Patent Literature 2 is a technology which efficiently performs removal of acid exhaust gas by an acid gas adsorbent and regeneration treatment of the acid gas adsorbent in the same reaction tower, specifically, the carbonate-type Mg-Al LDH is filled in the reaction tower, and the acid exhaust gas is passed through the tower to adsorb and remove the acid gas, and when the carbonate-type Mg-Al LDH changes to the anion-type Mg-Al LDH to reduce treatability of the acid exhaust gas, the technology includes operating a switching valve to switch the passage destination of the acid exhaust gas to another reaction tower, and then introducing the post-treatment gas into the reaction tower filled with the anion-type Mg-Al LDH to perform the regeneration treatment.

Citation List

Patent Literature

[0007]

PTL1: JP 6954569 B

PTL2: JP 6898627 B

Summary

Technical Problem

[0008]

An acid gas adsorbent which is used by filling it into a reaction tower and which is subjected to regeneration treatment by contact with water containing a predetermined gas in the reaction tower, as in the regeneration treatment method of Patent Literature 2, must satisfy each of the following requirements, but a method for producing the acid gas adsorbent which satisfies each of the following requirements has not yet been put into practical use.

(Requirement 1) It has a form such that the differential pressure is at a practical level when the acid exhaust gas or regenerated gas passes through the reaction tower.

(Requirement 2) It has crushing strength that does not collapse even when filled into the reaction tower and compacted.

(Requirement 3) It has water resistance that does not allow it to collapse, even when it is in contact with water during the regeneration treatment.

(Requirement 4) It has an apparent porosity that can achieve a dynamic adsorption amount required for the continuous passage of the acid exhaust gas.

[0009]

For example, the apparent porosity in (Requirement 4), the crushing strength in (Requirement 2), and the water resistance in (Requirement 3) are in a trade-off relation, and it

has been conventionally believed that it is difficult to realize an acid gas adsorbent which satisfies each of the above requirements.

[0010]

It is an object of the present disclosure to provide a method for producing an acid gas adsorbent which satisfies each of the above requirements.

Solution to Problem

[0011]

As a result of intensive studies, the present inventors have found that the above problem can be solved by hardening the acid gas adsorbent by heat treatment after granulating it into a specific form. The present disclosure is based on this knowledge.

[0012]

The present disclosure provides the following [1] to [5].

[1] In an aspect, there is provided a method for producing an acid gas adsorbent, the method comprising: a granulating step of granulating a layered double hydroxide together with a silicate binder and water added to form a granulated material having a granule size of 1 to 10 mm in the form of pellets or spheres; and a heat-treating step of heat treating the granulated material for hardening.

[2] The method for producing the acid gas adsorbent according to [1], wherein the granulating step further comprises adding a foaming agent to form the granulated material.

[3] The method for producing the acid gas adsorbent according to [1] or [2], wherein the foaming agent is pearl rock or obsidian.

[4] The method for producing the acid gas adsorbent according to any one of [1] to [3], wherein the silicate binder is sodium metasilicate.

[5] The method for producing the acid gas adsorbent according to any one of [1] to [4], wherein a heat treatment temperature in the heat-treating step is 150 to 600°C.

[6] The method for producing the acid gas adsorbent according to [1], wherein the silicate binder is a sodium metasilicate aqueous solution.

[7] The method for producing the acid gas adsorbent according to [6], wherein a concentration of the sodium metasilicate aqueous solution is 1 to 12% by mass.

[8] The method for producing the acid gas adsorbent according to [1], wherein the granulation is performed by using at least one selected from the group consisting of a rolling granulation method, a mixing and stirring granulation method, an extrusion granulation method, a compression granulation method, and a fluidized bed granulation method.

[9] The method for producing the acid gas adsorbent according to [1], wherein formation of the granulated material in the form of pellets is performed by using an extrusion granulation method.
[10] The method for producing the acid gas adsorbent according to [1], wherein formation of the granulated material in the form of spheres is performed by using an extrusion granulation method.

Advantageous Effects
[0013]

According to the present disclosure, provided can be a method for producing an acid gas adsorbent, which has a form such that the differential pressure is at a practical level when acid exhaust gas or regenerated gas passes through a reaction tower, which has crushing strength that does not collapse even when filled in the reaction tower and compacted, which has water resistance that does not allow it to collapse, even when it is in contact with water during regeneration treatment, and which has an apparent porosity that can achieve a dynamic adsorption amount required for continuous passage of the acid exhaust gas.
[0014]

According to the disclosure of item [2], by adding a silicate binder, a foaming agent, and water to LDH, mixing them, and granulating them to obtain granulated materials having a granule size of 1 to 10 mm in the form of pellets or spheres, and then heat treating them, the silicate binder hardens to enhance the water resistance, and the foaming agent foams to enhance the apparent porosity, and the diffusion of acid gas in granules is promoted, to enhance the dynamic adsorption amount of the acid gas. In the acid gas adsorbent made of granulated LDH obtained by the method of item [2], the crushing strength of 4 N or more is maintained even though the apparent porosity is enhanced. In the present description, the granulated LDH means the granulated material obtained in the granulating step and hardened by heat treatment, and is synonymous with the acid gas adsorbent.

If a filled bed height in the actual reaction tower is 3 m and a granule size of the granulated LDH is 5 mm, the load on the granulated LDH at the bottom of the filled bed is 0.34 N. Assuming a safety factor of 10, the crushing strength of the granulated LDH is sufficient for practical use if it is 4 N or more.

In the present description, the apparent porosity means volume/mass% of the void volume that are connected to the outside air of micro voids (pores) within the granulated LDH to the mass of the granulated LDH.