Title: PACKAGING FOR A SOLID

Abstract: Packaging for a solid (4), comprising an outer container (1) and an inner container (2), wherein a humidity absorbing substance (3) is located in between the outer container (1) and the inner container (2).
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Packaging for a Solid

The invention refers to a packaging for solids, in particular for chemicals that tend to harden by humidity. Powder-like chemicals or chemicals being present as a granulate are filled into commercially available containers made of metal, cardboard, paper, plastics and glass, and are transported and stored therein. The packaging protects humans from contact with hazardous materials, as well as the content from damages and from weather-related influences. Despite the fact that the chemicals are enclosed by the packaging, reactions with humidity of the air or with humidity enclosed in the product occur in the case of hygroscopic products, resulting in clotting of the product and in tendering its use more difficult.

Therefore, products sensitive to humidity, e.g. chemicals in the form of solids, are filled under an inert gas atmosphere after having been dried in the production process in the chemical industry. Despite these protection measures, clotting of chemicals resulting from humidity are often found after a certain time of storage. After a more detailed investigation, two causes for this were identified which may also occur in combination. First, it may occur that humidity in the form of gas penetrates from the outside through the packaging material into the solid. Humidity having diffused this way, forms a film of humidity on the surface of the product which in turn binds the crystals of the solid into clots. In case of completely dry solids, this reaction can be prevented by employing a packaging material that is 100% tight with respect to diffusion. A further reason for the forming of clots, however, results from residual humidity being already enclosed in the solid before packaging. After a certain time of storage, said residual humidity diffuses to the surface where it leads to the above mentioned clots. In the prior art, no packaging for solid chemicals is known, which is suitable for said purpose, easy to produce
and easy to use, in large quantities, in industry and which permits the prevention of the above mentioned clotting during expanded storage.

It is the object of the present invention to provide a packaging for solids that overcomes the shortcomings of the prior art and that prevents and/or diminishes clotting resulting from humidity being present in the solid.

This object is solved by a packaging for solids according to claim 1.

Advantageous embodiments of the inventive packaging are disclosed in the dependant claims.

According to the invention, the packaging consists of an outer, preferably gastight and lockable, container into which a further container can be inserted into wherein the solid to be packed is filled. Between the inner and the outer container, a substance absorbing humidity is positioned. Advantageously, humidity being present in the solid is absorbed by the substance absorbing humidity, and no clots can form in the solid.

Advantageously, the substance absorbing humidity is positioned between the outer and the inner container. Thereby, the inner container, together with the solid filled therein, can be taken out for further use without the necessity to remove the humidity absorbing substance first.

Preferably, the outer container is locked in a gas-tight and humidity-tight manner. This ensures that the solid is sufficiently protected against outside influences due to weather. Preferably, the outer container is made of metal, plastics or a combination of these materials, or also by including further materials such as paper, cardboard or glass or combinations thereof.
According to a further preferred embodiment, the inner container is made of a fabric. No limitations exist with respect to the materials to be used, so long as humidity is able to diffuse through said materials. Preferably, the fabric is made of polyethylene (PE), polypropylene (PP), polyester, polyamide, cotton or combinations thereof. The use of a fabric for the inner container has the advantage that humidity contained in the solid can diffuse easier our of the inner container and can be absorbed by the humidity absorbing substance. However, other suited containers are conceivable as well, which are, for example, made of metal, or a metal fabric, or glass, optionally perforated with openings for a better permeation of humidity, or that are made of natural material.

In this context, the inner container preferably is permeable with respect to humidity, such that the humidity of the solid may diffuse, at least partly, through the inner container.

According to a further embodiment, the inner container is adapted for the reception of a solid. This means that the mesh size of the tissue forming the inner container is smaller than the grain size of the solid to be received therein. Furthermore, the inner container is realized such that it can be inserted into the outer container and can be removed thereof, respectively. Depending on the use, it can be of advantage to arrange the inner container so that it is standing upright inside the outer container. For this purpose, a shelf can be inserted into the inside of the outer container in which the inner container can be inserted while maintaining a defined distance to the walls and optionally also to the bottom of the outer container. In particular in the case of an inner container manufactured from a flexible fabric, preferably a means is provided at the top edge of the outer container into which the inner container is hanged, such that the inner container can be stored in a hanging manner in the outer container.

Preferably, the outer container can be closed by a cover which can be locked by means of staining rings. The cover can also be formed as a screw cap.
Between the inner and the outer container a largely dimensioned gas-filled space exists into which a humidity absorbing substance is inserted, preferably as desiccant bags.

The number of desiccant bags depends on the residual humidity of the solid. Suited drying (=desiccant) substances preferably display a higher affinity for water than the solid, in order to absorb humidity defusing from the product. Assigning a certain drying substance for a certain solid will be preferably made according to the recommendations of the producer of the solid.

Preferably, the drying substance is selected from the following group comprising: alumina, silica gel, P₂O₅, zeolites, Mg(CO₃)₂, KOH, NaOH, CaO, CaCl₂, ZnCl₂, CuSO₄, KF. Particularly preferred, the drying substance if selected from Na₂O × Al₂O₃ × 5SiO₂ or CaO × Al₂O₃ × 5SiO₂.

Further advantages, features and embodiments of use of the present invention result from the following description with reference to the single drawing showing in perspective an embodiment of the inventive packaging.

The outer container 1 preferably is tight with respect to water, humidity and/or gas, and has the shape of a cylindrical barrel having a cover. The barrel having a cover can also be, depending on its use, of conical or of any other suited shape. The outer container 1 can be made of metal. However, composite materials in the form of metal foil combinations, e.g. constituted by an outer surface made of paper or cardboard onto which a layer of PE is deposited onto which in turn a layer of aluminum is deposited are suited as well. A further preferred design for an outer container consists of a multiple sequence of paper / PE layer combinations, wherein the PE layer forms the inner layer of the wall. In the inside of the outer container 1, an inner container 2 is inserted in which a chemical product in form of a solid 4, as a powder or as a granulate is filled. According to the invention, all
hygroscopic substances can be filled into the container. Examples are Potassium Dihydrogen Fluoride or Potassium Nitrate.

These products are sensitive to humidity or corrosion. The inner container 2 is made of an air permeable PP or PE fabric, permitting diffusion of humidity out of the solid through the material of the inner container 2. In between the outer container 1 and the inner container 2, a substance 3 absorbing humidity is installed in the shape of desiccant bags. Preferably the desiccant is produced on the basis of oxides of aluminum, silica gel, or a zeolite. As the drying substance comprises a higher water affinity than the filling product, humidity diffusing out of the inner container 2 is absorbed by the drying substance 3 and bound.

For a better handling, the inner container 2 is provided with suspension bands 5 for lifting. A user can easily remove the inner container 2 together with the solid 4 out of the outer container 1 by means of a lifting apparatus, and empty the solid over a reactor. In order to perform this operation, it is not necessary to remove the desiccant from the outer container 1.

The present invention is not limited to the embodiment described above but includes all other possible embodiments within the scope of skills of a person skilled in the art.
Claims

1. Packaging for a solid (4) comprising an outer container (1) and an inner container (2), wherein a humidity absorbing substance (3) is arranged in between the outer container (1) and the inner container (2).

2. Packaging according to claim 1, wherein the outer container (1) is locked tightly with respect to gas and humidity and is preferably made of metal, plastics of a combination thereof, or is made of a combination of metal and/or plastics with at least one more further material.

3. Packaging according to claim 2, wherein the other material is paper, cardboard, glass or a combination thereof.

4. Packaging according to one of the preceding claims, wherein the inner container is permeable with respect to humidity such that the humidity of the solid can permeate, at least partly, through the inner container.

5. Packaging according to one of the preceding claims, wherein the inner container (2) is manufactured of a fabric, preferably of polyethylene or polypropylene.

6. Packaging according to one of the preceding claims, wherein the inner container (2) is adapted for reception of a solid (4) and is being insertable into the outer container (1).

7. Packaging according to one of the preceding claims, wherein the humidity absorbing substance (3) is a substance displaying a higher water affinity than the solid (4).
8. Packaging according to claim 7, wherein the humidity absorbing substance is selected from the following group comprising: alumina, silica gel, P₂O₅, a zeolite, Mg (ClO₄)₂, KOH, NaOH, CaO, CaCl₂, ZnCl₂, CuSO₄, KF.

9. Packaging according to claim 8, wherein the humidity absorbing substance is Na₂O × Al₂O₃ × 5SiO₂ or CaO × Al₂O₃ × 5SiO₂.