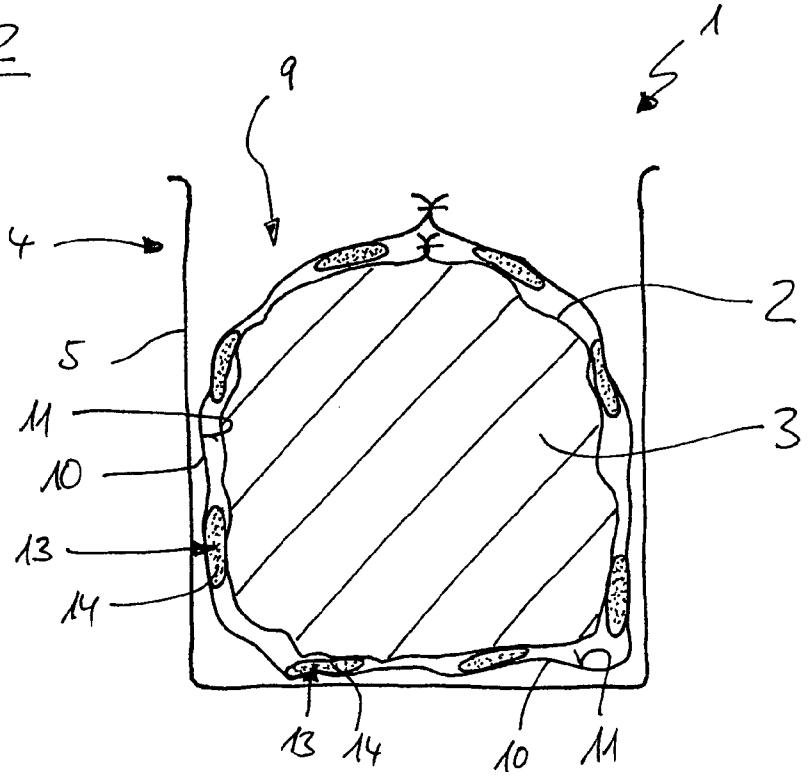
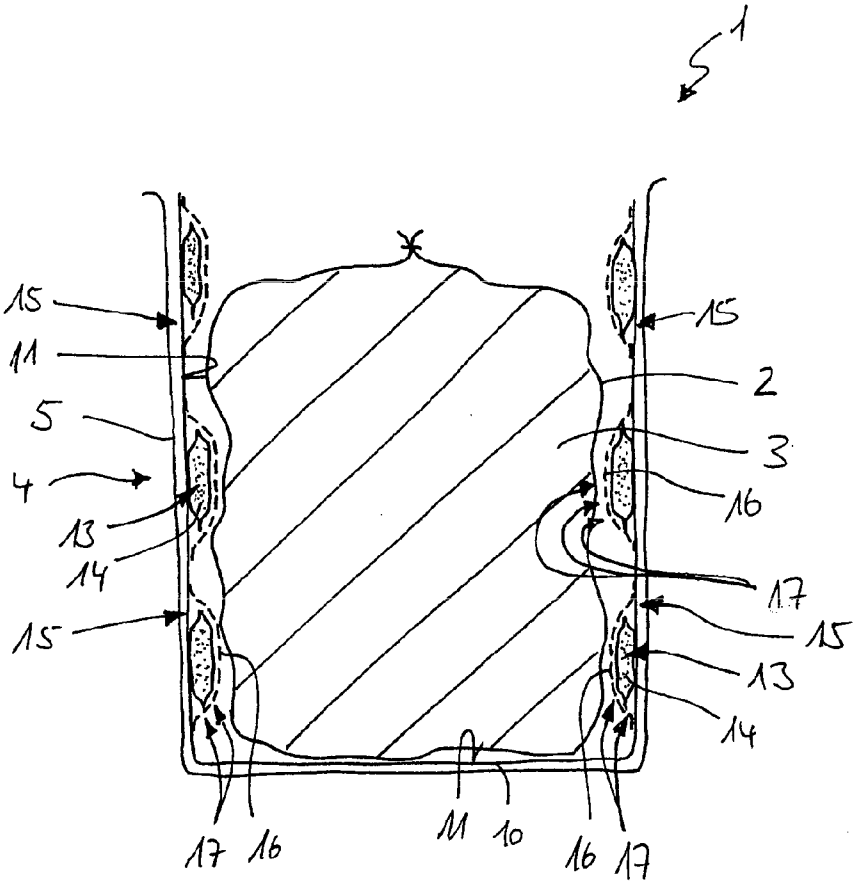

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FIG. 3



PACKAGING FOR A PRODUCT COMPRISING AT LEAST ONE HYGROSCOPIC FLOWABLE SOLID

[0001] The invention relates to packaging for a product comprising at least one hygroscopic flowable solid, where the packaging has a sealable product bag made from a moisture-permeable material for the accommodation of the product, a transport container surrounding the product bag, and a desiccant which is arranged outside the product bag and inside the transport container.

[0002] In the chemical or pharmaceutical industry, hygroscopic flowable solids, such as, for example, pulverulent substances, often have to be transported and stored before they are supplied for a use as intended. Numerous different types of packaging for this purpose are known from practice. In the case of many different types of packaging, the product or the chemical substance is introduced into a sealable product bag for protection against contamination and subsequently introduced into a transport container. The transport container can be, for example, a drum or a crate.

[0003] In the case of a product which either consists of a hygroscopic substance or comprises at least one hygroscopic component and is in pulverulent or granular or flowable form, the danger regularly exists that, due to moisture during the filling operation or subsequently during transport or storage, the product clumps due to residual moisture. If an excessive amount of moisture reaches and enters the product over an extended period, the flowability of the product may be reduced or disappear completely and the product may cake, forming one or more large lumps.

[0004] In order to reduce the risk of clumping or caking of the product during transport and storage, it is known to design the surrounding transport container to be moisture-tight and to seal it in a moisture-tight manner after filling with the product. However, it is nevertheless not possible to exclude the possibility of moisture entering the interior of the transport container during filling and in particular during successive removal of the product and consequent repeated opening and sealing of the transport container and resulting in clumping or caking of the hygroscopic product.

[0005] In order to avoid these disadvantageous effects of moisture present in the transport container, it is known from practice to arrange a desiccant in the transport container, which absorbs and stores moisture present in the transport container. The desiccant is usually arranged in a bag or in a plurality of bags. These desiccant-filled desiccant bags are placed in the transport container either before or after the product-filled product bag. WO 2003/004380 A2 describes packaging in which a plurality of bags filled with a desiccant are arranged in an interspace between the product bag and the transport container. However, it is not possible to exclude the possibility, in particular during movement and shaking of the transport container, for example due to transport, of the desiccant bags leaving their initial position and accumulating somewhere within the transport container, causing further absorption of moisture to be concentrated in the region around the desiccant bags and making absorption of moisture by the desiccant bags in regions remote therefrom more difficult.

[0006] It is known from practice that the desiccant bags are fixed in the region of a sealable opening of the product-filled product bag, for example by means of bands or loops. The effort necessary for this purpose is considerable. Although the desiccant bags can be arranged and fixed in the region of the opening of the product-filled product bag, they cannot be arranged and fixed at any desired place in the product bag or within the transport container without major effort.

[0007] It is likewise known from practice to arrange a moisture-permeable accommodation device in the transport container, in which a desiccant bag can be arranged. Transport containers which have accommodation devices of this type, for example in the form of small pockets or mesh boxes, for the accommodation of a desiccant bag are described, for example, in U.S. Pat. No. 6,102,198 and are complex and expensive to produce. The accommodation devices project into the interior of the transport containers and may under certain circumstances damage the product-filled product bag. The transport container provided with these accommodation devices must either have been intended for this purpose and produced correspondingly, or alternatively retrofitted with the accommodation devices. Besides the costs additionally arising for this purpose, it is frequently regarded as a severe disadvantage that only corresponding transport containers are suitable for the transport of hygroscopic products and these have to be kept ready in sufficient amount and separately from transport containers without accommodation devices of this type.

[0008] It is therefore regarded as an object of the present invention to design packaging for a product comprising at least one hygroscopic flowable solid component in such a way that moisture can be absorbed in the transport container inexpensively using the simplest possible means and clumping or caking of the hygroscopic product can be reduced or prevented entirely.

[0009] This object is achieved in accordance with the invention in that a drying wrapping which can be detached from the transport container and is made from a moisture-impermeable material which surrounds the product bag containing the product is arranged in the transport container, and in that the desiccant is arranged on an inside of the drying wrapping facing the product bag containing the product. Due to the use of a drying wrapping, the arrangement of the desiccant inside the transport container or in the vicinity of the product bag containing the product can be pre-specified independently of the product bag used for the accommodation of the product and independently of the transport container. Expensive and complex modifications of the transport container are not necessary. It is equally unnecessary to attach the desiccant to the product bag or in the closure region of the product bag after the product bag has been filled with the product and the product bag has subsequently been sealed.

[0010] The use of a drying wrapping which can subsequently be placed in a transport container which is already present enables the transport containers which are already present to be retrofitted and used for the transport of hygroscopic products. Since the drying wrapping can be used with various transport containers, existing distribution systems with the corresponding transport containers can be retained unchanged. The additional cost for the acquisition and use of the drying wrapping is extremely low.

[0011] The drying wrapping can be designed to be re-usable and can remain in the transport container after the product bag containing the product is removed, so that the drying wrapping continues to be available for re-use of the transport container. It is likewise possible to produce and intend the drying wrapping for a single use and to design it as a disposable product.

[0012] The use of a product bag which consists of a moisture-permeable material enhances the action of the desiccant. Should residues of moisture be present in the product bag or in the product located therein or accumulate after opening and re-sealing of the product bag, this moisture is transported through the moisture-permeable product bag into the interspace between the product bag and the surrounding drying wrapping, where it can be absorbed and bound by the desiccant.

[0013] According to an embodiment of the inventive idea, it is provided that the desiccant is arranged in at least one desiccant bag which is fixed to an inside of the drying wrapping. Desiccant bags of this type are commercially and inexpensively available in numerous variants and shapes for different desiccants. The desiccant bag can be fixed to the drying wrapping simply and reliably, for example by welding, adhesive bonding or sewing. A plurality of desiccant bags are advantageously fixed to the drying wrapping at a separation from one another in order to favour the absorption of moisture by the desiccant located in the desiccant bags and in order to prevent the desiccant from concentrating in a small region within the transport container and the moisture not being absorbed or only being absorbed to a small extent in other regions.

[0014] Particularly simple and effective fixing of the desiccant bags to the drying wrapping can be achieved in that the at least one desiccant bag is covered and fixed by a moisture-permeable covering on the inside of the drying wrapping. The moisture-permeable covering may be perforated and made from the same moisture-impermeable material as the drying wrapping. If the drying wrapping consists, for example, of a film, the desiccant bags can be arranged in pockets produced by multiple turning-over and subsequent fixing, or adhesive bonding or welding of the pockets of the drying wrapping formed in this way.

[0015] According to a particularly advantageous embodiment of the inventive idea, it is provided that the drying wrapping is matched to the shape of the transport container. The drying wrapping can be placed in the interior of the transport container and can form an inner lining of the transport container. Due to the matching of the drying wrapping to the shape of the transport container, the arrangement of the drying wrapping in the transport container or relative to the transport container can be pre-specified and the position of the desiccant bags fixed to the drying wrapping in the interior or on the walls of the transport container can thus be predetermined. Due to the drying wrapping lying against the transport container, the filling of the transport container with the product bag which is itself filled with the product does not become more difficult.

[0016] It is likewise conceivable and advantageous for individual applications for the drying wrapping to be matched to the shape of the product bag. The product-filled product bag can then be introduced into the drying wrapping, with the arrangement of the desiccant or the individual desiccant bags relative to the filled product bag being pre-specified. In this way, a highly uniform distribution of the desiccant on the product bag and thus in the immediate vicinity of the product can also be ensured for the case where the filled product bag only occupies a part-region of the transport container and its position and shape within the transport container frequently change during transport.

[0017] For many applications or products, it is already sufficient for a few desiccant bags to be arranged in the transport container. In these cases, it may be advantageous for the desiccant only to be arranged in a region of the drying wrapping facing an opening of the transport container. During filling of the transport container, an unused volume usually remains in the region of the opening of the transport container. After sealing of the transport container, air, which generally has a moisture content, is located in this volume. The arrangement of the desiccant in this region facilitates effective dehumidification of the air present in the transport container. In addition, fresh and moist air flows into the transport container each time the transport container is opened, for example for successive and gradual removal of the product. This air accumulates in the region close to the opening, where it can be effectively dehumidified.

[0018] In particular in the case where high air humidity is expected or in the case of a particularly moisture-endangered product, it may be advantageous to arrange the desiccant distributed over the entire inside of the drying wrapping. In this way, for example, a relatively large number of desiccant bags can be fixed to the drying wrapping distributed at regular or alternatively irregular separations over the inside of the drying wrapping. Irrespective of the shape of the product-filled product bag and independently of the amount of product remaining in the transport container after partial removal, it can thus be ensured that a plurality of desiccant bags are arranged at a separation from one another in the vicinity of the product bag.

[0019] In order to support dehumidification of the product located in the product bag, it is provided that the product bag is a textile nonwoven made from thermally welded high density polyethylene (HDPE) fibres. A nonwoven material of this type is already extensively employed in practice. Besides high permeability to moisture and air, the advantageous properties of a nonwoven material of this type also include high tear strength and straightforward use together with numerous hygroscopic products from the chemical industry or pharmaceutical industry.

[0020] A particularly inexpensive and at the same time effective and moisture-impermeable drying wrapping consists of a thin polyethylene wrapping or film, or comprises a thin polyethylene wrapping of this type as coating or individual layer of the drying wrapping. With a view to simple and inexpensive production, the individual desiccant bags are covered and fixed by a covering on the inside of the drying wrapping, where this covering may likewise consist of a thin polyethylene film, which is moisture-permeable owing to a perforation.

BRIEF DESCRIPTION OF FIGURES

[0021] The invention is explained in greater detail with reference to a plurality of illustrative embodiments, which are depicted in the drawing, in which:

[0022] FIG. **1** shows a sectional view of packaging with a transport container, with a drying wrapping arranged in the transport container, and with a product-filled product bag,

[0023] FIG. **2** shows a sectional view of another packaging in which the drying wrapping surrounds and lies closely against the product-filled product bag, and

[0024] FIG. **3** shows a sectional view of yet another embodiment of packaging, in which the drying wrapping lying against the transport container has a plurality of desiccant bags which are fixed laterally to the drying wrapping by a perforated covering.

[0025] Packaging **1**, depicted by way of example in FIG. **1**, has a sealable product bag **2**, which is filled with a flowable hygroscopic product **3**. The product bag **2** consists of a moisture-permeable nonwoven material made from high density polyethylene (HDPE) fibres. The hygroscopic product **3** can be, for example, a chemical substance which is required for the production of end products in the chemical or pharmaceutical industry.

[0026] The sealable product bag **2** is arranged in a transport container **4** surrounding the product bag **2**. The transport container **4** has a drum-like basic body **5**, which can be sealed by means of a lid. The transport container **4** consists of a moisture-impermeable material, for example polyethylene. The lid **6** can be arranged and fixed on the basic body **5** in a moisture-tight manner by additional sealing elements **7** in order to seal the transport container **4** in a moisture-tight manner. If it appears necessary, the sealed transport container **4** can additionally be provided with a tamper-proof seal, for example in the form of a lead seal **8**.

[0027] A drying wrapping **10** matched to the shape of the transport container **4** is arranged in an interior **9** of the transport container **4**. The drying wrapping **10** consists of a thin polyethylene film and is likewise designed to be moisture-impermeable. A plurality of desiccant bags **13** are adhesively bonded to the inside **11** of the drying wrapping **10** in a region **12** of the drying wrapping **10** facing the lid **6** of the transport container **4** on an inside **11** of the drying wrapping **10** facing the product bag **2** with the product **3** located therein. The desiccant bags **13** contain a suitable desiccant **14**, for example silica gel or zeolites, anhydrous sodium sulfate or magnesium sulfate.

[0028] Moisture present in the free interior **9** of the transport container **4** is absorbed and bound by the desiccant **14** in the desiccant bags **13**, which are arranged in this region **12** of the drying wrapping **10**. If residues of moisture are present in the product **3**, these are transported through the product bag **2** into the interior **9** of the transport container **4**, which is then dry, where they are likewise absorbed and bound by the desiccant **14**.

[0029] In the case of the illustrative embodiment depicted in FIG. **2**, the shape of the drying wrapping **10** is matched to the shape of the product bag **2**, so that the drying wrapping **10** surrounds and lies closely against the filled product bag **2**. A plurality of desiccant bags **13**, each of which contain a portion of the desiccant **14**, are attached to the inside **11** of the drying wrapping **10** at regular separations. The product bag **2** and the product **3** located therein are accordingly evenly dehumidified from all sides. The shape of the surrounding transport container **4** is unimportant in this variant of the packaging **1**.

[0030] In the case of the illustrative embodiment depicted in FIG. **3**, the shape of the drying wrapping **10** is matched to the shape of the transport container **4**, so that the drying wrapping **10** forms a lining of the side walls and base of the transport container. The drying wrapping **10** can be placed in the transport container **4** before the introduction of the product bag **2** and does not hinder the subsequent introduction of the product bag **2**, even in a state already filled with the product. The drying wrapping **10** has desiccant bags **13**, each containing a portion of the desiccant **14**, distributed over its side surfaces **15**. Each individual desiccant bag **13** is covered by a covering **16** comprising a section of a polyethylene film matched thereto, and is fixed to the side surface **15** of the drying wrapping **10**. The individual coverings **16** are each provided with a perforation **17**, so that the coverings are moisture-permeable in spite of the moisture-impermeable material polyethylene.

[0031] The present description will enable the person skilled in the art to apply the invention comprehensively. Even without further comments, it is therefore assumed that a person skilled in the art will be able to utilise the above description in the broadest scope.

[0032] For better understanding and in order to illustrate the invention, examples which fall within the scope of protection of the present invention are given in the drawings FIG. **1**, FIG. **2** and FIG. **3**. In addition, the embodiments depicted may exist in modified variants. Owing to the general validity of the inventive principle described, the examples shown in the drawings are therefore not suitable for reducing the scope of protection of the present invention to these alone.

1. Packaging (**1**) for a product (**3**) comprising at least one hygroscopic flowable solid, where the packaging (**1**) has a sealable product bag (**2**) made from a moisture-permeable material for the accommodation of the product (**3**), a transport container (**4**) surrounding the product bag (**2**), and a desiccant (**14**) which is arranged outside the product bag (**2**) and inside the transport container (**4**), characterised in that a drying wrapping (**10**) which can be detached from the transport container (**4**) and is made from a moisture-impermeable material which surrounds the product bag (**2**) containing the product (**3**) is arranged in the transport container (**4**), and in that the desiccant (**14**) is arranged on an inside (**11**) of the drying wrapping (**10**) facing the product bag (**2**).

2. Packaging (**1**) according to claim **1**, characterised in that the desiccant (**14**) is arranged in at least one desiccant bag (**13**) which is fixed to the inside (**11**) of the drying wrapping (**10**).

3. Packaging (**1**) according to claim **2**, characterised in that the at least one desiccant bag (**13**) is covered and fixed by a moisture-permeable covering (**17**) on the inside (**11**) of the drying wrapping (**10**).

4. Packaging (**1**) according to claim **3**, characterised in that the moisture-permeable covering (**17**) is perforated.

5. Packaging (**1**) according to claim **1**, characterised in that the drying wrapping (**10**) is matched to the shape of the product bag (**2**).

6. Packaging (**1**) according to claim **1**, characterised in that the drying wrapping (**10**) is matched to the shape of the transport container (**4**).

7. Packaging (**1**) according to claim **1**, characterised in that the desiccant (**14**) is only arranged in a region (**12**) of the drying wrapping (**10**) facing an opening of the transport container (**4**).

8. Packaging (**1**) according to claim **1**, characterised in that the desiccant (**14**) is arranged distributed over the inside (**11**) of the drying wrapping (**10**).

9. Packaging (**1**) according to claim **1**, characterised in that the product bag (**2**) for the accommodation of the product (**3**) is a textile nonwoven made from thermally welded high density polyethylene (HDPE) fibres.

10. Packaging (**1**) according to claim **1**, characterised in that the drying wrapping (**10**) is or comprises a thin polyethylene wrapping.

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