Reliable solutions by dedicated people

BEVERAGE INDUSTRIAL GASES OIL & GAS DESALINATION CUSTOMER SERVICE AIRCODIET

Advanced Amine

Technology

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With Advanced Amine Technology from Union Engineering, carbon dioxide can be captured from any gas stream based on the combustion of fossil fuels, including but not limited to coal, heavy fuel oilfired steam boilers, and natural gas-fired combustion engines.

Moreover, the technology can be used to capture carbon dioxide from non-power generation sources, like lime kilns.

The capture plants from Union Engineering are based on the most well-proven absorption technology currently available on the market, namely high concentrated monoethanolamine (MEA). MEA is a primary amine that reacts readily with carbon dioxide. Since the reaction is purely chemical absorption, it works well with gas streams having low partial CO_2 pressure, as is the case for flue gases.

Once the carbon dioxide is captured in the MEA solution it is transferred to a stripping system. Here it is again released from the MEA solution by increasing the temperature of the solution to a point where the chemical reaction that took place in the absorber is reversed.

Having started as a gas with a low concentration of carbon dioxide (depending on the type of fuel used the CO2 will be in the range of 3% to 30%), the gas being released from the stripper is a highly concentrated stream containing roughly 99% pure carbon dioxide. This stream can either be used directly in gaseous form or be further purified and liquefied to meet the strictest requirements for food and beverage grade carbon dioxide in accordance with specifications from regulators like the International Society of Beverage Technologists (ISBT).

Purification column is the final purification step, consisting of a distillation column which enables separation/blow-off of non-condensable gasses, thereby reducing O_2 content in the final product to max. 5 ppm (v/v) and obtaining corresponding CO_2 purity of higher than 99.99% (v/v).

The electrical system for the CO_2 generaing plant consists of a combined MCC and control panel. From the control panel, which comprises the latest PLC technology, the plant is operated and monitored, ensuring easy and continuous trouble-free operation.

The plant is started by an automatic start sequence and the operation is fully automatic. The entire process is easily surveyed on the operator panel, showing the status of all drives, readings of all transmitters and alarm warnings, which will also be indicated by audible alarm.

All instruments installed on the skids are wired to junction boxes or remote I/O boxes and tested in our workshop prior to shipment, thus reducing installation and commissioning time on site.

The plants are designed for high efficiency, availability and reliability through components selected for long life and 24/7 operation.

Advanced Amine Technology plant traditional sizes (measured as liquid food-grade CO_2 produced):

1000 - 4500 kW/h

Other sizes are available and more customised solutions

With a well-integrated on-site utility setup, any beverage manufacturer has greater control of critical utility supplies, including carbon dioxide supply.

General description of Advanced Amine Technology

The plant is based on extraction of CO_2 from an existing flue gas source resulting in significantly operating saving compared to traditional CO_2 Generation Plants. Basically any available flue gas source can be used the MEA solvent is continuously purified by means of a unique system allowing for high O_2 feed gas content which in other installations would result in excessive solvent degradation and plant corrosion. No use of inhibitors is needed and the solvent used constitutes a 35 w/w % MEA solution which is easily available.

The flue gas is directed to a flue gas scrubber, in which the gas is cooled and water condensed. Any SO_2 present in the flue gas will be removed by means of a chemical reaction with sodium carbonate (soda ash). The soda ash is automatically added to the scrubbing water by means of pH control.

After cooling and scrubbing, the gas is led via an exhauster through an absorber, in which the gas flows counter-current to the MEA solution flow. By chemical reaction, the MEA solution absorbs the CO_2 from the flue gas. The MEA solution containing the absorbed CO_2 (referred to as rich MEA solution) is first pressurised and heated in a heat exchanger and then led to the NOxFlash column. Here most of the contaminants are removed from the rich MEA solution by flashing to the absorber pressure.
Further heating is added to the bottom of the NOxFlash column for further reduction of the contaminants in the MEA solution. This optimises the process yield to the best possible CO_2 product without any use of expensive chemicals (Union patent pending).

The rich MEA solution is pumped to a stripper, where the CO_2 is released from the MEA solution by means of the combustion heat generated in the MEA heater. The CO_2 depleted MEA solution (referred to as lean MEA solution) is recycled to the absorber. After exiting the top of the stripper, the CO_2 rich gas is cooled in a gas cooler and washed in an after-scrubber for removal of potential MEA carry-over. The gas is then compressed in two stages to approx. 15-18 bar(g) by the CO_2 compressor.

Prior to liquefaction, the gas is dried to a dew point of approx. -60°C (10 ppm v/v H_2O) in the dehydrator. Regeneration is done automatically by electrical heating and use of dry purge gas from the CO_2 condenser. Traces (if any) of acetaldehyde are also removed in the dehydrator. The CO_2 gas then passes through an activated carbon filter for removal of any odour substances.

To remove the last non-condensable gases, the CO_2 gas first passes a reboiler in the purification system (type PUR-D). It is then condensed at a temperature of approx. -27°/-21°C in a CO_2 condenser, where the non-condensed gases are purged off. Finally, the liquefied CO_2 is led through the distillation column to an insulated storage tank.

A refrigeration unit, controlled by the CO_2 pressure in the CO_2 condenser, supplies the matching refrigeration capacity. The liquid CO_2 is stored under a pressure of approx. 15-18 bar(g) and a corresponding temperature of approx. -27°/-21°C. During a non CO_2 production period, the refrigeration unit is able to operate independently of the rest of the CO_2 plant in order to maintain the correct CO_2 storage tank temperature/pressure.

The CO_2 produced has a purity higher than 99.99% (v/v) and fulfils quality standards as a food/beverage ingredient.

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