Cold and Oxidation-free

Automatic hop extract dosage in practice

When fully automating and optimising the efficiency of brewhouses, many breweries consider retrofitting a fully automated hop extract doser. Now a space-saving, easy to use, quickly installed and cost-effective system has been put into operation by dosing specialists CoolSystem/ViscoTec at a brewery in Central Germany.

For decades hop extract has been warmed, transferred from one container to another exposed to oxygen, stirred and if necessary the stirring kept up at almost 50°C for several days. The firm of ViscoTec and CoolSystem has developed a system by which the hop extract is conveyed free of oxygen and at room temperature, precisely and simply.

Project description and technical solutions

The brewhouse to be automated, in a brewery in Central Germany, was supplied with external boilers by the firm Hupmann/GEA Brewery Systems in the early 90s. The goal was to replace can dosing with fully automated dosing from 200 kg of hop extract. Another specific challenge in the project planning was that it transpired that it would not be possible to mount the dosing system close to the dosing point.

Due to the limited amount of floor space in the emptying and dosing station (see Fig 1) of 1.2 x 0.9 m, an installation location was found in the passage from the brewhouse to the fermentation cellar, which allowed for adequate barrel logistics. This installation option made it necessary to have a 26 m-long, inclined dosing pipe filled with hop extract.

Since the oxygen-free conveyance of the extract means that there is no need to empty the pipeline, there are always around 45 kg of extract in the dosing pipe. Despite the fact that this is not the best prerequisite for exact dosing, the dosage and repeat accuracy are excellent. The extract is dosed directly into the wort pipeline. A flap valve integrated into the brewhouse control system prevents unintentional dosing.

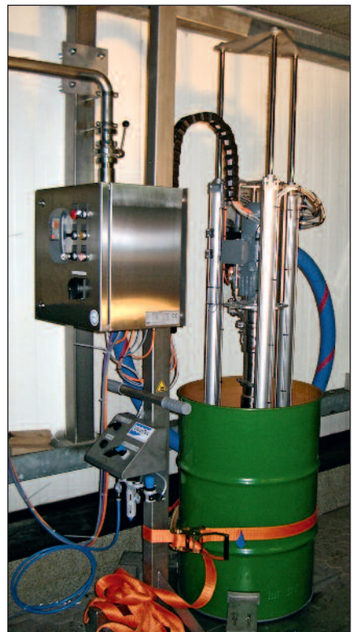

Fig. 1: The equipment comprises a frame with pneumatics, an eccentric screw pump with following plate and a parametrised frequency transformer with Profibus Module.

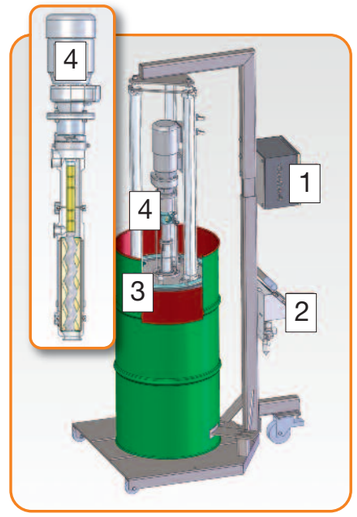

Fig. 2: Technology of the emptying station

System structure

The newly developed hop extract dosing system for 200 kg barrels empties and doses fully automatically. The extract is conveyed using an eccentric screw pump. The product is gently conveyed in an oxygen-free, cold state, tested to minus 3°C.

Gerd-Albrecht Graf

Qualification as brewer and malter, graduated as qualified Master Brewer from TU München-Weihenstephan, since 2012 exclusive brewery sales partner of ViscoTec Pumpen und Dosiertechnik GmbH (www.cool-hopextract-dosing.com)

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The equipment is compact, uses little energy, is basically maintenance-free and reasonably priced. The functions described here are shown in videos at **www.cool-hopextract-dosing.com**

The emptying station (see Fig. 2) comprises (1) electric control, (2) pneumatic control, (3) following-plate, (4) eccentric screw pump with lifting system.
The following-plate (3) is applied to the cold hop extract pneumatically and either manually or fully automatically deaerated.
The eccentric screw pump (4) sucks the product from the surface and transports it through a 3 m-long hose either to the brew kettle, to a holding tank or directly into a wort pipe.

The amount to be conveyed is volumetrically determined by the rotational speed of the pump. When the barrel is changed, the amount already conveyed is recorded in the control system to ensure that the dose introduced into the brew is always exact.

Technical data

Dimensions of the machine: 0.9 x 1.2 x 2.5 m (w x l x h)

Dosing speed: 2 to 12 kg/min

Tolerance, dosage accuracy measured at the pump: +/- 1 %

Perfect barrel emptying: less than 1% residue in the barrel

System is designed for processing ethanol, CO2 and Light Stable Kettle Extract (LSKE). For Isomerised Kettle Extract (IKE) an eccentric screw pump is available as an immersion pump.

Ethanol Extract, Isomerised Kettle Extract (IKE) and Light Stable Kettle Extract (LSKE) do not need to be homogenised

CO2 Extract should be homogenised with a drum hoop mixer

Electrical connection: 230 V, 50 Hz, 1 Phase, 0.55 KW with PROFIBUS Module

Compressed air pressure: 6 bar

Integrating the system

The emptying and dosing equipment is outfitted with a Profibus Module and communicates with the existing brewhouse control system (see Fig. 3), in this case supplied by the firm ProLeiT. The brewhouse control systemcalculates the volume of hop extract from the composition and alpha acid content of the extract, passes this figure on to the pump control system and dictates when the dose is to be introduced.

The pump control system relays the dose already introduced during the dosing process. In this way the exact dosage is monitored by both the pump control system and the brewhouse control system. The brewer will still be informed of an imminent barrel change, the amount left in the barrel and any peculiarities. Due to the system's integration into the brewhouse control system, batch tracking and uninterrupted quality assurance are automatically available. A change in the dosage when changing to a new beer type is dictated by the composition, so operating errors are ruled out.

Optimising the dosage

The hop extract supplier Hopsteiner, the brewery and the system supplier collaborated to calculate the optimum dosing point, the dosage per second and the dosing moment. Since the non-polar hop extract has to be mixed with wort as a polar medium, it is advantageous to introduce the dose as early and as accurately as possible. With the special ViscoTec dosing pump it is possible to introduce volumes upwards of 50 ml precisely, continually and without pulsation directly into the wort flow.

The hop extract is introduced cold and oxidation-free directly to the suction side of the external boiler pump. The fast-moving pump impeller of the centrifugal wort pump encourages the speedy homogenisation of the hop extract and thus increases the yield of iso-alpha acids in the finished beer. The hop extract at a volume flow of 50 ml/s is added to the wort volume flow at 300m3/h. Dosing begins when the external boiler pump is started, that is, at the earliest possible moment.

Fig. 4: Savings in extract thanks to effective emptying of residue

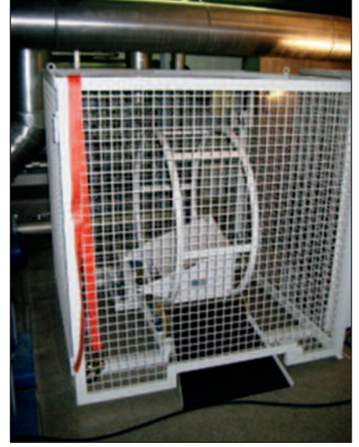

Fig. 5: Drum hoop mixer for homogenising the CO2 extract

Using the optimal dosing, as described above (see Fig. 4), of 50 ml of extract to 80 l of water[0] per second and with the support of the centrifugal pump, a fine suspension can be achieved. Introducing the extract immediately extends the period of contact by ca. 10 minutes. This measure has increased the extract yield by ca. 8 per cent.

Instead of dispensing thousands of cans, now only a few 200 kg barrels are necessary. Not only is the cost of the cans themselves eliminated but the manual handling and opening of the cans as well. Another positive side effect is increased safety, as the brewers no longer have to touch the hot containers or the wort.

Homogenising CO_2 extract

With CO_2 extract the resin fraction separates from the hop oils immediately after filling, which means that unlike ethanol-extract this extract is not homogenous when it arrives at the brewery. Working with the firm NATECO$_2$, the drum hoop mixer (see Fig 5) was tested and found to be the best solution for homogenising CO_2 extract.

Summary

The installed equipment completely fulfils the requirements with regard to dosing precision, easy handling, fast barrel changing, unburdening the brewer, low operation costs, reasonable purchase price and optimising extract yield. The ROI with this installation is short so the investment makes economic sense.
The experience gained with the system described here illustrates that investing in a fully automatic ViscoTec hop extract doser is interesting from a business point of view even for a relatively small volume of hop extract, if the yield of iso-alpha acids with the existing system is less than 30 per cent and/or the price of hop extract rises significantly.

CoolSystem at the drinktec:
Hall B2, Stand 534

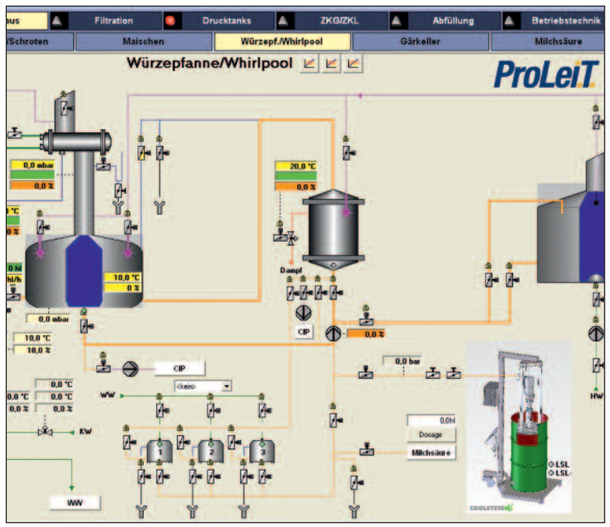

Fig 3: Integration of the system by ProLeit