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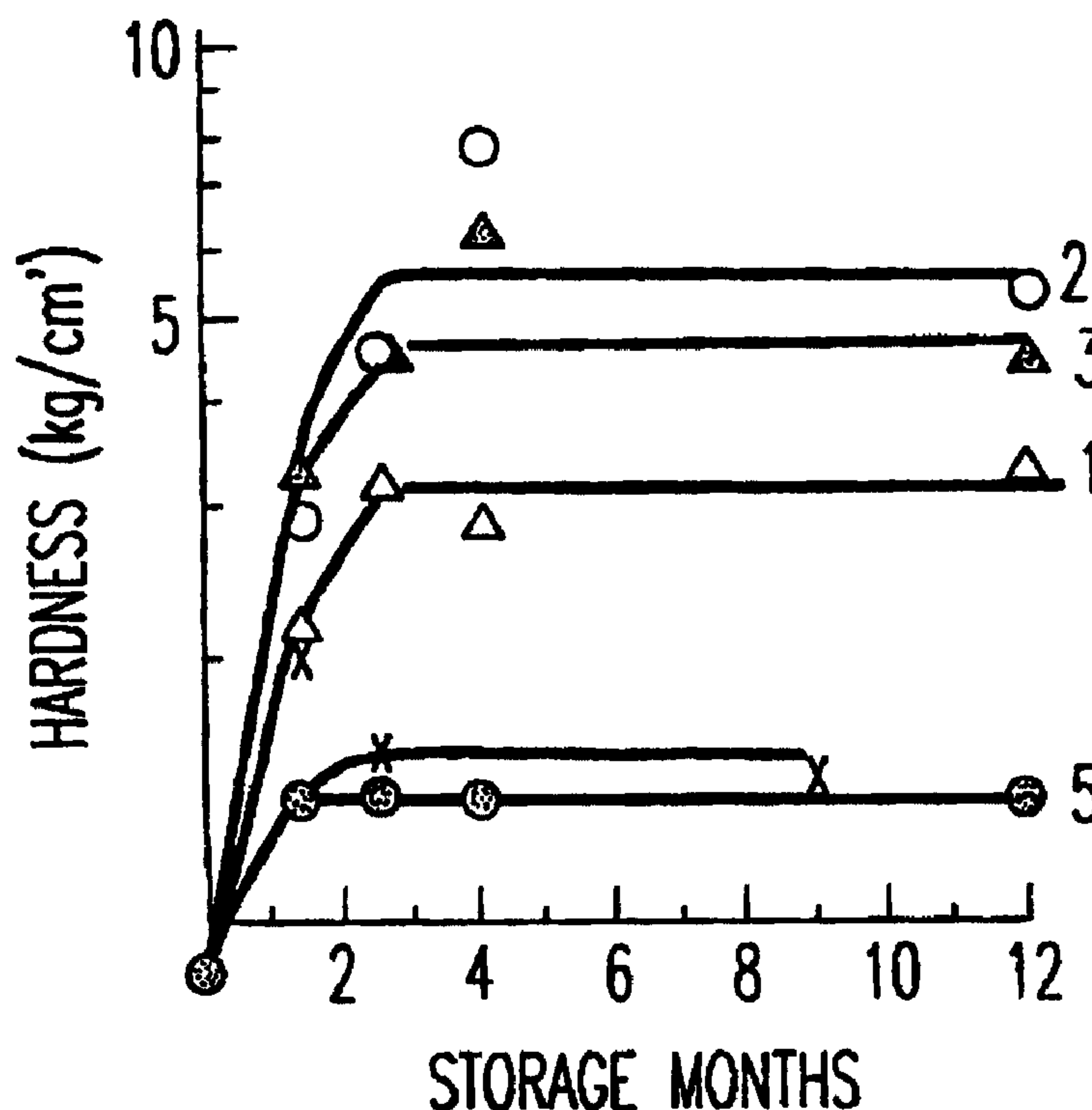
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(54) Titre : EMBALLAGE POUR LA PREVENTION DE L'AGGLOMERATION DE POUDRES ET DE GRANULES

(54) Title: A PACKAGE FOR PREVENTING CAKING OF POWDERS AND GRANULES



(57) Abrégé/Abstract:

The invention relates to a package for preventing caking of powders or granules, which comprises an inner container having a high water vapor permeability for packaging powders or granules, an outer container having no water vapor permeability or a low water vapor permeability for packing the inner container, and desiccants disposed between the inner and outer containers. The package according to the present invention enables powders and granules having caking properties to be stored for a long term of over six months, even over one year without the occurrence of caking.

ABSTRACT

The invention relates to a package for preventing caking of powders or granules, which comprises an inner container having a high water vapor permeability for packaging powders or granules, an outer container having no water vapor permeability or a low water vapor permeability for packing the inner container, and desiccants disposed between the inner and outer containers. The package according to the present invention enables powders and granules having caking properties to be stored for a long term of over six months, even over one year without the occurrence of caking.

The present invention relates to packages for preventing powders or granules from caking in the presence of water.

Among amino acids, threonine, arginine hydrochloride and lysine hydrochloride cake easily. Even when these amino acids are packed in a plastic bag for storage, in extreme cases, they may cake so that the total contents become as hard as stone. Therefore, extreme care has to be taken to prevent them from caking.

Hitherto, there has been employed a double packing bag comprising an inner bag and an outer bag both having no or extremely low water vapor permeability and desiccants such as silica gel and the like are placed between the inner and outer bags in order to completely prevent the entry of moisture into the packaged article from the outside. However, even though packed in a double bag, the total contents in the inner bag may cake and form hard lumps while in storage for long periods of time such as over one year. In some cases, the contents cake after several months storage.

As a caking inhibiting means for L-lysine hydrochloride, a process was developed for transforming L-lysine hydrochloride dihydrate into α -form crystals of anhydrous L-lysine hydrochloride at a temperature of 115°C or higher and then packaging in a bag as disclosed in Japanese KOKAI Publication No. 45145/1982. However, this process is not widely applicable as a caking preventing means, since it improves the caking property of L-lysine hydrochloride only.

In addition to amino acids, inorganic salts such as ammonium nitrate and the like have encountered similar caking problems. It has been proposed to coat the particle surface with wax or other surface covering

agents. In this process, however, lowering the purity of the products is unavoidable.

Furthermore, in order to prevent the caking of powders or granules of hygroscopic food products during the preservation, desiccants such as silica gel have been placed directly with articles in the container. However, this process has a disadvantage that the packaged articles suffer a danger of contamination with the drying agents or desiccants. Therefore, it is not suitable for the package of pharmaceuticals in bulk and of raw materials for manufacturing pharmaceuticals such as amino acids for transfusion, which require high purity.

It is therefore an object of the present invention to provide a package which prevents powders and granules from caking, without lowering the purity of the products.

In accordance with the invention, there is provided a package for preventing caking of powders or granules, which comprises an inner container having a high water vapor permeability for packaging powders or granules, an outer container having no water vapor permeability or a low water vapor permeability for packing the inner container, and desiccants disposed between the inner and outer containers.

The present invention also provides, in another aspect thereof, a method of packaging powders or granules, which comprises placing the powders or granules in an inner container having a high water vapor permeability, sealing the inner container, packing the inner container in an outer container having no water vapor permeability or a low water vapor permeability, disposing desiccants between the inner and outer containers, and sealing the outer container.

It is believed that the powders or granules packed in the prior art double package would cake during storage probably due to the following mechanism. A very small amount of water is present on the surface of the particles so that part of the surface of the particles dissolves in the water. Upon evaporation of the water, the dissolved substance precipitates and acts as adhesive agent for binding of the particles, thereby causing caking.

Furthermore, a series of experiments were made. When powders were packed in a hermetic container having no or low water vapor permeability together with desiccants and stored, no caking occurred. When all of the desiccants were removed from the bag during the storage term and the container was re-sealed and storage was continued in the absence of the desiccants, then caking occurred. In this case, Applicant has found that the relative humidity inside the inner container at that time increased in comparison with that measured when the desiccants were removed.

It is also believed that a very small amount of water is contained in the particles, which migrates to the particle surface with the passage of time to cause caking.

Although care has been hitherto taken toward preventing entry of moisture through the packaging material from the outside, it is impossible to prevent caking with the prior art packages. For preventing caking, it is necessary to remove water quickly which migrates to the particle surface from the inside with passage of time as indicated above, and forms an aqueous membrane growing to a thick layer sufficient to dissolve the surface of particles by maintaining a low humidity in the inner container.

The developement of the package according to the present invention is based on the above findings.

Caking is affected by the relationship between humidity and solubility of the packed article at the storage temperature and in addition by the contact area between the particles of powders or granules (the shape and the size of the particles). Therefore, if the packed article and the storage temperature are fixed, the upper limit of no caking humidity may be determined as follows.

Dishes filled with a saturated solution of various inorganic salts are placed in a desiccater where dry articles are placed in another dish. The relative humidity is maintained at a constant level by the effect of the saturated solutions and the caking state of articles are observed to estimate an approximate no caking humidity.

Therefore, the water vapor permeability of the inner container as well as the kind and amount of the desiccant may be selected so that the humidity in the inner container can be less then the upper limit. The water vapor permeability values indicated herein represent values measured at 40°C and 90% relative humidity (RH) difference according to JIS K 7129.

The inner container of the package according to the present invention is characterized by a high water vapor permeability and it is desirable that it is as high as possible. The lower limit of the water vapor permeability for the inner container depends on the kind of packed article and the storage conditions such as storage temperature. The water vapor permeability of the inner container may be selected so that the article packed in it does not cake during the storage time. For example, for the purpose of packing 50 kg of powders or granules in an inner bag having a total surface area of

- 2 m², the water vapor permeability of the inner bag may be 400 g/m²·24 hrs. or more, preferably 1000 g/m²·24 hrs. or more, and more preferably 1500 g/m²·24 hrs. or more. For example, in the case of
- 5 crystals of L-lysine acetate stored at room temperature, a water vapor permeability of 500 g/m²·24 hrs. or more is preferred. There is generally no upper limit of water vapor permeability in respect of the inner container.
- 10 The required water vapor permeability may be an average value for the inner container in its entirety. The inner container may be a close-fitting complex of packaging material having extremely high water vapor permeability and having no or low water vapor
- 15 permeability.
- The preferred examples of packaging materials for the inner container include non-woven fabric made of polyethylene, polypropylene, polystyrene, polyurethane, polyamide, cellulose and the like, various plastic
- 20 films or sheets (such as cellophane, nylon-12, nylon-6, nylon-6,6, polyvinyl alcohol, cellulose acetate, etc.), various perforated films or sheets having micropores, films or sheets containing inorganic salt (such as polypropylene film containing magnesium carbonate)
- 25 paper, woven fabric and the like.
- The inner container may be in the shape of various bags such as flat bags and gusset bags. It may also be a rigid container such as a box, can, drum and the like.
- 30 For preventing the entry of moisture into the package from outside, the outer container should have no water vapor permeability or a low water vapor permeability of 10 g/m²·24 hrs. or less, preferably 2 g/m²·24 hrs. or less, and more preferably
- 35 0.1 g/m²·24 hrs. or less. Examples of such packaging

materials include various plastic films or sheets such as low density polyethylene, high density polyethylene, polyvinylidene chloride, polyethylene terephthalate and polypropylene and the like. These may also be films or
5 sheets laminated silica coated ones, aluminum coated ones, alumina coated ones, and metal foils. Metals are also included.

The outer container may also be in the shape of various bags, boxes, cans, drums, etc.

10 Moreover, the inner container may be partially joined to the outer container by heat-sealing, gluing or the like to form one united package.

The desiccants for preventing caking of the powders or granules are those which are capable of
15 absorbing water contained inside the powders or granules and which evaporate gradually therefrom and pass through the inner container. Examples of suitable desiccants include silica gel, dry calcium chloride, calcium oxide, water absorbing polymers (such as sodium
20 acrylic resin, etc.) and minerals (such as sodium calcium aluminosilicate hydrated clays, etc.). A moisture permeable pouch containing such moisture absorbing agents, is the most suitable form of desiccant, but other shapes can also be used in the
25 case where there is no possibility of contaminating the packed article. Moreover, the inner packaging material itself may be one having hygroscopic property.

The type and amount of desiccant are selected so that the humidity in the inner container can be
30 maintained to no caking level. Usually silica gel or dry calcium chloride may be used in an amount of 0.5 to 5% by weight based on the amount of packed powders or granules.

The packaged articles are powders and granules
35 having the possibility of losing their free flowing

- / -

properties and caking or forming white lumps in storage by the effect of a very small amount of water in their particles. In general, they may be obtained by crystallizing out from an aqueous solution, spray
5 drying of an aqueous solution or pulverizing the dried solid.

Examples of amino acids to which the package of the present invention may be conveniently applied include threonine, arginine hydrochloride, lysine
10 hydrochloride, lysine acetate, taurine, ornithine hydrochloride, serine, glutamine, proline etc, (in anhydride, respectively) and they may be mixtures. In the case of crystalline amino acids, the caking preventing effect may be achieved by maintaining the
15 humidity in the inner container to 20% RH or less for the α -form of lysine hydrochloride, to 30% RH or less for the β -form of lysine hydrochloride, lysine acetate or arginine hydrochloride, to 40% RH or less for alanine or threonine, or to 50% RH or less for serine,
20 respectively.

The packages of the present invention may be applied to all kinds of powders and granules containing a very small amount of water, including the cases where entry of water from the environment under the packaging
25 operation causes caking.

Thus, the package according to the present invention may be widely applied to water-soluble powders or granules particularly demanding purity, other than amino acids. Examples of such products
30 include artificial or natural flavoring matters, pharmaceuticals in bulk, raw materials for manufacturing pharmaceuticals, vitamins (such as vitamin C, etc.) inorganic salts (such as sodium chloride, sodium nitrate, ammonium sulfate, etc.).

Whether or not the package of the present invention is effective for powders or granules to be packed therein can be judged by measurement of the humidity change. For this purpose, a sample immediately
5 after drying is placed in a hermetically-sealed vessel in which is set a temperature and humidity sensor and the change in humidity in the closed vessel is measured continuously. If the humidity increases with passage of time, then this shows that water has migrated to the
10 particle surface from the inside to form an aqueous membrane thereon. Therefore, the package of the present invention may be conveniently applied to articles showing such a humidity increase, since it is considered that they would cake when packed in an
15 ordinary package. Of course, the package of the present invention is also effective in the case where moisture carried from the environment during packaging operation causes a caking problem.

In the packaging process with the package of the
20 present invention, the inner and outer containers may be manufactured according to the known processes. In the case where they are in the shape of a bag, the opening part of the bag may be closed by heat-sealing, gluing or clipping with string or rubber bands, etc.
25 the opening edge of the outer container may be folded or twisted by wrapping. In the case of a box, can or drum, the opening portion thereof is generally closed with a lid. A seal tape may be applied over the junction between the lid and the container for
30 protection, if necessary. Of course, a plural number of inner containers may be packaged in an outer container.

The desiccants may be placed at the outer, upper, lower and side portions of the inner container. They may be placed at one side collectively but it is

preferable to place them all around the outside of the inner container.

In the package of the present invention, the water vapor permeability of the inner container is extremely high so that water which migrates to the particle surface from its inside with passage of time is removed by evaporation before an aqueous membrane formed on the particle surface grows into a sufficiently thick layer to dissolve a surface portion of the particle. The desiccants which are disposed between the inner and outer containers absorb the moisture permeated through the inner container at an extremely high rate in comparison with the rate of the humidity increase in the inner container by the moisture generated from the packed articles inside. As a consequence, the humidity in the inner container may be controlled at a lower level to prevent the particles from losing their free flowing properties and caking or forming lumps while in storage.

According to the present invention, even in the case of L-lysine hydrochloride which involves a conversion of crystal form, the crystal conversion and the caking can be inhibited by controlling the humidity in the inner container below 20% RH at room temperature.

The package according to the present invention enables powders and granules having caking properties to be stored for a long term of over six months, even over one year without the occurrence of caking.

The following non-limiting examples further illustrate the invention, reference being made to the accompanying drawings, in which:

Fig. 1 is a graph showing the relationship between the maximum relative humidity attained in inner bags and the hardness of L-threonine crystals stored for one

year, using various inner bags having different water vapor permeabilities;

Fig. 2 is a graph showing the relationship between the period of storage and the hardness of the L-threonine crystals, using various inner bags having different water vapor permeabilities;

Fig. 3 is a graph showing the relationship between the maximum relative humidity attained in inner bags and the hardness of the L-arginine hydrochloride crystals stored for six months, using various inner bags having different water vapor permeabilities; and

Fig. 4 is a graph showing the relationship between the maximum relative humidity attained in inner bags and the hardness of the L-lysine acetate crystals stored for six months, using various inner bags having different water vapor permeabilities.

Example 1

Fifty kg of crystals of L-threonine (a product of Ajinomoto Co., Inc. loss on drying (for 3 hours at 105°C; 0.03% by weight) were placed in each of five inner bags made of a packaging material having a different water vapor permeability, and the opening parts of the respective inner bags were clipped securely with a string.

Each of the inner bags was placed in an outer bag made of an aluminum foil laminated film PET/PE/Al/PE/L-LDPE; PE representing a polyethylene adhesive layer and Al representing aluminum foil having a very low water vapor permeability ($\leq 0.1 \text{ g/m}^2 \cdot 24 \text{ hrs.}$) and 90 μm , in total thickness and then 500 g of silica gel were inserted between the inner and outer bags. The opening part of the respective outer bags was heat-sealed and each of the outer bags was placed in a fiber drum. The fiber drum was capped and stored in an ordinary warehouse without air conditioning for a year.

The packing conditions during the storage are shown in Table 1. The relationship between the maximum relative humidity attained in the inner bags during storage and the caking extent of the contents therein after storage was investigated.

The relationship between the maximum relative humidity attained in the inner bag and the hardness of the crystals representing the caking extent is shown in Figs. 1 and 2. The hardness of the crystals was measured using a hardness meter for fruits. That is a sharp-pointed needle of 4 mm in diameter was slowly stuck vertically into the crystals and the required pressure (kg/cm²) at that time was read from the gauge.

The water vapor permeability of the packaging materials was measured at 40°C and 90% relative humidity (RH) difference according to JIS K 7129.

The crystals in Exp. Nos. 1, 2 and 3 caked so that the total contents became a hard lump, while the crystals in Exp. Nos. 4 and 5 did not cake at all and were free flowing as before storage.

Table 1

<Packing conditions>

Exp.No.	Water Vapor Permeability of Packaging Material (g/ m ² ·24 hrs.)		Ratio of Silica Gel to the Crystals (%)	Amount Packed of the Crystals (kg)
	Outer Bag	Inner Bag		
1	≤ 0.1	7	1	50
2	≤ 0.1	19	1	50
3	≤ 0.1	140	1	50
4	≤ 0.1	3100	1	50
5	≤ 0.1	—	1	50

The inner bags of Exp. Nos. 1 to 5 were made of the following packaging materials:

Exp. No. 1: Low density polyethylene film (80 μ m in thickness);

5 Exp. No. 2: Low density polyethylene film (30 μ m in thickness);

Exp. No. 3: Polyvinyl alcohol based film (65 μ m in thickness);

10 Exp. No. 4: Various perforated film (CELLPORE WN-07*; a product of Sekisui Chemical Industry Co., Ltd. (170 μ m in thickness);

Exp. No. 5: Nothing.

Example 2

15 Fifty kg of crystals of L-arginine hydrochloride (a product of Ajinomoto Co., Inc., loss on drying; 0.04% by weight) were packed in a bag under the conditions shown in Table 2 and stored for 6 months under the same conditions as in Example 1.

20 The relationship between the maximum relative humidity attained in the inner bag during storage and the caking extent of the crystals after storage was estimated.

25 The relationship between the maximum relative humidity attained and the hardness of the crystals representing the caking extent is shown in Fig. 3.

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Table 2

<Packing conditions>

Exp.No.	Water Vapor Permeability of Packaging Material (g/m ² ·24 hrs.)		Ratio of Silica Gel to the Crystals (%)	Amount Packed of the Crystals (kg)
	Outer Bag	Inner Bag		
1	2	7	0.6	50
2	2	270	0.6	50
3	2	470	0.6	50
4	2	3100	0.6	50

Outer bag: silica coated polyethylene terephthalate
(PET)/linear low density polyethylene
(L-LDPE), 85 μm in total thickness
(moisture permeability of 2 g/m²·24 hrs.)

Inner bag:

Exp. No. 1: Low density polyethylene film (80 μm in
thickness);

Exp. No. 2: Polyvinyl alcohol based film (30 μm in
thickness);

Exp. No. 3: Complex film of CELLPORE WN-07 (15% of
total area) and cast polypropylene (35% of
total area; 50 μm in thickness);

Exp. No. 4: Various perforated film CELLPORE WN-07,
170 μm in thickness).

The crystals in Exp. Nos. 1, 2 and 3 caked so that
the whole contents became a hard lump, while the
crystals in Exp. No. 4 did not cake and the whole
contents were free flowing as before storage. It is
apparent that the tendency of the crystals to cake and

form lumps while in storage may be remarkably reduced by increasing the water vapor permeability of the inner bag and controlling the maximum relative humidity attained therein at low levels.

5 Example 3

Crystals of L-lysine hydrochloride (a product of Ajinomoto Co., Inc., loss on drying; 0.15% by weight) were packed in a bag under the following conditions and stored for a year under the same conditions as in
10 Example 1.

Packing conditions:

① Inner bag having a low water vapor permeability:

Outer packaging drum: fiber drum;

Outer bag (very low water vapor permeability
15 $(\leq 0.1 \text{ g/m}^2 \cdot 24 \text{ hrs.})$): an aluminum foil laminated film (PET/PE/Al/PE/L-LDPE) 90 μm in total thickness;

Inner bag having a low water vapor permeability: Low density polyethylene film 80 μm in
20 thickness) 7 $\text{g/m}^2 \cdot 24 \text{ hrs.}$;

Amount of silica gel used: 500 g (1% based on the amount of crystals);

Amount of crystals packed: 500 kg.

② Inner bag having water vapor permeability

25 Outer packaging drum: fiber drum

Outer bag (very low water vapor permeability
 $(\leq 0.1 \text{ g/m}^2 \cdot 24 \text{ hrs.})$): an aluminum laminated film (PET/PE/Al/PE/L-LDPE) 90 μm in total thickness;

30 Inner bag having a high water vapor permeability: 3100 $\text{g/m}^2 \cdot 24 \text{ hrs.}$ Perforated film CELLPORE WN-07, 170 μm in thickness;

Amount of silica gel used: 500 g (1% based on the amount of the crystals);

35 Amount of crystals packed: 50 kg.

The relationship between the conversion of crystal form and the caking after storage is shown in Table 3.

Table 3

<Result>

	Crystal Form		Caking State After Storage for A Year	Relative Humidity in the Inner Bag After Storage for A Year
	When Started for Storage	After Storage for A year		
①Low Moisture-Permeable Inner Bag	α	β	Hard and Compacted State	39 %
②Large Moisture-Permeable Inner Bag	α	α	Free Flowing State	18 %

In the packaging where the inner bag having a high water vapor permeability was employed, conversion of the crystal form into β -form did not occur and the crystals packed therein were free flowing as before storage. In contrast, the crystals packed in the inner bag having a low water vapor permeability caked completely owing to the crystal conversion of α -form into β -form.

25 Example 4

Crystals of L-lysine acetate (a product of Ajinomoto Co., Inc., loss on drying; 0.05% by weight) were packed under the conditions shown in Table 4 and stored for 6 months while the temperature was left uncontrolled. Thereafter, the relationship between the maximum relative humidity attained in the inner bag and the caking state of the crystals after storage was examined.

Table 4

<Packing conditions>

5 Exp.No.	Water Vapor Permeability of Packaging Material (g/m ² ·24 hrs.)		Ratio of Silica Gel to the Crystals (%)	Amount Packed of the Crystals (kg)
	Outer Bag	Inner Bag		
1	2	7	1.2	50
10 2	2	470	1.2	50
3	2	1040	1.2	50
15 4	2	3100	1.2	50

Outer bag: silica coated PET/L-LDPE 85 μ m in thickness
(water vapor permeability: 2 g/m²·24 hrs.)

Inner bag:

20 Exp. No. 1: Low density polyethylene film (80 μ m in thickness);

Exp. No. 2: Complex film of CELLPORE WN-07 (15% of total area) and cast polypropylene (85% of total area; 50 μ m in thickness);

25 Exp. No. 3: Complex film of CELLPORE WN-07 (33% of total area) and cast polypropylene (67% of total area; 50 μ m in thickness):

Exp. No. 4: Perforated film CELLPORE WN-07 (170 μ m in thickness);

30 The relationship between the maximum relative humidity attained in the inner bag and the hardness of the crystals representing the caking extent is shown in Fig. 4. The crystals in Exp. No. 1 caked so that the total content in the inner bag became a hard lump. In
35 contrast, the crystals in Exp. Nos. 2, 3 and 4 did not

cake at all and were free flowing as before storage. It is apparent that the caking inhibiting effect may be achieved by increasing the water vapor permeability of the inner bag and controlling the maximum relative humidity attained therein at low level.

Example 5

The dried and purified crystals of L-ornithine hydrochloride were packed in a bag under the conditions shown in Table 5 and stored for 1.5 years while the temperature was left uncontrolled. Thereafter, the caking state of the crystals was estimated. The results were as shown in Table 6.

Table 5

<Packing conditions>

Exp.No.	Water Vapor Permeability of Packaging Material (g/m ² ·24 hrs.)		Ratio of Silica Gel to the Crystals (%)	Amount Packed of the Crystals (kg)	Structure of an Inner Bag
	Outer Bag	Inner Bag			
1	2	7	1	50	LDPE only
2	2	14700	1	50	"Tyvek" only
3	2	3700	1	50	• 1
4	2	7350	1	50	• 2
5	2	7350	1	50	• 3
6	2	7350	1	50	• 4

1 A bag composed of a combination of two kinds of packaging materials TYVEK (unwoven cloth made of high-density polyethylene, manufactured by DuPont Company; 1/4 of the total) and (3/4 of the total)

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in the form of belt between the opening and bottom parts, respectively.

- 5 *2 A bag composed of a combination of two kinds of packaging materials, TYVEK (1/2 of the total) and LDPE (1/2 of the total) in the form of belt between the opening and bottom parts, respectively.
- *3 A bag composed of LDPE (1/2 of the total) in the upper half part and TYVEK in the lower half part.
- 10 *4 A bag composed of TYVEK (1/2 of the total) in the upper half part and LDPE in the lower half part.
- Outer bag: silica coated PET/L-LDPE film having 85 μm in total thickness (water vapor permeability of 2 $\text{g}/\text{m}^2 \cdot 24 \text{ hrs.}$).
- 15 Inner bag: Exp. No. 1: bag consisting of low density polyethylene (LDPE) film of 80 μm in thickness (water vapor permeability of 7 $\text{gm}^2 \cdot 24 \text{ hrs.}$) only;
- Exp. No. 2: bag consisting of TYVEK (water vapor permeability of 14700 $\text{g}/\text{m}^2 \cdot 24 \text{ hrs.}$) only;
- 20 Exp. Nos. 3 to 6: bag composed of a combination of TYVEK and LDPE (80 μm in thickness).

Table 6

<Caking state>

5	Exp. No.	Hardness of the Crystals	The State of the Crystals Taken Out When the Inner Bag Opened After the Storage
	1	6.0	* 1
10	2	1.1	* 2
	3	1.1	* 3
15	4	1.1	* 4
	5	1.1	* 5
20	6	1.1	* 6

*1 Caked so that the total contents became a hard lump.

25 *2 Uncaked and free flowing as before storage.

*3 Uncaked and free flowing as a whole although a very small amount of extremely soft and fine blocks coexisted.

*4 Uncaked and free flowing as before storage.

30 *5 Uncaked and free flowing as a whole although a very small amount of extremely soft and fine blocks coexisted.

*6 Uncaked and free flowing as before storage.

It is apparent from Table 6 that the caking may be effectively inhibited by using an inner bag having a high water vapor permeability and that the caking inhibiting effect may also be achieved by using a
5 packaging material having a high water vapor permeability as a part of the inner bag.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A storage container for hygroscopic powder or granular material, comprising:
 - a) an inner container having water vapor permeability of $\geq 400 \text{ g/m}^2 \cdot 24 \text{ hrs}$ for controlling the maximum relative humidity within said container;
 - b) an outer container enclosing the inner container, wherein the outer container has no water vapor permeability or low water vapor permeability; and
 - c) a desiccant between the inner container and the outer container.
2. The container as claimed in claim 1, wherein either or both the inner and outer containers are in the shape of a bag.
3. The container as claimed in claim 1, wherein said container contains powders or granules of an amino acid having a caking property.
4. The container as claimed in claim 1, wherein the outer container is an aluminum foil laminated film.
5. The container as claimed in claim 1, wherein the inner container has a water vapor permeability of $\geq 1,500 \text{ g/m}^2 \cdot 24 \text{ hrs}$.
6. A process for packaging powder or granular material, comprising the steps of:
 - a) placing hygroscopic powder or granular material in an inner container having water vapor permeability of $\geq 400 \text{ g/m}^2 \cdot 24 \text{ hrs}$;
 - b) sealing the inner container;
 - c) enclosing the inner container in an outer container having no water vapor permeability or low water vapor permeability;
 - d) placing a desiccant between the inner container and the outer container; and
 - e) sealing the outer container.

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7. The process of claim 6, wherein the outer container is an aluminum foil laminated film.
8. The process of claim 6, wherein the inner container has a water vapor permeability of $\geq 1,500 \text{ g/m}^2 \cdot 24 \text{ hrs}$.

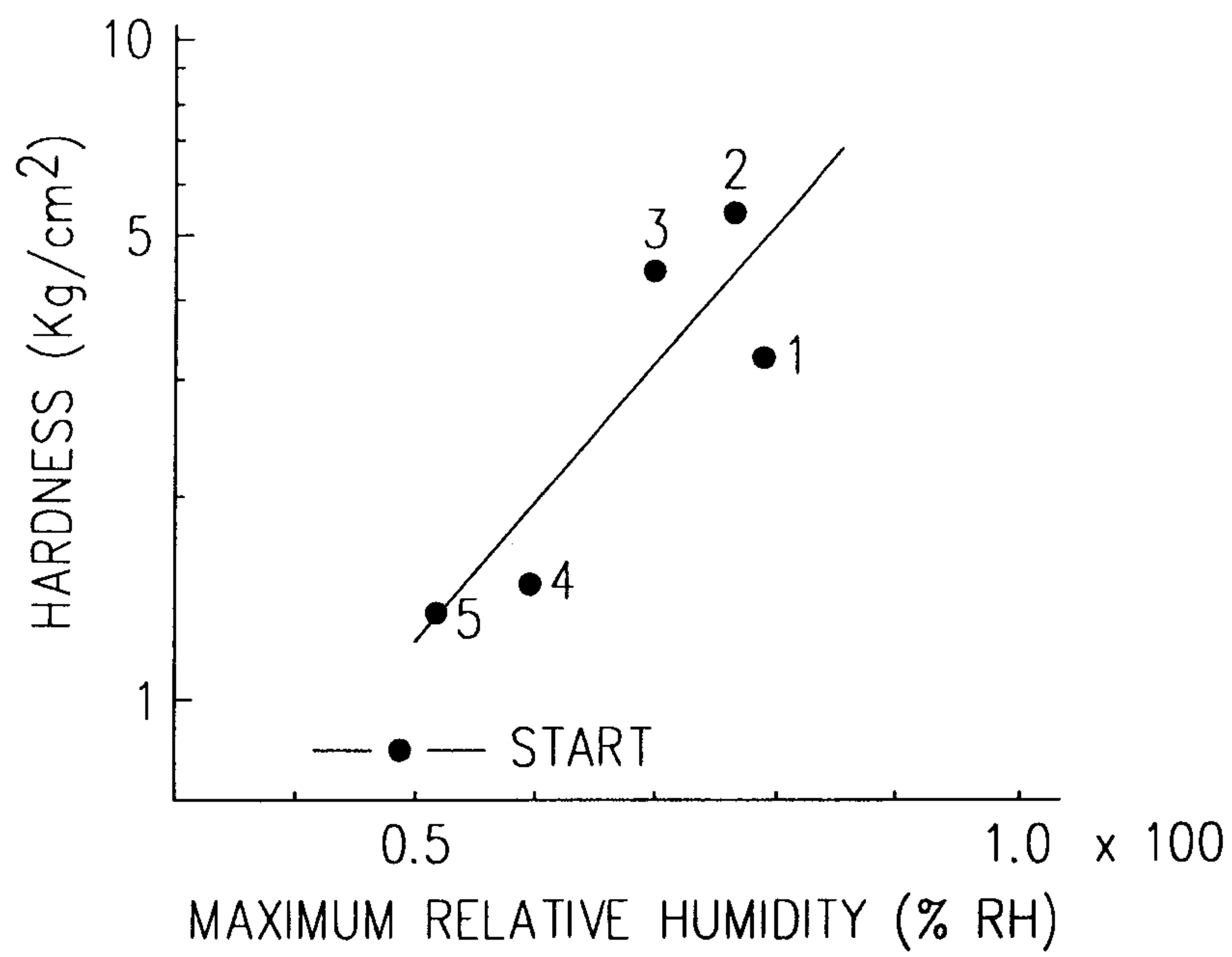


Fig. 1

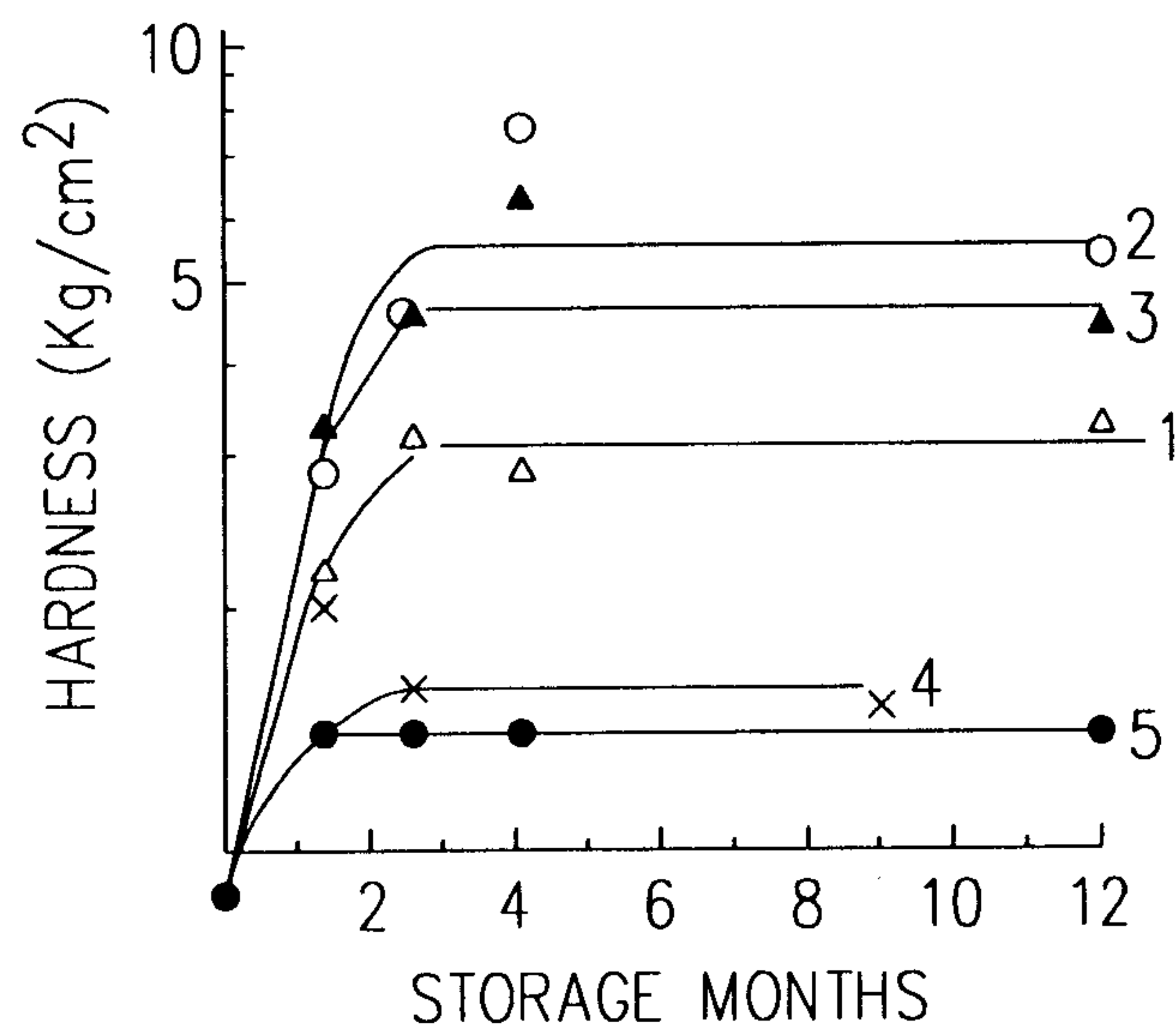


Fig. 2

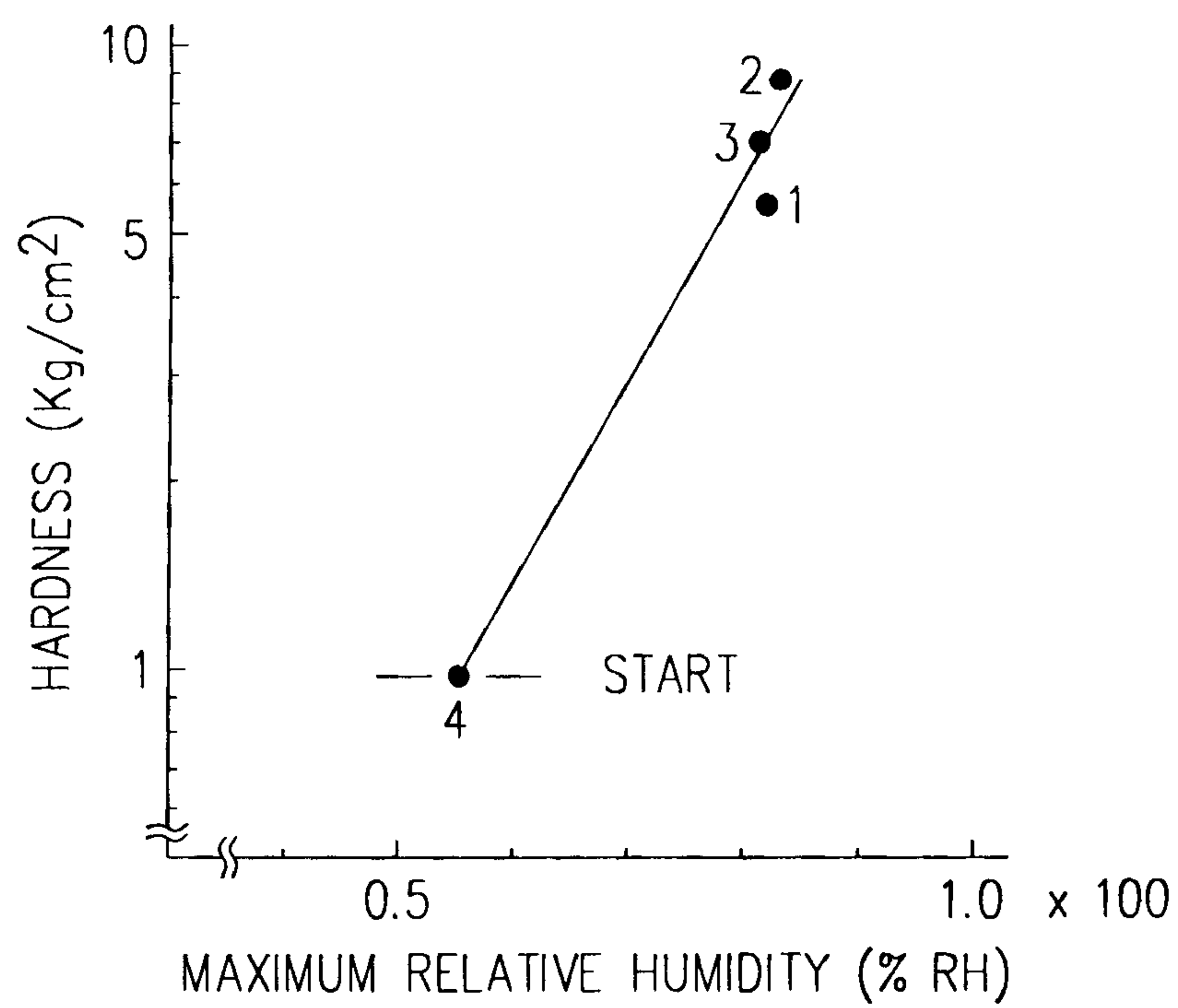


Fig. 3

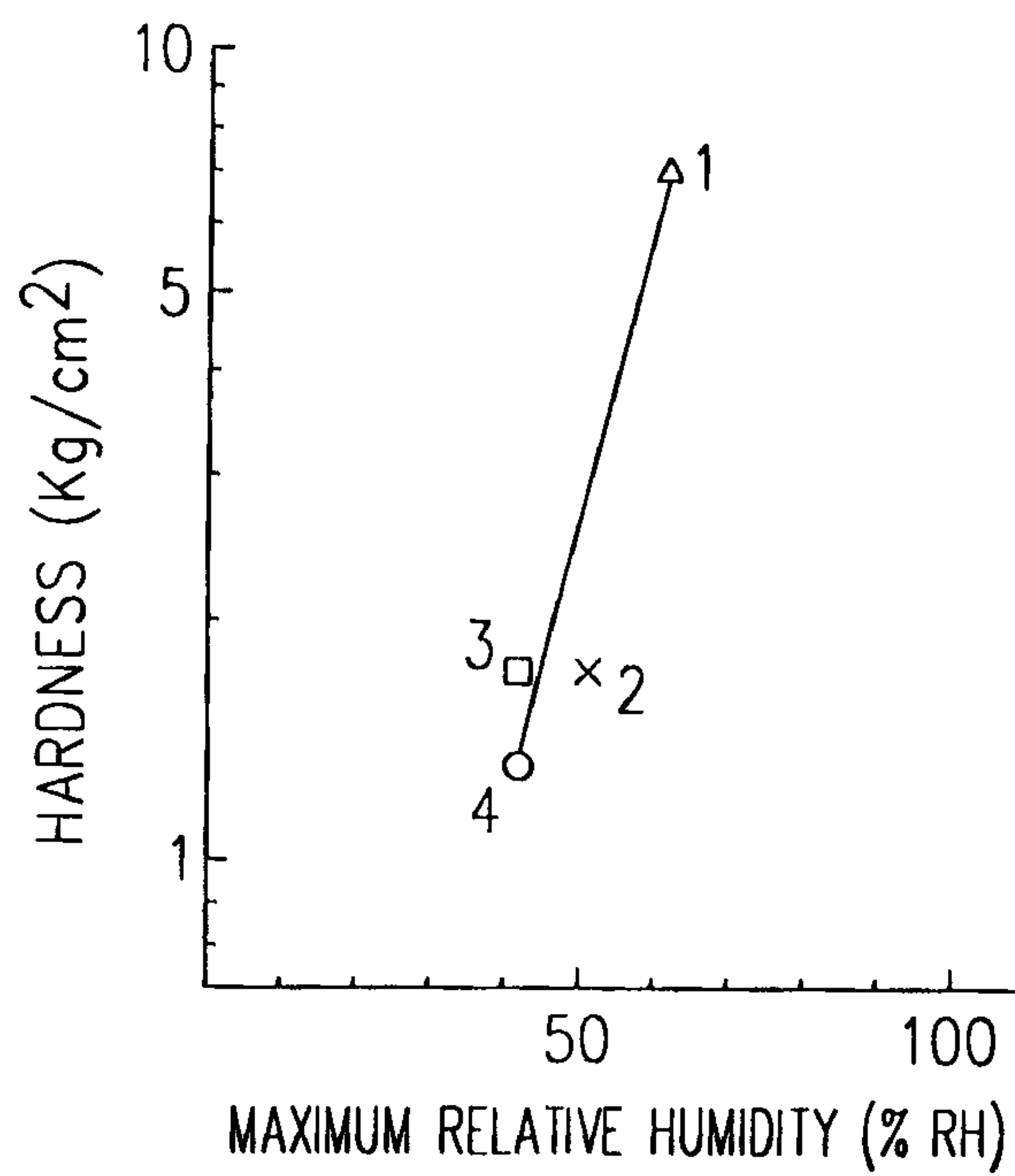


Fig. 4

