

Application report

Phase Separation Yeast / Beer

This application leads us into the fermentation cellar of a brewery. It can be divided into a fermentation and a storage cellar with separate fermentation and storage tanks. If the complete fermentation and storage is carried out in one tank, the process is called single-tank process. In each case it is important to remove the greatly multiplied yeast from the tank between primary fermentation and storage. This is also called yeast harvest.

Benefits

Loss of product is one of the biggest problems in any production process. By avoiding these losses, the brewery can optimize their capacity and save money. In many cases, the liquid (wort), which will finally become beer, undergoes many process steps before a first monitoring is carried out. In other words: each process step which is not monitored will result in a loss and reduce the profitability, and should thus be avoided. We are talking about an actual loss of product of 4–10 %!

«By re-using residual beer and return beer in the brewing process, breweries can minimize their internal loss of beer. This more efficient design of the brewing process moreover saves resources and lowers the costs for waste water. The quantitatively most important streams of residual beer in the brewery are the yeast beers and the first running and after running from filtration with an annual volume of > 5 % of the total output.» (Source: Final report of the research project B77).

Typical application

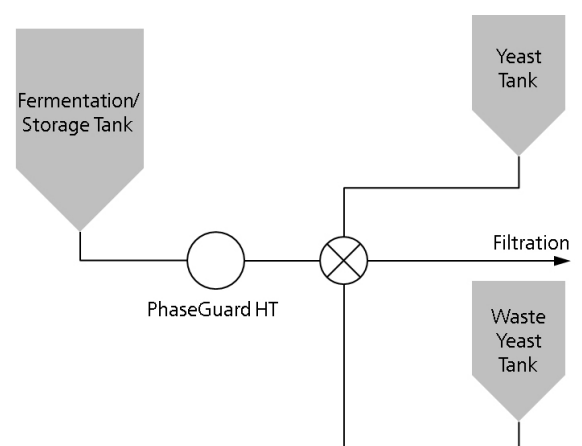
Fermentation is one of the most important process steps in the production of beer.

The fermentation tank contains a mixture of yeast and beer. Normally, the fermentation time amounts to 7 days followed by 1–3 weeks of secondary fermentation in the storage tank.

The fermentation process can be carried out as a single-tank process (also called unitank process) and the dual-tank process. In the single-tank process, the tank is used for fermenting the beer as well as for its storage; in the dual-tank process, the beer is pumped into the storage tank after primary fermentation. In both processes, the yeast has to be removed from the tank after primary fermentation. The yeast is then either collected in the harvest yeast tank (and is then used again for a next fermentation), or in the waste yeast tank (as raw material for animal feed or used yeast processing in the cosmetics or food industry).

If the primary fermentation is completed, the temperature in the tank is lowered and the yeast cells settle in the conical part of the fermentation tank. Now the yeast harvesting is carried out. The valve at the lower part of the conical tank is opened so that the yeast can be fed into the yeast tank. This occurs very slowly in order to avoid the formation of a funnel in the yeast which is still in the fermentation tank and thus to avoid undesirable dilution (DN65: approx. 20 hl/h, DN80: approx. 30 hl/h, DN100: approx. 50 hl/h). Our PhaseGuard HT is designed to quickly and accurately detect the phase transition yeast/beer to allow a yeast harvest with a high dry matter content (8–12 %; determined by thermal drying of the yeast). The liquid proportion in the waste yeast is synonymous with loss of beer when that yeast is sold.

This separation process is repeated during storage of the beer since it still contains suspended yeast. The amounts of yeast separated during these processes are continually smaller; this yeast is then always waste.

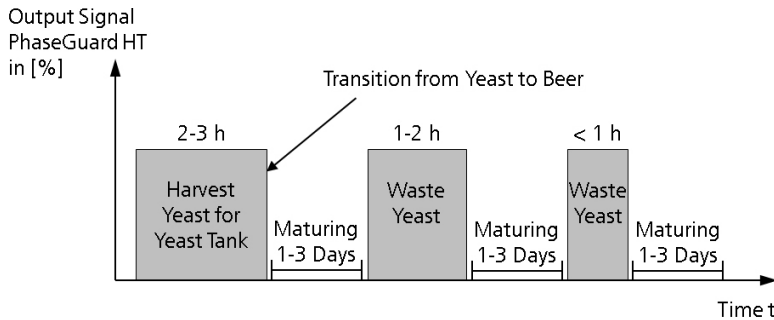


Fermentation and yeast harvest

Application report

Phase Separation Yeast / Beer

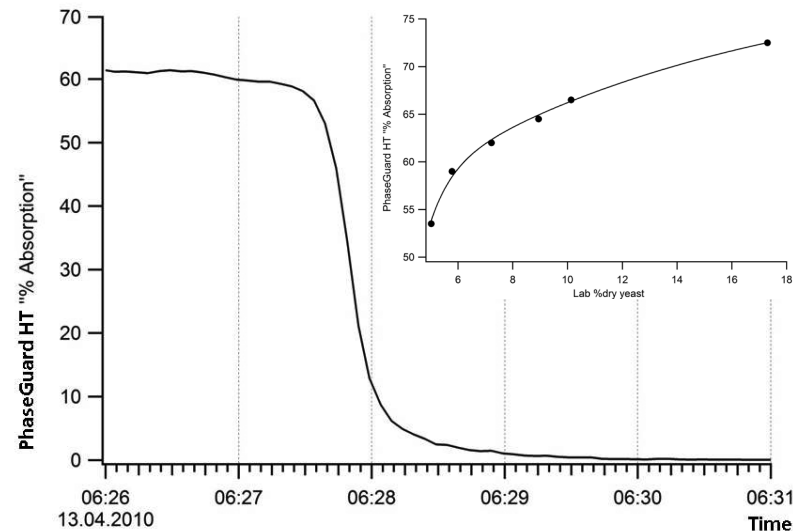
In the following diagram, several yeast collection processes in a fermentation/storage tank are shown. You can see that the PhaseGuard HT is suitable for the yeast harvest as well as for the separation of the waste yeast. At the separation of the waste yeast, the respective duration of the process becomes shorter since the amount of yeast decreases. The level of the signal is not affected. It is not important whether a single-tank or a dual-tank process is used during fermentation and storage.



Yeast collection process

Practical measurement (example):

This diagram shows the typical progress of a phase transition from yeast to beer, which takes place within about 30 seconds. The PhaseGuard HT quickly and accurately detects this transition and allows its user to determine an individual optimum switching point (compromise between loss of beer and proportion of beer in the yeast tank).



Phase transition from yeast to beer

Typical example to calculate the reductions:

In a brewery, two litres of yeast result per hl of beer sold. For a brewery with an annual production of 500 000 hl that means an amount of yeast of 10 000 hl. Depending on the recovery system, a beer yield of up to 75 % can be achieved.

The yeast harvested has a dry matter content of 8–12 %; the «rest» is beer. To allow a useful and efficient further processing of this yeast, a clean phase separation is essential. Otherwise, considerable amounts of beer are sold together with waste yeast diluted with too much beer. The production costs per hl beer are around 40 €/hl.

SIGRIST product and configuration for this application:

- PhaseGuard HT
- Optionally: SICON control unit

Parameter settings

- Limit formation of the mA signal in the PLC (provided by the customer)
- Output of the switching point at the PhaseGuard HT via two opto-couplers

Advantages of the SIGRIST PhaseGuard HT

- LED light source, only 2 W power consumption
- No purge air required
- Sealless design
- Extremely low maintenance costs



PhaseGuard HT