PATENT DOCUMENT

[0004]

Patent Document 1: Japanese Unexamined Patent Publication No. 2009-019863

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0005]

In the adsorption heat exchanger, adsorption performance may deteriorate, especially when the adsorption layer deteriorates in a short period of time.

[0006]

~~It is an object~~Embodiments of the present disclosure ~~to~~ substantially prevent deterioration of the adsorption layer in the adsorption heat exchanger.

SOLUTION TO THE PROBLEM

[0007]

~~A first~~According to an aspect of the present disclosure, ~~is directed to~~there is provided an adsorption heat exchanger ~~(20)~~ including: a base sheet ~~(26)~~; and an adsorbent ~~(41)~~ supported on the base sheet ~~(26)~~ by using a binder ~~(42)~~. The adsorption heat exchanger ~~(20)~~ satisfies at least one of a first condition in which amounts of the binder ~~(42)~~ and the adsorbent ~~(41)~~ supported after immersing the base sheet ~~(26)~~ with the adsorbent ~~(41)~~ in 10% aqueous nitric acid solution for 40 hours at an environment temperature of 70°C are 32% to 100% of amounts of the binder ~~(42)~~ and the adsorbent ~~(41)~~ supported before the immersion, or a second condition in which amounts of the binder ~~(42)~~ and the adsorbent ~~(41)~~ supported after alternately exposing to a dry state at an environment temperature of 70°C and a humidity of 20% and a wet state with water spraying over the adsorption heat exchanger ~~(20)~~, a total of 5000 times are 90% to 100% of amounts of the binder ~~(42)~~ and the adsorbent ~~(41)~~ supported before the exposure.

[0008]

In the ~~first~~above aspect, the adsorption heat exchanger ~~(20)~~ is configured to satisfy at least one of the first condition or the second condition. Thus, aging deterioration can be kept within a desirable range when the adsorption heat exchanger ~~(20)~~ is practically used.

[0009]

~~A second aspect of the present disclosure is an embodiment of the first aspect. In the second aspect~~In an embodiment of the above aspect, the adsorption heat exchanger satisfies the first condition.

[0010]

~~In the second aspect~~In the above embodiment, the adsorption heat exchanger ~~(20)~~ satisfies the first condition. Thus, aging deterioration can be kept within a desirable range when the adsorption heat exchanger ~~(20)~~ is practically used.

[0011]

~~A third aspect of the present disclosure is an embodiment of the first aspect. In the third aspect~~In an embodiment of the above aspect, the adsorption heat exchanger satisfies the second condition.

[0012]

~~In the second aspect~~In the above embodiment, the adsorption heat exchanger ~~(20)~~ satisfies the second condition. Thus, aging deterioration can be kept within a desirable range when the adsorption heat exchanger ~~(20)~~ is practically used.

[0013]

~~In the fourth aspect of the present disclosure~~In an embodiment of the above aspect, the adsorption heat exchanger satisfies both the first and second conditions.

[0014]

~~In the fourth aspect~~In the above embodiment, the adsorption heat exchanger ~~(20)~~ satisfies both the first and second conditions. Thus, aging deterioration can be kept within a desirable range more reliably when the adsorption heat exchanger ~~(20)~~ is practically used.

[0015]

~~A fifth aspect of the present disclosure is an embodiment of any one of the first to fourth aspects. In the fifth aspect~~In an embodiment of the above aspect, an overall thickness of the binder (42) and the adsorbent (41) is in a range from 20 μm to 100 μm.

[0016]

~~A sixth aspect of the present disclosure is an embodiment of any one of the first to fifth aspects. In the sixth aspect~~In an embodiment of the above aspect, the binder includes at least one of a fluorine resin, an acrylic resin, an epoxy resin, or an urethane resin, and the crosslinking agent is a hydrocarbon having at least one of a carbodiimide group, an isocyanate group, or an ester group.

[0017]

~~In the sixth aspect~~In the above embodiment, the adsorption heat exchanger can be realized by using specific materials described above as the respective components.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a piping system diagram illustrating a configuration of a refrigerant circuit in a humidity control apparatus. In FIG. 1, an illustration (A) illustrates an operation during a first operation, and an illustration (B) illustrates an operation during a second operation.

FIG. 2 is a schematic perspective view of an adsorption heat exchanger.

FIG. 3 is a side view of a heat exchanger unit constituting the adsorption heat exchanger.

FIG. 4 is a sectional view taken along line A-A in FIG. 3.

FIG. 5 schematically illustrates a binder and an adsorbent provided on a base sheet.

FIG. 6 illustrates an example where a coating layer is provided on the base sheet in