Solution to Problem

[0012]

As the results of intense study for achieving the above object, the present inventors provide, by using as shell materials a natural water-soluble polymer and chitosan powder dispersed therein, a capsule which does not disintegrate in stomach and small intestine after orally administrating them and which disintegrate specifically in large intestine, in which the capsules are safely and easily produced, and the capsules are obtained without using organic solvents.

[0013]

The present invention provides a capsule which disintegrates specifically in large intestine, comprising a content comprising a main agent, and a shell, covering the content, comprising a natural water-soluble polymer as a shell base material and chitosan powder dispersing in the natural water-soluble polymer.

[0014]

In order to perform the present invention preferably;
the natural water-soluble polymer may preferably be a mixture of a first natural water-soluble polymer and a second natural water-soluble polymer, wherein the first natural water-soluble polymer is selected from the group consisting of gelatin, carrageenan, starch, agar, pullulan, modified starch, alginic acid, mannan and a mixture thereof, and the second natural water-soluble polymer is selected from the group consisting of pectin, gellan gum, ~~cardlan~~ curdlan and a mixture thereof,

thereof. The second water-soluble polymer includes pectin, gellan gum, ~~cardlan~~ curdlan and a mixture thereof.

[0020]

The first water-soluble polymer may be present in an amount of 1 to 98 % by mass, preferably 2 to 85 % by mass, more preferably 3 to 70 % by mass, based on a total weight of shell after drying. Amounts of less than 1 % by mass lower strength of resulting capsules and those of more than 98 % by mass can not give acid resistance and disintegrating properties in large intestine.

[0021]

The second water-soluble polymer may be present in an amount of 1 to 24 % by mass, preferably 2 to 18 % by mass, more preferably 3 to 6 % by mass, based on a total weight of dried shell. Amounts of less than 1 % by mass do not give enough acid resistance and those more than 24 % by mass increase viscosity of shell solution and make it difficult to produce capsules.

[0022]

Chitosan can be obtained by deacetylating chitin. Deacetylation can be conducted by heating in concentrated alkali. The chitin is a polysaccharide in which N-acetyl-D-glucosamine is linearly bonded with β-1,4-bond, and chitin is contained in shell of crabs or shrimps, outerlayer of insects, skeletal structure of cuttlefishes, cell wall of fungus, such as mushrooms. The chitosan employed in the present invention can be derived either from animals or plants.

[0023]

The chitosan powder used for the capsule of the present invention has a particle size of from 90 % or more passing through a sieve having an opening of

WHAT IS CLAIMED IS:

1. A capsule which disintegrates specifically in large intestine, comprising a content comprising a main agent, and a shell, covering the content, comprising a natural water-soluble polymer as a shell base material and chitosan powder dispersing in the natural water-soluble polymer, wherein the natural watersoluble polymer is a mixture of a first natural water-soluble polymer and a second natural water-soluble polymer, wherein the first natural water-soluble polymer is selected from the group consisting of gelatin, carrageenan, starch, agar, pullulan, modified starch, alginic acid, mannan and a mixture thereof, and the second natural water-soluble polymer is selected from the group consisting of pectin, gellan gum, cardlan and a mixture thereof.

2. The capsule according to claim 1, wherein the shell further comprises a plasticizer.

3. The capsule according to claim 2, wherein the chitosan powder is derived from animal or plant and is contained in an amount of 1 to 27 % by mass based on a total weight of dried shell, and the second natural water-soluble polymer is contained in an amount of 1 to 24 % by mass based on a total weight of dried shell.

4. The capsule according to claim 2 or 3, wherein the natural water-soluble polymer is a combination of gelatin as the first natural water-soluble polymer and pectin as the second water-soluble polymer.

5. The capsule according to anyone of claims 1 to 4, wherein an intermediate layer(s) is(are) present between the content and the shell.

6. The capsule according to anyone of claims 1 to 65, wherein the

main agent is selected from the group consisting of polypeptide drug, bifidobacterium, lactobacillus, lactoferrin and nattokinase.

7. The capsule according to claim 6, wherein the main agent is selected from the group consisting of bifidobacterium and lactobacillus.

8. A method of producing the capsule according to claim 1, comprising ejecting into cooling solution a solution drop of a content solution containing a main agent from an innermost nozzle and a shell solution containing comprising a natural water-soluble polymer as a shell base material and chitosan powder dispersing in the natural water-soluble polymer from an outermost nozzle wherein
the natural water-soluble polymer is a mixture of a first natural water-soluble polymer and a second natural water-soluble polymer, wherein the first natural water-soluble polymer is selected from the group consisting of gelatin, carrageenan, starch, agar, pullulan, modified starch, alginic acid, mannan and a mixture thereof, and the second natural water-soluble polymer is selected from the group consisting of Pectin, gellan gum, cardlan and a mixture thereof.

WHAT IS CLAIMED IS:

1. A capsule for delivering a main agent to a large intestine, comprising:

an inner layer that includes a composition comprising the main agent, and

a shell that is an outermost layer of the capsule,

wherein the shell comprises a natural water-soluble polymer matrix as a shell base material and a chitosan powder that is dispersed within the natural water-soluble polymer matrix,

wherein the natural water-soluble polymer matrix comprises a first natural water-soluble polymer that is at least one selected from the group consisting of gelatin, carrageenan, starch, agar, pullulan, modified starch, alginic acid and mannan and a second natural water-soluble polymer that is at least one selected from the group consisting of pectin, gellan gum and curdlan,

wherein the first water-soluble polymer is present in an amount of 1 to 98%, the second natural water-soluble polymer is present in an amount of 1 to 24%, and the chitosan powder is present in an amount of 1 to 27%, said amounts being based on the total weight of a dried shell.

2. The capsule according to claim 1, which further comprises a plasticizer.

3. The capsule according to claim 1, wherein the chitosan powder is derived from animal or plant.

4. The capsule according to claim 1, wherein the natural water-soluble polymer is a combination of gelatin as the first natural water-soluble polymer and pectin as the second water-soluble polymer.

5. The capsule according to claim 1, wherein at least one intermediate layer is present between the inner layer and the shell.

6. The capsule according to claim 1, wherein the main agent is at least one selected from the group consisting of polypeptide drug, bifidobacterium, lactobacillus, lactoferrin and nattokinase.

7. The capsule according to claim 6, wherein the main agent is at least one selected from the group consisting of bifidobacterium and lactobacillus.

8. The capsule according to claim 6, wherein the shell comprises (c) a plasticizer.