with environmental standards. These standards are much less demanding than those applied for food CO_2. As with the water purifier, this solution involves the addition of an external component.

Handling chemical reagents such as sodium hydroxide requires special care and additional equipment (storage, metering system). For example, the use of sodium bicarbonate leads to strong constraints. Indeed, this solution must be used at a temperature of between 140°C and 300°C.

Adsorption beds can be based on physical adsorption. The weak adsorption force implies easy regeneration, but also fairly weak or moderate adsorption capacities. Thus, on the one hand, it allows a regenerative process, having a long lifetime; on the other hand, it may require high amounts of adsorbents detrimental to the cost or very rapid cycle times (time comprising adsorption then the regeneration steps) requiring significant amounts of regeneration gas to be available.

For the management of the impurities in question, physical adsorption is often combined with chemical adsorption. It consists in using "dead" charges of impregnated adsorbents which react chemically with impurities. Since the regeneration of these adsorbents is often not economical on site, when the bed is saturated with impurities, the charge is replaced with a new one. By way of example, sulfur-bearing compounds containing CO_2 can be brought into contact with a support material (activated carbon, alumina, etc.) impregnated with metal oxides (FeO, ZnO, CuO, etc.). Then, the metal oxides react with sulfur-bearing compounds and create metal sulfides and water vapor.

From there, a problem which arises is that of providing an improved and economical process for purifying a feed gas stream comprising at least 90% of CO_2.

Summary

In one aspect, there is provided a process for purifying a feed gas stream comprising at least 90% of CO_2 on a dry basis, at least 20% relative humidity and at least one impurity chosen

from chlorinated, sulfur-bearing, nitrated or fluorinated compounds, comprising the following successive steps:

a) a step of subjecting the feed gas stream to catalytic oxidation in such a way as to produce a gas stream comprising at least one acid impurity chosen from HCl, NOx, SOx or hydrofluoric acid;

b) a step of maintaining the temperature of the gas stream from step a) above the highest value between the dew point of water and the dew point of the acid(s) contained in the gas downstream of the catalytic process;

c) a step of removing at least a part of the acid impurities by bringing the gas stream from step b) into contact with at least one corrosion-resistant heat exchanger in such a way as to condense the acid compounds while regulating the temperature of the gas stream exiting below the dew point of water;

d) a step of separating the acid condensates from the gas stream from step c) by means of a corrosion-resistant separator in such a way as to produce a CO_2-enriched gas stream;

e) a step of liquefying the CO_2-enriched gas stream,

f) a step of drying the liquefied stream, and

g) a step of sending the dried stream to a cryogenic unit.

In another aspect, there is provided a facility for the purification of a feed gas stream comprising at least 95% of CO_2, at least 20% relative humidity and at least one impurity chosen from chlorinated, sulfur-bearing, nitrated or fluorinated compounds, comprising, in the direction of circulation of the gas stream:

a) a catalytic oxidation unit making it possible to subject the gas stream to catalytic oxidation in such a way as to produce a gas stream comprising at least one acid impurity chosen from HCl, NOx and SOx;

b) a means for maintaining the temperature of the gas stream exiting the catalytic oxidation unit above the acid dew point;

c) a corrosion-resistant heat exchanger making it possible to condense the acid compounds of the gas stream;

d) a corrosion-resistant separator making it possible to separate the acid compounds from the gas stream in such a way as to produce a CO_2-enriched gas stream;

wherein downstream of the separator and in the direction of circulation of the CO_2-enriched gas stream, the facility further comprises:

e) a liquefier making it possible to liquefy the CO_2-enriched gas stream;

f) a dryer making it possible to dry the liquefied gas; and

g) a cryogenic unit.

Description

A solution of the present invention is a process for purifying a feed gas stream comprising at least 90% of CO_2, preferably at least 95% of CO_2, at least 20% relative humidity and at least one impurity chosen from chlorinated, sulfur-bearing, nitrated or fluorinated compounds, comprising the following successive steps:

Claims

1. A process for purifying a feed gas stream comprising at least 90% of CO_2 on a dry basis, at least 20% relative humidity and at least one impurity chosen from chlorinated, sulfur-bearing, nitrated or fluorinated compounds, comprising the following successive steps:

a) a step of subjecting the feed gas stream to catalytic oxidation in such a way as to produce a gas stream comprising at least one acid impurity chosen from HCl, NOx, SOx or hydrofluoric acid;

b) a step of maintaining the temperature of the gas stream from step a) above the highest value between the dew point of water and the dew point of the acid(s) contained in the gas downstream of the catalytic process;

c) a step of removing at least a part of the acid impurities by bringing the gas stream from step b) into contact with at least one corrosion-resistant heat exchanger in such a way as to condense the acid compounds while regulating the temperature of the gas stream exiting below the dew point of water;

d) a step of separating the acid condensates from the gas stream from step c) by means of a corrosion-resistant separator in such a way as to produce a CO_2-enriched gas stream;

e) a step of liquefying the CO_2-enriched gas stream,

f) a step of drying the liquefied stream, and

g) a step of sending the dried stream to a cryogenic unit.

2. The process as claimed in claim 1, characterized in that the heat exchanger and the separator consist of materials chosen from austenitic steel, glass or a composite resistant to nitric, sulfuric or hydrochloric acid.

3. The process as claimed in one of claims 1 to 2, characterized in that the catalytic oxidation is carried out by means of a catalytic oxidation unit resistant to sulfur and to chlorine.

4. The process as claimed in one of claims 1 to 3, characterized in that the feed gas stream subjected to the catalytic oxidation is at a temperature of at least 300°C, preferably at least 425°C.

5. The process as claimed in one of claims 1 to 4, characterized in that the feed gas stream subjected to the catalytic oxidation is at a pressure of at least 1 bar absolute.

6. The process as claimed in one of claims 1 to 5, characterized in that the feed gas stream comes from a monoethylene glycol unit, from washing of CO_2 by absorption, from a monoethylene glycol synthesis unit, from a biofermentation or any other process generating a CO_2-rich stream.

7. The process as claimed in one of claims 1 to 6, characterized in that, in step c), water is used as refrigerant within the heat exchanger.

8. A facility for the purification of a feed gas stream comprising at least 95% of CO_2, at least 20% relative humidity and at least one impurity chosen from chlorinated, sulfur-bearing, nitrated or fluorinated compounds, comprising, in the direction of circulation of the gas stream:

a) a catalytic oxidation unit making it possible to subject the gas stream to catalytic oxidation in such a way as to produce a gas stream comprising at least one acid impurity chosen from HCl, NOx and SOx;

b) a means for maintaining the temperature of the gas stream exiting the catalytic oxidation unit above the acid dew point;

c) a corrosion-resistant heat exchanger making it possible to condense the acid compounds of the gas stream;

d) a corrosion-resistant separator making it possible to separate the acid compounds from the gas stream in such a way as to produce a CO_2-enriched gas stream;

wherein downstream of the separator and in the direction of circulation of the CO_2-enriched gas stream, the facility further comprises:

e) a liquefier making it possible to liquefy the CO_2-enriched gas stream;

f) a dryer making it possible to dry the liquefied gas; and

g) a cryogenic unit.

9. The facility as claimed in either of claims 8 and 9, characterized in that the heat exchanger and the separator consist of materials chosen from austenitic steel, glass or a composite resistant to nitric, sulfuric or hydrochloric acid.

10. The facility as claimed in one of claims 8 to 9, characterized in that the catalytic oxidation is carried out by means of a catalytic oxidation unit resistant to sulfur and to chlorine.