[0012]

However, Patent Literature 1 describes that the microorganism immobilized carrier should preferably contain a resin in an amount of 70 mass % or more. This means that the carrier is resin-rich and is difficult for microorganisms to adhere to. Another problem is that carbon fibers and activated carbon fibers are costly for use as a material for the carrier.

[0013]

The microorganism immobilized carrier of Patent Literature 2 is produced by carbonizing or graphitizing a formed material of an aggregate employing one or more carbonaceous substances selected from natural graphite, artificial graphite, carbon fiber, coke, carbon black, and precursors thereof. Therefore, the bulk density of the carrier is believed to be at least 1.3 or higher, which means that the carrier will require a large amount of energy when it needs to flow inside a tank and that running cost will be high.

[0014]

Embodiments of the present invention provide a microorganism immobilized carrier that is easy for microorganisms to adhere to, and to reduce the manufacturing cost of the microorganism immobilized carrier and the running cost of an apparatus that uses the microorganism immobilized carrier.

SOLUTION TO PROBLEM

[0015]

According to a first aspect of the present invention, there is provided a microorganism immobilized carrier, including a carbon component and a resin and a cross-linking agent, having a zeta potential of from −25 mV to 0 mV, and containing microorganisms adhered to a surface thereof and/or an interior thereof, wherein the carbon component is isotropic graphite, the resin comprises a hydrophilic resin having a hydroxy group, and the cross-linking agent comprises a chemical compound having a carboxyl group and/or an aldehyde group,

wherein the proportion of the carbon component is from 50 weight % to 75 weight %, and the proportion of the resin is from 20 weight % to 40 weight %,

wherein the carbon component has a particle size of 2 μm to 500 μm.

~~[0015a]~~

~~According to a second aspect of the present invention, there is provided a microorganism immobilized carrier, including a carbon component and a resin, having a~~

~~zeta potential of from −25 mV to 0 mV, and containing microorganisms adhered to a surface thereof and/or an interior thereof, wherein the proportion of the carbon component is from 50 weight % to 75 weight %, and the proportion of the resin is from 20 weight % to 40 weight %.~~

ADVANTAGEOUS EFFECTS OF INVENTION

[0016]

Embodiments of the present invention achieve significant advantageous effects of allowing microorganisms to easily adhere to the microorganism immobilized carrier, and also reducing the manufacturing cost of the microorganism immobilized carrier or the like.

BRIEF DESCRIPTION OF DRAWINGS

[0017]

[Fig. 1] Fig. 1 is a cross-sectional SEM image of a carrier A1.

DESCRIPTION OF EMBODIMENTS

[0018]

A microorganism immobilized carrier is characterized by comprising a carbon component and a resin, having a zeta potential of from −25 mV to 0 mV, and containing microorganisms adhered to a surface thereof and/or an interior thereof.

In the present invention, the term “carbon component” refers to a carbon nano material and a carbon material other than carbon fibers.

When the zeta potential is from −25 mV to 0 mV as in the just-described configuration, the deviation from the zeta potential of microorganisms is small (for example, the zeta potential of nitrifying bacteria is about −22 mV to −27 mV), so it is easier to cause interaction. As a result, a large number of microorganisms can be adhered to the microorganism adhered carrier. Moreover, because the carrier is a mixture of a carbon component and a resin, it is possible to reduce the manufacturing cost (i.e., the material cost) of the microorganism adhered carrier. In particular, for the wastewater treatment plant that uses a large amount of microorganism adhered carrier, the effect of cost reduction is extremely significant.

In addition, the carbon component shows high physical strength and high

CLAIMS

1. A microorganism immobilized carrier, characterized by comprising a carbon component and a resin and a cross-linking agent, having a zeta potential of from −25 mV to 0 mV, and containing microorganisms adhered to a surface thereof and/or an interior thereof,

wherein the carbon component is isotropic graphite, the resin comprises a hydrophilic resin having a hydroxy group, and the cross-linking agent comprises a chemical compound having a carboxyl group and/or an aldehyde group,

wherein the proportion of the carbon component is from 50 weight % to 75 weight %, and the proportion of the resin is from 20 weight % to 40 weight %,

wherein the carbon component has a particle size of 2 μm to 500 μm.

~~2. A microorganism immobilized carrier, characterized by comprising a carbon component and a resin, having a zeta potential of from −25 mV to 0 mV, and containing microorganisms adhered to a surface thereof and/or an interior thereof,~~

~~wherein the proportion of the carbon component is from 50 weight % to 75 weight %, and the proportion of the resin is from 20 weight % to 40 weight %.~~

~~3. The microorganism immobilized carrier according to claim 1 or 2, wherein the carbon component has a particle size of 1 μm to 1000 μm.~~

~~4~~2. The microorganism immobilized carrier according to claim 1 ~~or 2~~, wherein the microorganisms are nitrifying bacteria.

~~5. The microorganism immobilized carrier according to claim 2, wherein the carbon component is graphite.~~

~~6. The microorganism immobilized carrier according to claim 5, wherein the graphite is isotropic graphite.~~

~~7~~3. The microorganism immobilized carrier according to claim 1 or 2~~any one of claims 1 to 6~~, wherein the interior thereof includes continuous pores, and the pores have a diameter of from 1 μm to 1000 μm.

4. The microorganism immobilized carrier according to any one of claims 1 to 3, wherein the chemical compound having a carboxyl group is selected from the group consisting of formic acid, acetic acid, citric acid, and oxalic acid.

5. The microorganism immobilized carrier according to any one of claims 1 to 4, wherein the chemical compound having an aldehyde group is formaldehyde.

6. The microorganism immobilized carrier according to any one of claims 1 to 5, wherein the hydrophilic resin having a hydroxy group is polyvinyl alcohol.

7. The microorganism immobilized carrier according to any one of claims 1 to 6, wherein the proportion of the carbon component is from 55 weight % to 70 weight %, and the proportion of the resin is from 25 weight % to 35 weight %.