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(54) **A process for treating containers provided with a metal closure.**

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EP 0 250 056 B1

Description

The present invention relates to a process for treating filled containers closed with metal closures to prevent rust formation, i.e. oxidative attack on iron.

During filling, closing and storing all kinds of beverages and foodstuffs in jars, ceramic or metal containers, such as tins, bottles and pots, the foodstuff and beverage industry frequently has to cope with the problem that certain iron parts of the closed containers or the closures tend to corrode or rust. Particularly when the containers are filled with acid-reacting products, which will often be the case from a viewpoint of preservation, the presence of slight amounts of the product near or under the edge of the closure can give rise to rust formation, as will be explained below.

For instance, when glass bottles filled with beer are closed with a crown cork, the situation occurs that after filling rests of beer are present on the top and on the exterior of the bottle at the moment of closing the bottle with the crown cork. Since during manufacture the bottles have been treated with metal oxides which may also be present on the top of the bottle near the crown cork, both metal oxides, rests of beer and free metal, more particularly iron surface, are found near the crown cork. On the one hand, this free metal surface originates from the cutting edge of the crown cork, and, on the other hand, damage caused to the interior and the exterior of the crown cork during closing leads to removal of a part of the protective layer on the crown cork. Since the rests of beer consist of water having dissolved therein, among other things, electrolytes with a pH in the acid range, there is a risk of corrosion owing to electrolytic interaction of the various substances present near the crown cork. This may manifest itself in a more or less perceptible rust formation on the bottle next to the crown cork or on the crown cork.

The same problem occurs with other containers closed with metal closures, such as jam jars with screw caps, mustard jars, but also with beer tins and vegetable tins.

To prevent rust formation, a great many researches were conducted in the past, which researchers were mainly concentrated on improving the coating of the crown cork, cap, etc., minimizing the amount of metal oxide on the bottle surface near the crown cork, and, after the container has been closed, removing moisture as much as possible near the closure. This moisture may be removed, e.g., by blow drying the container near the closure.

For certain products the practice obtains of providing the container-with-closure with a foil e.g., an aluminum foil which leads to a situation that moisture, if any, can evaporate less easily, so that in this situation rust formation can occur sooner and more easily. This is particularly the case in combination with containers, e.g., of ceramic material, which more readily give rise to corrosion of the iron in the closure.

Accordingly, there is a marked need for a good economical method of preventing rust formation on metal parts of containers closed with metal closure.

To that end, the invention is characterized by treating the assembly of closure and container in closed condition with a diluted aqueous alkali metal silicate solution.

According to a preferred embodiment of the invention this assembly is treated with sodium silicate, the silicate content in the alkali metal silicate solution preferably ranging from 0.1 to 5 wt.%, more specifically from 0.2 to 1.0 wt.%. It is particularly advantageous in the treatment of the closed containers to start from a diluted water glass solution, which solution can be obtained by diluting commercially available water glass with normal water.

At alkali metal silicate concentrations lower than 0.01% the activity is too poor, while at concentrations above the upper limit there is a risk of discoloration of the metal.

Surprisingly, it has been found that when the containers-with-closures are treated near the metal closure with such a solution, rust formation does not occur at all, even not when the treated containers are provided in wet condition with an aluminum foil. An additional advantage is that the substances used, water and alkali metal silicate are hardly objectionable from a viewpoint of security, health and appearance of the treated containers.

In this connection it is observed that it is known per se indeed to use sodium silicate for preventing corrosion of, e.g., central heating systems, but this is a situation which is absolutely incomparable to the treatment of crown corks or comparable closures.

Furthermore, U.S. patent 4,351,883 discloses a process for treating aluminum surfaces against the formation of tarnish and corrosion. In this process the aluminum surface is provided with a solution containing an alkali metal silicate in combination with certain film-forming organic polymers, which is followed by a heat treatment. The prevention of rust formation is not involved here.

The treatment preferably takes place by spraying the diluted solution to the boundary face of the closure and the container.

As containers, there may be used all the containers known for storing beverages and foodstuffs, such as glass bottles, ceramic bottles, glass jars, but also deep-drawn metal tins for carbonated beverages, and so-called "open tops", i.e. three-piece metal tins capable of being closed on the top, such as vegetable tins, etc. The containers may therefore be made of both glass, ceramic materials and metals. In the last case, special mention may be made of tinplate which is often used for tins for carbonated beverages.

According to the invention the above-mentioned containers are to be closed with metal closures, in which connection it is of course material that the invention is effective only if either the container or the closure is at least partly made on the basis of iron. Suitable closures are in this connection crown corks which are to comprise not only the conventional crown corks for beer or milk bottles, but also "twist crowns", screw caps, flip tops, etc. The term metal closures, however, also comprises metal screw caps, as used for jam jars, or mayonnaise, pi-

calilli, gherkin and mustard jars. Metal closures on the basis of iron preferably consist of "tin" or steel plate provided with a tin or chromium layer.

With deep-drawn metal containers made of tinplate aluminum closures are often also found. In this case of course, the corrosion does not occur at the closure itself but at the metal container which can be damaged during applying the aluminum closure or afterwards.

The above-mentioned closed containers are preferably filled with foodstuffs or beverages having an acid pH, i.e. a pH less than 6. In case of carbonated beverages, such as carbonated lemonades, fruit-juices and beer, this is definitely the case, but also for non-carbonated beverages and for foodstuffs the aim will generally to slightly acidify the product so as to improve its keeping qualities.

When many containers are filled, more particularly with carbonated beverages, the aim is to achieve a slight foaming of the product during filling so that the air is completely expelled form the space above the liquid, which will improve the keeping qualities. Owing to this foaming up or over, liquid arrives at the exterior of the container and contacts the metal closure, which leads to the "galvanic" effect described above.

The treatment according to the invention is carried out at the closed container, the exact moment of which treatment is not very critical. This may take place, e.g., immediately after the container has been closed but also at a later stage of the treatment of the filled containers, e.g., shortly before applying foil, if any, after or preferably before labelling or shortly before packaging.

If required, the treated container may be blow-dried, e.g., with compressed air. This is not necessary, however, since an excellent anti-rust effect is also obtained without blow-drying.

As already indicated, the solution with which the containers are treated is a diluted alkali metal silicate solution obtainable by diluting water glass with water. It is of course also possible to use alkali metal silicate solutions obtained otherwise. The solution preferably has an Na_2O/SiO_2 molar ratio in the range of from 1 to 0.1, a ratio of about 0.5-0.3 being preferred. The pH of such solutions is preferably from 10 to 14.

The invention will now be illustrated by some examples, which, however, do not mean a limitation of the invention.

Example I and Comparative Example 1

A tank of stainless steel, as also used for sterilization or pasteurization tests, is filled with normal mains water. Bottles previously filled with beer and closed with a crown cork are immersed in this tank. Already after 1 day of immersion at room temperature it can be established that incipient rust formation occurs at the unprotected cutting edge of the crown cork. Also in those places where the lacquer coatings of the crown cork would be damaged incipient rust formation can be established. In the same arrangement but using 1% aqueous water glass solution instead of normal water, rust formation still cannot be established after weeks of immersion.

Example II

In well-known techniques and plants bottles are filled with beer and closed with a crown cork. This is performed with fully automatic machines and at velocities of 20,000-40,000 bottles per hour. Optionally, this process is followed by a pasteurization process. In this example the invention is preferably used after this stage. For the labelling machine the bottles are arranged in one row.

Along both sides of the conveyor belt feeding the bottles in one row, spraying nozzles are placed at crown cork level. The spraying nozzles are so arranged that both the crown cork but surely also the cutting edged and the bottom side of the crown cork are sprayed by the liquid jets. The alkali metal silicate solution is prepared previously, starting from a commercially available water glass solution ($Na_2/O/SiO_2$ molar ratio: 0.5) at a concentration of 30-35%, and diluting it with water to obtain a dry content of 1%. This diluted solution is passed to the spraying nozzles from a reservoir via a pipe and a pump with a slight excess pressure.

Depending on the machine speed, two to four spraying nozzles are mounted on each side of the bottle conveyor belt. Rust protection is obtained by spraying, and, in addition, rests of beer, if any, are removed from the mouth. Although it is sometimes usual to blow-dry the last rests of moisture under the crown cork this is not necessary when the invention is used. In practice, it has even been found that rust protection will subsist, even if these rests of moisture are enclosed by applying an aluminum foil over the bottle closure.

Claims

1. A process for treating filled containers closed with metal closures to prevent rust formation, characterized by treating the assembly of closure and container in closed condition with a diluted aqueous alkali metal silicate solution.
2. A process according to claim 1, characterized by using an aqueous sodium silicate solution.
3. A process according to claim 1 or 2, characterized in that the content of silicate is 0.01-5 wt.%, calculated as SiO_2 on the total solution.
4. A process according to claim 3, characterized in that the SiO_2 content is 0.2-1.0 wt.%.
5. A process according to claim 1, characterized by treating a glass container provided with a metal closure on the basis of iron.
6. A process according to claims 1-4, characterized by treating a metal container on the basis of iron with a metal closure.
7. A process according to claim 6, characterized by treating a metal container with an aluminum closure.
8. A process according to claim 5, characterized by treating a bottle provided with a crown cork.
9. A process according to claim 8, characterized in that the bottle contains beer.
10. A process according to claim 8, characterized

by covering the crown cork, after treatment, with a foil, preferably an aluminum foil.

Patentansprüche

1. Verfahren zur Behandlung von gefüllten Behältern, die mit einem metallischen Verschluß versehen sind, zur Verhinderung von Rostbildung, dadurch gekennzeichnet, daß der mit dem Verschluß versehene Behälter mit einer wässrig verdünnten Lösung eines Alkalimetall-Silikats behandelt wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß eine wässrige Lösung von Natriumwasserglas verwendet wird.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Silikatgehalt 0,01 bis 5 Gewichtsprozent beträgt bezogen auf den SiO_2-Anteil an der Gesamtlösung.

4. Verfahren nach Anspruch 3, dadurch gekennzeichnet, daß der SiO_2-Anteil 0,2 bis 1,0 Gewichtsprozent beträgt.

5. Verfahren nach Anspruch 1, gekennzeichnet durch die Behandlung eines Glasbehälters mit einem eisenhaltigen metallischen Verschluß.

6. Verfahren nach Anspruch 1 bis 4, gekennzeichnet durch die Behandlung eines eisenhaltigen metallischen Behälters mit einem metallischen Verschluß.

7. Verfahren nach Anspruch 6, gekennzeichnet durch die Behandlung eines metallischen Behälters mit einem Verschluß aus Aluminium.

8. Verfahren nach Anspruch 5, gekennzeichnet durch die Behandlung einer Flasche mit einem Kronenverschluß.

9. Verfahren nach Anspruch 8, dadurch gekennzeichnet, daß die Flasche Bier enthält.

10. Verfahren nach Anspruch 8, dadurch gekennzeichnet, daß der Kronenverschluß nach der Behandlung mit einer Folie, vorzugsweise einer Aluminiumfolie, überzogen wird.

Revendications

1. Un procédé de traitement de récipients remplis, fermés par des fermetures métalliques pour empêcher la formation de rouille, caractérisé par le traitement de l'ensemblement de fermeture et récipient à l'état fermé, avec une solution aqueuse diluée de silicate de métal alcalin.

2. Un procédé conforme à la revendication 1, caractérisé par l'utillisation d'une solution aqueuse de silicate de sodium.

3. Un procédé conforme à la revendication 1 ou 2, caractérisé en ce que la teneur en silicate est de 0,01 à 5%, calculée en tant que SiO_2 sur la solution totale.

4. Un procédé conforme à la revendication 3, caractérisé en ce que la teneur en SiO_2 est de 0,2 à 1,0%.

5. Un procédé conforme à la revendication 1, caractérisé par le traitement d'un récipient en verre muni d'une fermeture métallique à base de fer.

6. Un procédé conforme à l'une des revendications 1 à 4, caractérisé par le traitement d'un récipient métallique à base de fer muni d'une fermeture métallique.

7. Un procédé conforme à la revendication 6, caractérisé par le traitement d'un récipient métallique avec une fermeture en aluminium.

8. Un procédé conforme à la revendication 5, caractérisé par le traitement d'une bouteille munie d'une capsule.

9. Un procédé conforme à la revendication 8, caractérisé en ce que ladite bouteille contient de la bière.

10. Un procédé conforme à la revendication 8, caractérisé par le recouvrement de la capsule, après traitement, par une feuille, de préférence une feuille d'aluminium.