

**Yogurt with Encapsulated Lactic Acid Bacteria
and Method for Producing the Same**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a yogurt with encapsulated lactic acid bacteria. Particularly the present invention relates to a yogurt with encapsulated lactic acid bacteria in which a large number of latic acid bacteria-containing [hereinafter, referred to as "L.A.B.-containing"] capsules, which are packed by acid resistant and intestine-soluble coating substance, are uniformly distributed in a liquid yogurt. L.A.B.-containing capsules in a drinkable and liquid yogurt are minimally chewed by teeth, and are protected from the gastric acid within the stomach, so that the lactic acid bacteria can be maximally survived until they reach the intestine.

Further, the present invention relates to a method for producing(manufacturing) the yogurt with encapsulated lactic acid bacteria, in which the yogurt with encapsulated lactic acid bacteria can be mass-produced by a simple and speedy process at a low cost.

2. Description of the Prior Art

In the conventional yogurt, lactic acid bacteria are not encapsulated within acid resistant and intestine-soluble coating substance. Therefore, when the lactic acid bacteria pass through the stomach, a majority of the lactic acid bacteria are killed.

Meanwhile, conventionally there has been a semi-solid yogurt with encapsulated lactic acid bacteria. In this conventional semi-solid yogurt, the yogurt is eaten with a spoon, and therefore, a majority of the lactic acid bacteria are killed by the gastric acid because the capsules are chewed by the teeth. Therefore, the survival rate of the lactic acid bacteria is low. That is, a majority of the lactic acid bacteria are killed before reaching the intestine, because the chewed capsules cannot protect the lactic acid bacteria from the gastric acid.

With the conventional method for producing(manufacturing) the semi-solid yogurt with encapsulated lactic acid bacteria, a drinkable and liquid yogurt with encapsulated lactic acid bacteria cannot be produced(manufactured). Therefore, the survival rate of the lactic acid bacteria cannot be maximized.

SUMMARY OF THE INVENTION

The present invention is intended to overcome the above described disadvantages of the conventional techniques.

Therefore, it is an objective of the present invention to provide a yogurt with encapsulated lactic acid bacteria in which the lactic acid bacteria are protected from the gastric acid by being contained in acid resistant and intestine-soluble capsules, thereby maximizing the survival rate of the lactic acid bacteria until they reach the intestine.

It is another objective of the present invention to provide a method for producing(manufacturing) a yogurt with encapsulated lactic acid bacteria, in which the producing(manufacturing) process is simple and speedy, and the producing(manufacturing) cost is low.

In achieving the above objectives, the yogurt with encapsulated lactic acid bacteria according to the present invention is characterized in that: a large number of L.A.B.-containing capsules are uniformly distributed in a liquid yogurt, with the specific gravity of the liquid yogurt and the specific gravity of the L.A.B.-containing capsules being made, bilaterally, same or almost same; and the capsules are uniformly distributed in the drinkable and liquid yogurt

to make the chewing of the capsules minimal and to protect the lactic acid bacteria from being killed by the gastric acid so as to maximize the survival rate of the lactic acid bacteria.

In another aspect of the present invention, the method for producing(manufacturing) a yogurt with encapsulated lactic acid bacteria according to the present invention comprises steps of: steps for preparing L.A.B.-containing capsules and a liquid yogurt, with the specific gravity of the capsules and the specific gravity of the liquid yogurt being made, bilaterally, same or almost same; a step for putting the L.A.B.-containing capsules into a lower portion of a interior of a yogurt bottle; and a step for injecting a liquid yogurt into the interior of the yogurt bottle in a state with the L.A.B.-containing capsules having been put into the lower portion of the interior of the yogurt bottle, whereby the L.A.B.-containing capsules are automatically dispersed within the interior of the bottles, the whole process being carried out in a simple and speedy manner at a low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objectives and other advantages of the present invention will become more apparent by describing in detail the preferred embodiment of the present invention with reference to the attached drawings in which:

FIG. 1 is a longitudinal sectional view showing an embodiment of the yogurt bottle containing the liquid yogurt with encapsulated lactic acid bacteria according to the present invention;

FIG. 2 is a partly cut-out sectional view showing the L.A.B.-containing capsule according to the present invention, in which:

FIG. 2(a) illustrates one embodiment of the L.A.B.-containing capsule; and

FIG. 2(b) illustrates another embodiment of the L.A.B.-containing capsule;

FIG. 3 illustrates a third step of the method for producing the yogurt with encapsulated lactic acid bacteria, in which only the L.A.B.-containing capsules are put into a lower portion of the yogurt bottle;

FIG. 4 illustrates a fourth step of the method for producing the yogurt with encapsulated lactic acid bacteria, in which the liquid yogurt is injected into the lower portion of the yogurt

bottle, in a state with the L.A.B.-containing capsules having been put into the lower portion of the yogurt bottle, in which:

FIG. 4(a) is a longitudinal sectional view showing an initial stage of the filling of the liquid yogurt; and

FIG. 4(b) is a longitudinal sectional view showing an intermediate stage of the filling of the liquid yogurt; and

FIG. 5 is a longitudinal sectional view showing the finish stage of filling the liquid yogurt according to the fourth step of the method for producing the yogurt with encapsulated lactic acid bacteria.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIGs. 1, 2(a), and 2(b), the L.A.B.-containing capsule 10 contains lactic acid bacteria(which are shown by the dots in FIG. 2), and is packed by coating substance 10a which is acid resistant and intestine-soluble. The "intestine-soluble" is meant that the capsules 10 are decomposed within the human intestine by the digestive enzymes of the intestine and the pH level of the intestine, and that the capsules 10 are hydrophobic within a limit as far as the

operations of the digestive enzymes of the intestine and the pH level of the intestine are allowed.

In order that a large number of the L.A.B.-containing capsules 10 can be uniformly distributed in a liquid yogurt 20, the specific gravity of the liquid yogurt 20 is made same as or almost same as the required specific gravity of the L.A.B.-containing capsules 10. Thus a large number of the L.A.B.-containing capsules are uniformly distributed within the liquid yogurt 20.

The required specific gravity of the L.A.B.-containing capsules 10 should be preferably 0.9 to 1.5, while the specific gravity of the liquid yogurt should be preferably about 0.9 to 1.5.

As another embodiment of a yogurt with encapsulated lactic acid bacteria according to the present invention, the L.A.B.-containing capsule 10 contains lactic acid bacteria and is packed by coating substance 10a which is acid resistant and intestine-soluble. In order that a large number of the L.A.B.-containing capsules 10 can be uniformly distributed in a liquid yogurt 20, the specific gravity of the L.A.B.-containing

capsules 10 is made same as or almost same as the required specific gravity of the liquid yogurt 20. Thus the L.A.B.-containing capsules 10 are uniformly distributed in the liquid yogurt 20.

The required specific gravity of the liquid yogurt 20 should be preferably 0.9 to 1.5, while the specific gravity of the L.A.B.-containing capsules 10 should be preferably about 0.9 to 1.5.

In the above described two embodiments, the lactic acid bacteria should be mixed with a mixing substance 2 such as a hardened oil and starch, etc., and this mixture thus formed should be contained within the L.A.B.-containing capsule 10. The outside layer of the mixture should be dried, to form a coating substance 10a. Or the outside of the mixture is spread with a mixing substance 2 such as a hardened oil or starch, etc. to form a coating substance 10a. This corresponds to FIG. 2(b), and is a simple coating. If the simply coated mixture is again coated with a coating substance consisting of gelatin and pectin, this corresponds to FIG. 2(a), and is a dual coating.

The liquid yogurt 20 having the required specific gravity can be made by adjusting kinds of, and a combination ratio of, raw milk, non-fat milk, powered milk, sugars, stabilizers or other additives and by fermenting a combination thereof.

The required specific gravity of the liquid yogurt 20 equivalent to 0.9 to 1.5 and the specific gravity of the liquid yogurt 20 equivalent to about 0.9 to 1.5 are realized by preferable kinds of, and a preferable combination ratio of, raw milk, non-fat milk, powdered milk, sugars, stabilizers and other additives.

The required specific gravity of the L.A.B.-containing capsules 10 can be made by adjusting the kinds of, and the combination ratio of, the coating substance 10a, and by adjusting the kinds of, and the combination ratio of, the hardened oil, and starch which are mixed with the lactic acid bacteria 1.

The required specific gravity of the L.A.B.-containing capsules 10 equivalent to 0.9 to 1.5 and the specific gravity of L.A.B.-containing capsules 10 equivalent to about 0.9 to 1.5 are realized by the preferable kinds of, and the preferable combination ratio of, the coating substance 10a, and by the preferable kinds of, and the preferable combination ratio of, the hardened oil and the starch which are mixed with the lactic acid bacteria 1.

The L.A.B.-containing capsules 10 should be preferably contained in an amount of 0.1 wt% to 1.0 wt% in the liquid yogurt 20.

The liquid yogurt 20 contains about 100 millions of lactic acid bacteria per ml of the liquid yogurt 20 like the general yogurt, and in addition, the L.A.B.-containing capsules 10 contain about one million of lactic acid bacteria per ml of the liquid yogurt 20.

The diameter of the L.A.B.-containing capsule 10 should be preferably 1 mm to 3 mm.

The lactic acid bacteria 1 refer to the general lactic acid bacteria, i.e., the microbes which produce lactic acid, acetic acid and the like by decomposing carbohydrates such as glucose and lactose. Morphologically, they are gram-positive, and are bacillus or micrococcus. They do not form a endospore, but are mobile. Physiologically, they are anaerobic, and are catalase-negative. They use sugar as the only source of energy. They convert sugar into lactic acid by 50% or more.

Categorically, the lactic acid bacteria includes: *Lactobacillus*, *Leuconostoc*, *Pediococcus*, *Streptococcus* and the like. Further they include bifidobacterium microbes which produce lactic acid by less than 50% of the glucose. Morphologically, the bifidobacterium belong to bacillus, and are grown into various kinds depending on

the growing conditions. They are similar to the *Lactobacillus*, but they are acid non-resistant, and convert glucose into lactic acid and acetic acid at a ratio of 2:3.

According to the report of the FAO/WHO, " the fermented yogurt is a solid-fluid product which is obtained by lactic-acid-fermenting a milk or a milk product (sterilized or condensed) by the help of the operations of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Further, it should be alive and should contain microbes profusely." However, besides the above two microbes, *Lactobacillus acidophilus* or *bifidus* is also used in producing(manufacturing) the yogurt.

As shown in FIGs. 1 to 5, the method for producing the yogurt with encapsulated lactic acid bacteria according to the present invention comprises steps of:

a first step for preparing L.A.B.-containing capsules 10 which contain lactic acid bacteria and are coated with an acid resistant and intestine-soluble coating substance 10a, and have a required specific gravity;

a second step for preparing a liquid yogurt 20 having a specific gravity same as or almost same as the required specific gravity of the L.A.B.-containing capsules 10;

a third step for putting the L.A.B.-containing capsules 10 prepared by the first step into the lower portion 100b of the interior 100a of a yogurt bottle 100;

and a fourth step for injecting the liquid yogurt 20 prepared by the second step into the interior 100a of the yogurt bottle 100, in a state with the L.A.B.-containing capsules 10 having been put into the lower portion 100b of the interior 100a of the yogurt bottle 100 according to the third step.

Under this condition, the required specific gravity of the L.A.B.-containing capsules 10 should be preferably 0.9 to 1.5, while the specific gravity of the liquid yogurt 20 should be preferably about 0.9 to 1.5.

Preferably, in the L.A.B.-containing capsules 10, the lactic acid bacteria 1 should be mixing with a mixed substance 2 such as hardened oil and starch, etc. and the mixture thus formed should be contained within the L.A.B.-containing capsule 10. The outside layer of the mixture should be dried, to form a coating substance 10a, or the mixing substance 2 such as hardened oil and starch, etc. should be spread on the outside of the mixture, to form a coating substance 10a. This corresponds to FIG. 2(b), and is a simple coating. If the simply coated mixture is again coated with a

coating substance consisting of gelatin and pectin, this corresponds to FIG. 2(a), and is a dual coating.

The L.A.B.-containing capsules 10 having the required specific gravity can be made by properly adjusting the kind of the substance 10a and the combination ratio thereof and by properly adjusting kinds of the hardened oil and the starch which are combined with the lactic acid bacteria 1, and a combination ratio thereof.

The required specific gravity of the L.A.B.-containing capsules 10 equivalent to 0.9 to 1.5 is realized by the preferable kind of the coating substance 10a and the preferable combination ratio of the coating substance 10a, and by the preferable kind of hardened oil and starch which are combined with the lactic acid bacteria 1, and the preferable combination ratio thereof.

The liquid yogurt 20 having the required specific gravity can be made by adjusting kinds of, and a combination ratio of, raw milk, non-fat milk, powdered milk, sugars, stabilizers or other additives and by fermenting a combination thereof.

The specific gravity of the liquid yogurt 20 equivalent to about 0.9 to 1.5 is realized by preferable kinds of, and preferable combination ratio of raw milk, non-fat milk, powdered milk, sugars, stabilizers, and other additives.

In another embodiment of the present invention, the method for producing the yogurt with encapsulated lactic acid bacteria according to the present invention comprises steps of:

a first step for preparing a liquid yogurt 20 having a required specific gravity;

a second step for preparing L.A.B.-containing capsules 10 which contain lactic acid bacteria and are coated with an acid resistant and intestine-soluble coating substance 10a, and have a specific gravity same as or almost same as the required specific gravity of the liquid yogurt 20;

a third step for putting the L.A.B.-containing capsules 10 prepared by the second step into the lower portion 100b of the interior 100a of a yogurt bottle 100;

and a fourth step for injecting the liquid yogurt 20 prepared by the first step into the interior 100a of the yogurt bottle 100, in a state with the L.A.B.-containing capsules 10 having been put into the lower portion 100b of the interior 100a of the yogurt bottle 100 according to the third step.

Under this condition, the required specific gravity of the liquid yogurt 20 should be preferably 0.9 to 1.5, while the specific gravity of the L.A.B.-containing capsules 10 should be preferably about 0.9 to 1.5.

Preferably, in the L.A.B.-containing capsules 10, the lactic acid bacteria 1 should be mixed with a mixing substance 2 such as hardened oil and starch, etc. and the mixture thus formed should be contained within the L.A.B.-containing capsule 10. The outside layer of the mixture should be dried, to form a coating substance 10a, or the mixing substance 2 such as hardened oil and starch, etc., should be spread on the outside of the mixture, to form a coating substance 10a. This corresponds to FIG. 2(b), and is a simple coating. If the simply coated mixture is again coated with a coating substance consisting of gelatin and pectin, this corresponds to FIG. 2(a), and is a dual coating.

The liquid yogurt 20 having the required specific gravity can be made by adjusting kinds of, and a combination ratio of, raw milk, non-fat milk, powered milk, sugars, stabilizers or other additives and by fermenting a combination thereof.

The required specific gravity of the liquid yogurt 20 equivalent to 0.9 to 1.5 is realized by preferable kinds of, and preferable combination ratio of, raw milk, non-fat milk, powdered milk, sugars, stabilizers, and other additives.

When preparing the L.A.B.-containing capsules 10, the required specific gravity of the L.A.B.-containing capsules 10 can be made by properly adjusting the kind of the coating substance 10a and the combination ratio thereof, and by properly adjusting kinds of the hardened oil and the starch which are combined with the lactic acid bacteria 1, and a combination ratio thereof.

The specific gravity of the L.A.B.-containing capsules 10 equivalent to about 0.9 to 1.5 is realized by the preferable kind of the coating substance 10a and combination ratio of the coating substance 10a, and by the preferable kinds of hardened oil and starch which are combined with the lactic acid bacteria 1, and the preferable combination ratio of the hardened oil and the starch.

The L.A.B.-containing capsules 10 are put into the interior 100a of the yogurt bottle 100 in the following manner. That is, an injection device with a proper amount of L.A.B.-containing

capsules 10 contained therein is installed above a conveyor upon which the yogurt bottles 100 are conveyed. When the yogurt bottles 100 pass below the injection device, proper amounts of the L.A.B.-containing capsules 10 are put into the yogurt bottles 100.

The injection device is controlled to put, or not put, the L.A.B.-containing capsules 10 into the bottles 100 discretely according to signal of a sensor which is attached at a side of a capsule orifice of the injection device.

After undergoing the fourth step, caps are fitted to the yogurt bottles 100, thereby completing the production(manufacture).

Now the operation of the present invention is performed as follows :

In the yogurt with encapsulated lactic acid bacteria of the present invention, a large number of L.A.B.-containing capsules 10 are dispersed in the liquid yogurt 20. Also, the specific gravity of the liquid yogurt 20 and the specific gravity of the L.A.B.-containing capsules 10. are made, bilaterally, same or almost same.

Therefore, there is no difference or almost no difference between the specific gravity of the liquid yogurt 20 and the L.A.B.-containing capsules 10.

Therefore, once the L.A.B.-containing capsules 10 are uniformly distributed in the liquid yogurt 20, the uniform distribution can be maintained for a long time. Therefore, the quality of product is estimated to be very high.

Thus the yogurt with lactic acid bacteria of the present invention in which the L.A.B.-containing capsules 10 are uniformly distributed is a liquid type drinkable one. Therefore, the L.A.B.-containing capsules 10 need not be chewed, but can be drunk directly into the stomach. Since the chewing is eliminated, the lactic acid bacteria are protected from the gastric acid, so that the survival rate of the lactic acid bacteria can be maximized.

Since the coating substance 10a of the L.A.B.-containing capsule 10 is acid resistant, the lactic acid bacteria 1 which are contained in the L.A.B.-containing capsules 10 can be protected from the gastric acid. Therefore, the lactic acid bacteria 1 survive in the midst of the gastric acid and arrive to the intestine with the maximum survival rate. The L.A.B.-containing capsules 10 which

have passed through the stomach are dissolved within the intestine by the digestive enzymes of the intestine and by the pH state of the intestine. Therefore, the lactic acid bacteria are released from the capsules to perform beneficial operations within the intestine. This will be described in further details below.

The yogurt is very high in its nutritional and health effects compared with an unfermented milk. Specifically, nutritionally, the fermented yogurt is improved in its storability owing to its lactic acid formed during the fermentation. Further, the flavor is soft, and the sour taste is pleasant. Further, the lactic acid inhibits the growth of harmful microbes. Further, the absorptions of milk protein and lactose are promoted, and the utilization of the inorganic substances is improved. Further, the carriage of the contents of the stomach to the intestine is prompted, and the secretion of the gastric fluid is accelerated.

The lactic acid bacteria are engaged in the growth competitions with other microbes, and therefore, an antagonistic operation is resulted. Or they produce lactic acid or acetic acid, and therefore, they inhibit the proliferation of the microbes which are susceptible to acids, or they kill these microbes. Further, they improve the number composition ratios of different kinds of microbes, and exert laxative functions. Further they cause a

reduction of the cholesterol level within the blood, and give an anti-cancer effect.

In order to obtain the above described effects, the yogurt which contains the lactic acid bacteria has to pass through the stomach and has to arrive at the intestine. The pH value of the stomach is 1-2, and the stomach becomes completely empty in about 4 hours after food ingestion. At or below a pH value of 4, 99.9% of the general microbes are killed within 30 minutes. At or below pH 3, i.e., in the normal stomach, 99% of microbes are killed within 15 minutes, and after one hour, most of microbes are killed. To look into the experiments on the lactic acid bacteria when producing(manufacturing) the yogurt, the lactic acid bacteria including bifidus show a survival rate of 1% at pH 1 within one hour. Even if the pH level is raised to 2-4, the survived microbes are steeply decreased with the elapses of time. Thus, although the lactic acid bacteria are beneficent, if the beneficent effects are to be reaped, the microbes have to survive until they arrive at the intestine after passing through the stomach in the midst of the secretion of the gastric acid. In order to improve the survival rate of the lactic acid bacteria, conventionally, there has been invented a yogurt with encapsulated lactic acid bacteria. However, this conventional yogurt is a semi-solid type which has to be eaten by a spoon. That is, it cannot be drunk. Therefore, when it is eaten by

using a spoon, the capsules are chewed by the teeth within the mouth, and as a result the lactic acid bacteria within the capsules are released to be killed within the stomach by the secreted gastric acid. Therefore, a majority of the acid resistant and intestine-soluble capsules become useless, and as a result the survival rate of the lactic acid bacteria is drastically reduced. Such is the problem of the conventional semi-solid type capsuled yogurt.

The coating substance 10a of the L.A.B.-containing capsule 10 is acid resistant, and therefore, the capsule 10 does not dissolve within the gastric acid. However, the coating substance 10a of the L.A.B.-containing capsule 10 is intestine-soluble, and therefore, it is decomposed or dissolved within the intestine. Consequently the lactic acid bacteria contained within the L.A.B.-containing capsule 10 are released and dispersed.

In the yogurt with encapsulated lactic acid bacteria of the present invention, the liquid yogurt 2 contains 100 millions or more of lactic acid bacteria per ml , and in addition the L.A.B.-containing capsules 10 contains one million or more lactic acid bacteria per ml of the liquid yogurt 20. The survival rate of the lactic acid bacteria is as follows.

That is, within an HCl solution having a pH value of 1.2 and at 37°C ,

the lactic acid bacteria lying outside the L.A.B.-containing capsules 10 show a survival rate of 0.001% or less after a time elapse of two hours, while the lactic acid bacteria contained in the L.A.B.-containing capsules 10 show a survival rate of 10% or more.

In the case of a yogurt containing no L.A.B.-containing capsules 10, if the gastric acid has a pH value of 1.2, 10 to 100 thousand lactic acid bacteria can reach the intestine alive per ml of the yogurt. However, in the case of the liquid yogurt containing the L.A.B.-containing capsules 10, one hundred thousand or more lactic acid bacteria are added to the above described survival rate per ml of the liquid yogurt 20. If the gastric acid has a pH value of 3.5, and if the yogurt has no L.A.B.-containing capsules 10, then the lactic acid bacteria can arrive at the intestine with a survival rate of 1% or less. However, if the liquid yogurt 20 contains the L.A.B.-containing capsules 10, the lactic acid bacteria reach the intestine with a survival rate of 25% or more. Therefore, it is evident that the yogurt with encapsulated lactic acid bacteria of the present invention gives a drastically improved effect of lactic acid bacteria compared with the conventional drinkable yogurt.

When the taste, economy and the beneficial effects are considered, the L.A.B.-containing capsules 10 should be preferably put in, by an amount of 0.1 wt% to 1 wt% of the liquid yogurt 20.

The size of the L.A.B.-containing capsules 10 is about 1 to 3 mm, and therefore, they are not chewed by the teeth, but can be smoothly drunk.

Now the method for producing the yogurt with encapsulated lactic acid bacteria according to the present invention will be described as to its operation.

In the method for the yogurt with encapsulated lactic acid bacteria of the present invention, based on the first step and the second step of the first embodiment, and based on the first step and the second step of the second embodiment, first the specific gravity of the L.A.B.-containing capsules 10 and the specific gravity of the liquid yogurt 20 are made, bilaterally, same or almost same.

The preparation of the liquid yogurt 20 with the specific gravity can easily be done by adjusting kinds of, and the combination ratio of, the ingredients such as raw milk, non-fat milk, powdered milk, sugars, stabilizers and other additives, and by fermenting the combination thereof.

The required specific gravity of the liquid yogurt 20 equivalent to 0.9 to 1.5 and the specific gravity of the liquid yogurt

20 equivalent to about 0.9 to 1.5 are realized by properly adjusting kinds of, and the combination ratio of, raw milk, non-fat milk, powdered milk, sugars, stabilizers and other additives.

The preparation of the L.A.B.-containing capsules 10 with the specific gravity can easily be done by properly adjusting the kind of, and the combination ratio of, the coating substance 10a, and by properly adjusting kinds of, and the combination ratio of the hardened oil and the starch which are combined with the lactic acid bacteria 1.

The required specific gravity of the L.A.B.-containing capsules 10 equivalent to 0.9 to 1.5 and the specific gravity of the L.A.B.-containing capsules 10 equivalent to about 0.9 to 1.5 are realized by properly adjusting the kind of, and the combination ratio of, the coating substance 10a, and by properly adjusting the kind of, and the combination ratio of the hardened oil and the starch which are combined with the lactic acid bacteria 1.

As shown in FIG. 3 based on the third step of the first embodiment, and based on the third step of the second embodiment, proper amounts of the L.A.B.-containing capsules 10 are put into the lower portion 100b of the yogurt bottles 100 without encountering any resistance, the proper amounts of the L.A.B.-containing capsules

10 being decided in view of the amount of the liquid yogurt 20 to be filled into the bottles 100.

The proper amount of the L.A.B.-containing capsules 10 to be put into the bottles 100 is such that about one million lactic acid bacteria should be contained per ml of the liquid yogurt 20, thereby maximizing the operation of the lactic acid bacteria.

As shown in FIG. 4 and FIG. 5, based on the fourth step of the first embodiment, and based on the fourth step of the second embodiment, the liquid yogurt 20 is filled into the interior 100a of the bottles 100, in a state with the L.A.B.-containing capsules 10 having been put into the lower portion 100b of the yogurt bottle 100 according to the third step. If the liquid yogurt 20 is injected from the above into the interior 100a of the yogurt bottle 100, the level of the liquid yogurt 20 comes up from the bottom part 100c upward to be filled in the interior 100a of the yogurt bottle 100.

Accordingly, the L.A.B.-containing capsules 10 are dispersed gradually from the lower portion 100b of the yogurt bottle 100, to be mixed with the liquid yogurt 20. When the liquid yogurt 20 is continuously injected, the L.A.B.-containing capsules 10 are uniformly distributed within the liquid yogurt 20, owing to the whirl caused by the injection of the liquid yogurt 20.

Therefore, the L.A.B.-containing capsules 10 are, automatically, uniformly distributed in the liquid yogurt 20. Thus when the liquid yogurt 20 is fully filled into the interior 100a of the yogurt bottle 100, the uniform distribution of the L.A.B.-containing capsules 10 within the liquid yogurt 20 becomes perfect.

When the L.A.B.-containing capsules 10 are uniformly distributed in the liquid yogurt 20, since the specific gravity of the L.A.B.-containing capsules 10 and the specific gravity of the liquid yogurt 20, are made, bilaterally, same or almost same, there is no or almost no difference between the specific gravities of the two. Therefore, the uniform distribution of the L.A.B.-containing capsules in the liquid yogurt 20 can be maintained for a long time.

Accordingly, the L.A.B.-containing capsules 10 can be put into the yogurt bottles 100 in uniform amounts, so that the product quality would become superior.

As to the method for putting the L.A.B.-containing capsules 10 into the interior 100a of the yogurt bottle 100 and making them distributed in the liquid yogurt 20, if the methods

other than that of the present invention are looked into, there are found the following difficulties.

If the liquid yogurt 20 and the L.A.B.-containing capsules 10 are mixed in advance before being injected into the interior 100a of the bottles 100, there are accompanied the following difficulties, That is, the coating substance 10a of the L.A.B.-containing capsule 10 becomes sticky with water, and therefore, the L.A.B.-containing capsules 10 clog the yogurt-discharging orifice, and as a result the injection of the liquid yogurt 20 into the interior 100a of the bottle 100 becomes difficult. Further, the L.A.B.-containing capsules 10 are sucked into the vacuum path to obstruct the vacuum path, and as a result the injection of the yogurt 20 into the interior 100a of the yogurt bottle 100 becomes difficult.

Meanwhile, the method that the L.A.B.-containing capsules 10 are put in after injecting the liquid yogurt 20 into the interior 100a of the yogurt bottle 100 will be described. In this method, the L.A.B.-containing capsules 10 are not automatically dispersed into the liquid yogurt 20, but are segregated to a corner, thereby aggravating the product quality. Further, the partly dissolved L.A.B.-containing capsules 10 are stuck together to form agglomerations, thereby aggravating the product quality.

Therefore, the method according to the present invention is most desirable. That is, with the status that the L.A.B.-containing capsules 10 are put into the lower portion 100b of the yogurt bottle 100, the liquid yogurt 20 is injected into the interior 100a of the yogurt bottle 100 as done at the fourth step of the method for producing yogurt with encapsulated lactic acid bacteria of the present invention. Thus, as the liquid yogurt 20 is being filled into the interior 100a of the yogurt bottle 100, the L.A.B.-containing capsules 10 are automatically dispersed in the liquid yogurt 20, so that proper amounts of the L.A.B.-containing capsules 10 can be made contained in the yogurt bottles 100. Thus the yogurt with encapsulated lactic acid bacteria of a superior quality can be mass-produced by a simple and speedy process at a low cost.

According to the yogurt with encapsulated lactic acid bacteria of the present invention as described above, the specific gravity of the L.A.B.-containing capsules 10 and the specific gravity of the liquid yogurt 20 are made, bilaterally, same or almost same, so that the L.A.B.-containing capsules 10 can be uniformly distributed in the liquid yogurt 20. Thus the yogurt with encapsulated lactic acid bacteria is drinkable, and the chewing of the L.A.B.-containing capsules 10 by the teeth is minimized. Therefore, the lactic acid bacteria can be maximally protected from

the gastric acid, and can be made to be maximally survived until they reach the intestine. Further, the uniform distribution of the L.A.B.-containing capsules 10 in the liquid yogurt 20 can be maintained for a long time. Therefore, a high quality yogurt product can be mass-produced by a simple and speedy process at a low cost.

Further, according to the method for producing the yogurt with encapsulated lactic acid bacteria of the present invention, first the specific gravity of the L.A.B.-containing capsules 10 and the specific gravity of the liquid yogurt 20 are made, bilaterally, same or almost same. Then the L.A.B.-containing capsules 10 are put into the lower portion 100b of the yogurt bottle 100. Then the liquid yogurt 20 is injected into the interior 100a of the yogurt bottle 100, in a state with the L.A.B.-containing capsules 10 stacked in the lower portion 100b of the yogurt bottle 100. Therefore, as the L.A.B.-containing capsules 10 are filled in the yogurt bottle 100, the L.A.B.-containing capsules 10 are, automatically, uniformly dispersed in the liquid yogurt 20. Therefore, proper amounts of the L.A.B.-containing capsules 10 can be easily contained in the bottles 100 in a uniform manner. Further, the uniform distribution of the L.A.B.-containing capsules 10 in the liquid yogurt 20 can be maintained for a long time. Therefore, a high quality yogurt product can be mass-produced by a simple and speedy process at a low cost.



WHAT IS CLAIMED IS:

1. A yogurt with encapsulated lactic acid bacteria characterized in that:

lactic acid bacteria 1 are contained within acid resistant and intestine-soluble lactic acid bacteria-containing[hereinafter, referred to as "L.A.B.-containing"] capsule 10;

a specific gravity of the liquid yogurt 20 is made same as or almost same as a required specific gravity of the L.A.B.-containing capsule 10 in order that a large number of the L.A.B.-containing capsules 10 can be uniformly distributed in a liquid yogurt 20; and

a large number of the L.A.B.-containing capsules 10 are uniformly distributed in the liquid yogurt 20.

2. The yogurt with encapsulated lactic acid bacteria as claimed in claim 1, wherein the required specific gravity of the L.A.B.-containing capsule 10 is 0.9 to 1.5, and the specific gravity of the liquid yogurt 20 is about 0.9 to 1.5.



3. A yogurt with encapsulated lactic acid bacteria characterized in that:

lactic acid bacteria 1 are contained within acid resistant and intestine-soluble L.A.B.-containing capsule 10;

a specific gravity of the L.A.B.-containing capsule 10 is made same as or almost same as a required specific gravity of the liquid yogurt 20 in order that a large number of the L.A.B.-containing capsule 10 can be uniformly distributed in a liquid yogurt 20; and

a large number of the L.A.B.-containing capsules 10 are uniformly distributed in the liquid yogurt 20.

4. The yogurt with encapsulated lactic acid bacteria as claimed in claim 3, wherein the required specific gravity of the liquid yogurt 20 is 0.9 to 1.5, and the specific gravity of the L.A.B.-containing capsule 10 is about 0.9 to 1.5.

5. A method for producing a yogurt with encapsulated lactic acid bacteria, comprising steps of:

a first step for preparing L.A.B.-containing capsules 10 which contain lactic acid bacteria and are coated with an acid resistant and intestine-soluble coating substance 10a, and have a required specific gravity;



a second step for preparing a liquid yogurt 20 having a specific gravity same as or almost same as the required specific gravity of the L.A.B.-containing capsules 10;

a third step for putting the L.A.B.-containing capsules 10 prepared by the first step into a lower portion 100b of an interior 100a of a yogurt bottle 100; and

a fourth step for injecting the liquid yogurt 20 prepared by the second step into the interior 100a of the yogurt bottle 100, in a state with the L.A.B.-containing capsules 10 having been put into the lower portion 100b of the interior 100a of the yogurt bottle 100 according to the third step.

6. The method as claimed in claim 5, wherein the required specific gravity of the L.A.B.-containing capsules 10 is 0.9 to 1.5, and the specific gravity of the liquid yogurt 20 is about 0.9 to 1.5.

7. A method for producing yogurt with encapsulated lactic acid bacteria, comprising steps of:

a first step for preparing a liquid yogurt 20 having a required specific gravity;



a second step for preparing L.A.B.-containing capsules 10 which contain lactic acid bacteria and are coated with an acid resistant and intestine-soluble coating substance 10a, and have a specific gravity same as or almost same as the required specific gravity of the liquid yogurt 20;

a third step for putting the L.A.B.-containing capsules 10 prepared by the second step into a lower portion 100b of an interior 100a of a yogurt bottle 100; and

a fourth step for injecting the liquid yogurt 20 prepared by the first step into the interior 100a of the yogurt bottle 100, in a state with the L.A.B.-containing capsules 10 having been put into the lower portion 100b of the interior 100a of the yogurt bottle 100 according to the third step.

8. The method as claimed in claim 7, wherein the required specific gravity of the liquid yogurt 20 is 0.9 to 1.5, and the specific gravity of the L.A.B.-containing capsules 10 is about 0.9 to 1.5.