MOLSON COORS

CO_2 RECOVERY UNIT

A DURABLE, SUSTAINABLE SOLUTION

One of the United Kingdom's largest and most modern carbon dioxide (CO_2) recovery plants at a brewery is in operation at Molson Coors with a 24/7 capacity of 2,000 kg/h CO_2.

Molson Coors Brewing Company brews, markets and sells a portfolio of leading brands across North America, Europe and Asia. It operates in Canada through Molson Coors Canada; in the U.S. through MillerCoors. In the UK, Molson Coors (UK & Ireland) has over 2,000 employees and breweries in Burton on Trent, Alton and Tadcaster. Its portfolio includes Carling, the UK's best selling lager for three decades, Coors Light, Grolsch, Worthington's, Caffrey's, Corona, Cobra and a range of speciality beers.

The Burton Brewery, a fusion of two neighboring breweries, has a capacity of five million UK barrels per year. Even today, the tradition of two breweries in the same town on the same site remains. Molson Coors (UK & Ireland) continues to brew beer in separate production sites, now called North and South.

CO_2 – an essential brewing element
After entering the UK brewing market in 2002 Molson Coors continued to purchase CO_2, which at the time was mainly derived from non-natural and old chemical production processes. Against this backdrop, Molson Coors looked into a CO_2 recovery system in 2005. But because CO_2 price, quality and availability were acceptable in the UK at that time, the investment was postponed.

In 2008, several major CO_2 production facilities closed and, as a result, many beverage producers faced bottlenecks. Due to the shortage, CO_2 became very expensive.

In 2009, Molson Coors restarted the CO_2 recovery system project with clear goals. First, the brewer wanted to be CO_2 self-sufficient. Carbon dioxide is essential for beer production. Molson Coors did not want to risk running out of CO_2, a lesson they learned during the UK's CO_2 shortage. Secondly, they wanted a solution that was energy efficient. Moreover, the system had to be durable as this was a long-term investment.

Molson Coors needed a single solution to meet the CO_2 needs for both the North and the South breweries. This posed a special challenge for the CO_2 collection and distribution system. The CO_2 is collected in only one of the two breweries and then delivered to all operating sites. At the South site, for example, can filling is located, while the bottle and keg filling is at the North site. That means long distances for the CO_2 to travel.

The solution was to source the green short-cycle CO_2 generated during fermentation. Pentair Haffmans had the responsibility for processing, storage and evaporation of the CO_2. Moreover, the company's expertise was essential for the entire process chain, from the collection at the fermenters through transporting the CO_2 to where it is used.

KEY FACTS

Location
Burton on Trent
United Kingdom

Application
Brewery

Capacity
2,000 kg/h CO_2

Start-Up
2010

The road to "Green CO_2 "
During beer fermentation, nearly equal amounts of alcohol and CO_2 are generated.

Roughly, 2.5 kg CO_2 per hectoliter of beer can be recovered from an original wort of 12 degrees Plato. Considering a beer of 13 degrees Plato this would amount to roughly 2.9 to 3 kg of CO_2.

Before the green CO_2 is used, it must be purified. The CO_2 generated during fermentation contains several impurities including dimethyl sulfide (DMS), hydrogen sulfide (H_2S), and oxygen (O_2) that must be removed as they have a negative effect on taste, odor and shelf life on the finished product.

A state-of-the-art CO_2 recovery system is a cost-effective, sustainable way to purify the CO_2 to food-grade quality. Such a system includes the following steps:

- Foam separator
- Gas balloon
- Gas washer
- CO_2 compressor
- Activated carbon filter
- Dryer
- CO_2 condenser
- Storage tank

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Collection of the CO_2 is mainly from the top of the fermenters. Other sources are the maturation vessels and the bright beer tanks. The necessary inlet purity for the treatment of the CO_2 depends on the installed technology and ranges from 95 to 99.7 percent.

Up to 60 percent energy recovery

Most of the energy consumed during the CO_2 recovery process is used during gas compression, removal of off-flavors, to dry the gas, and during CO_2 liquefaction and vaporization. However, there are a number of reverse processes in the recovery system. Carbon dioxide, for example, is first liquefied and in the next step vaporized. This means that a great amount of energy must be extracted, while later almost the same amount of energy is added again. Another example is the compression of the gas. Before the gas is sent to the brewery, the pressure must be slightly reduced. By linking such processes together, both inside and outside of the recovery process, costs can be considerably reduced and the net energy use for CO_2 recovery can be reduced by up to 60 percent.

The heat recovery system, type LiquiVap, makes it possible to liquefy the CO_2 while using very little energy for cooling. If CO_2 production and consumption take place simultaneously, there is an immediate energy saving because the extracted CO_2 can be used to liquefy the CO_2. At times when there is no CO_2 production or consumption, it is possible to liquefy or vaporize CO_2 in the traditional way, for example, at the start of the week when the fermentation has not yet started, but the beer is already being bottled, canned or put in kegs.

By using the LiquiVap system whenever possible, Molson Coors saves energy in a number of processes, including CO_2 condensation energy with the release of heat to the centralized brewery cooling system linked to it, when pre-cooling the cooling water, and as the energy necessary to vaporize CO_2. However, the heat recovery system cannot cool more than is actually evaporated. For example, the capacity of a plant like the system installed at Molson Coors is 2,000 kg/h.

During production, only 1,000 kg/h CO_2 is needed and therefore only 1,000 kg/h can be cooled down by the LiquiVap system. For the remaining 1,000 kg/h a separate cooling method is necessary. The control system accurately regulates the plant so it uses only the energy for the 1,000 kg/h. Optimum energy efficiency is always reached – and up to 60 percent of the energy consumption can be saved. Water consumption is also significantly reduced.

In operation since mid 2010, Pentair Haffmans' CO_2 recovery system encompasses production, processing, storage and distribution at Molson Coors' Burton-on-Trent brewery and runs 24/7. A five-year Service Level Agreement between Molson Coors and Pentair Haffmans was put into place in 2011 to maintain the high performance level.

Gas washer column and CO_2 collection balloon

LiquiVap CO_2 condenser

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