THE MEURABREW: the brewhouse of the future!

First industrial results

MEURABREW

Meura's Continuous Brewhouse

In the last two decades, major advances in performance have been achieved in batch brewhouses mainly by using fine milling technology. Despite these improvements, breweries keep asking for further productivity increases together with a reduction of utilities consumption and waste disposal. The likelihood of further improvements using the current method of batch brewing is limited. Only a conceptual change can respond to the current and future demands of the brewing industry. In 1998, Meura, Traditionally a Pioneer, thus started a research programme to develop a continuous brewhouse, called the "MEURABREW". The first industrial plant was successfully started up in May 2007. A second plant was commissioned in Suzhou (China) in April 2008. And several other projects are under discussion.

HISTORY OF THE MEURABREW DEVELOPMENT

In 1998, Meura started the development of the continuous brewing concept. A complete pilot plant was installed in 1999.
Based on these successful pilot trials, Meura's engineering department began designing an industrial plant in 2004. With information gained, it was possible to start looking for a "first mover".

In 2005, the discussions started with Jan Martens in Belgium, leading to an order in June 2006. The first operation of the Meurabrew on an industrial scale of 200 hl/h wort (up to 20°P) took place on 12 May 2007. In January 2007 a similar order was obtained for a plant in Suzhou (China).

CONTINUOUS versus BATCH

In general, continuous processes are more energy efficient, easier to control and consequently lead to a lower production cost. As far as the brewhouse process is concerned, here are the main specific reasons to develop a continuous brewhouse:

Reduced peak consumption of utilities

The most important utilities consumed in the brewhouse are steam and cooling liquid. In a batch brewhouse, different batches are processed at the same time and consequently lead to a large steam peak. The wort cooling takes place normally within 50-60 minutes, which means peak consumption during that period.

Reduced energy and extract losses

All pipes and vessels stay continuously filled with mash or wort, which makes it possible to avoid the heat and extract losses experienced in batch processes.

Reduced waste disposal

During the production no drainage occurs, which considerably reduces the wastewater volume.

Limited space requirements

The most state-of-the-art batch brewhouses only brew about 14 batches a day. About every 100 minutes one batch is produced, which consequently requires vessels that can handle the necessary volumes. Brewhouse vessels of a large size also mean large piping diameters, large-sized valves and pumps at the high flows. A continuous flow significantly reduces the plant dimensions.

Easy process control

In practice, it is difficult to have the same process conditions between similar batches. The fouling of the mash tun(s) and wort kettle during production change the heating performance of these vessels and thus change the process conditions. Consequently a significant variation in for example colour or bitterness is noted between batches of the same brands. These fluctuations are avoided with a continuous process.

Table I shows a comparison between a batch brewhouse at 12 brews/day and a continuous brewhouse for a brewery with 3 million hl final capacity.

Table I: Comparison of a 3 million hl final capacity at 12°P

	Batch brewhouse	Continuous brewhouse
Capacity	12 brews/day of 400 hl cold wort at 20°P	200 hl/h of cold wort at 20°P
Pumps		
Mash	1 500 hl/h – 15 KW	180 hl/h – 5.5 KW
Wort	3 600 hl/h – 30 KW	225 hl/h – 4 KW
Utilities		
Steam peak flow	14 T/h	3T/h
Water peak flow	650 hl/h	220 hl/h
Electricity installed	375 kW	250 kW
Electricity peak	300 KW	200 KW
Peak cooling power	4,650 kW	2,200 kW

Continuous brewing

View on a 3 000 000 hl final beer continuous brewhouse.

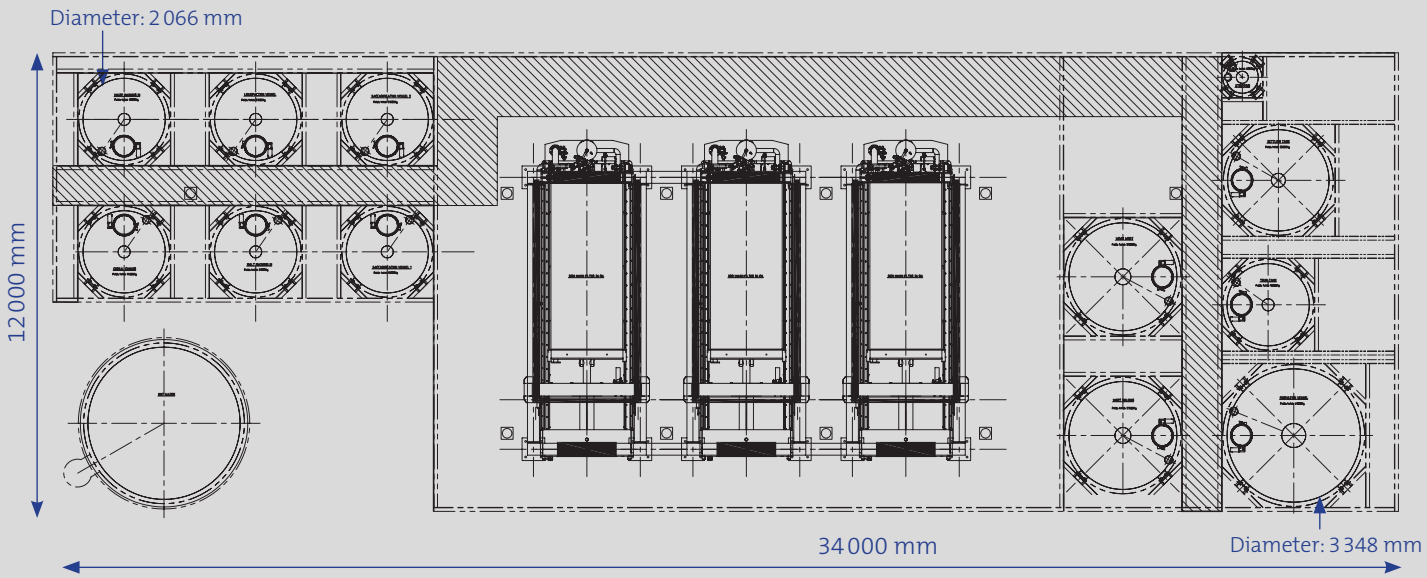

Fig. 1
The Meurabrew: from milling up to mash filtration

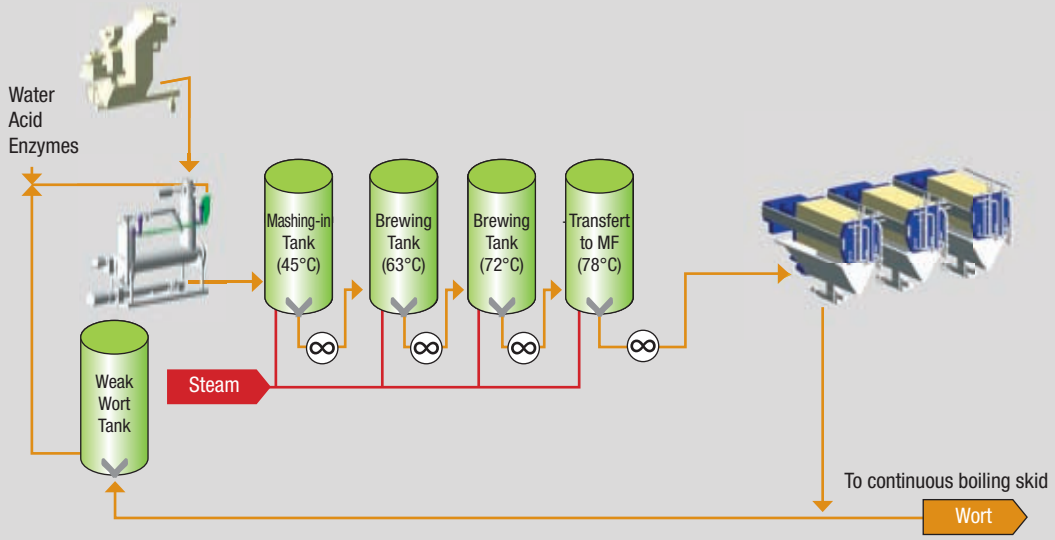

Figure 1

shows the first part of the Meurabrew from milling till mash filtration using the following technologies:

- **Milling:** Meura's Classicmill or Carbomill is perfectly able to work in a continuous system.
- **Mashing-in and mashing:** The Mechamasher provides a continuous lump free mash that will be pumped to the mash unit. Different mash vessels keep the mash at a constant temperature with a specific holding time. A continuous flow passes through these vessels and ensures the brew diagram. Thanks to the Aflosjet system, Meura's patented direct steam heating system, these vessels do not need to be cleaned during the production process. Fool-proof mash heating is required for the continuous process. Classical double jackets are thus not an option.
- **Mash Filtration:** Wort filtration is performed with Meura 2001 mash filters equipped with Meuraclean. Three parallel filters ensure a regular continuous filtration process. Consequently all the renowned advantages of the Meura 2001, like for example the highest yield, wort quality and density, are retained with the Meurabrew.

THE MEURABREW

The Meurabrew: part of the "brewery of the future" concept

The first industrial Meurabrew installed in Bocholt (Belgium) is part of the "brewery of the future" concept, which is a combination of the process technologies of Meura (brewhouse) and Norit (cold block including membrane filtration and utilities) and continued with a Sidel PET bottling plant. The brewery of the future at Martens is a 3 million hectolitrers brewery, combining the most innovative technologies on the market. Measuring only 200 metres by 350 metres, the plant houses raw material storage and treatment, milling room, brewhouse, fermentation, beer filtration, yeast management, wastewater treatment and all utilities. The entire operation is managed by 45 people, with just two staff members per shift to run the brewing operation from raw material intake to filtered beer during the daytime.

This first industrial Meurabrew is designed to produce 200 hl/h cold wort at a density up to 20°P.
The continuous brewhouse is connected to a batch fermentation process. Every 24 hours one fermenting vessel of 4 800 hl net is filled.

Principle of the Meurabrew

In fact, the Meurabrew is a combination of Meura's proven technologies that have been adapted to a continuous set-up.

MEURABREW: FIRST INDUSTRIAL RESULTS

The first industrial results of the new brewery are quite promising and confirm the assumptions that were made. All the figures have been recalculated to hl of final beer. The final beer has an 11.5°P original gravity. The figures given were obtained from a measuring campaign during July 2007. That was only two months after the first production day and these figures may improve even further.

Water consumption

Depending on the type of process and bottling, a state-of-the-art brewery consumes between 4 and 6 hl of water per hl of beer sold.

Table II shows the water consumption at the beginning of the year 2008.

Table II: Water consumption per hl final beer		
Brewing and process water	2.56	hl/hl
Process water bottling	0.25	hl/hl
TOTAL	2.81	hl/hl

At this moment, no system to re-use wastewater is in operation. However, in the future the brewery intends to partially treat wastewater and re-use it for the production. It is estimated that the final water consumption after that implementation will be below 2.0 hl/hl.

Fig. 2
The Meurabrew: continuous wort boiling and hot trub separtion

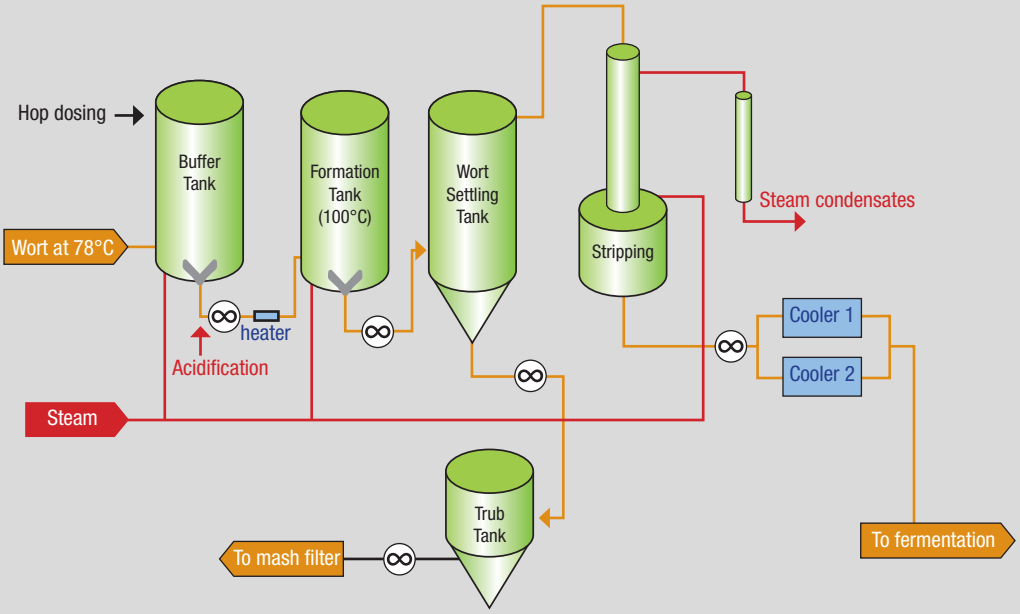

Figure 2

shows the second part of the Meurabrew using the following technologies:

- **Wort boiling and trub recovery:** As the first step, the wort is in-line heated up to its boiling temperature. Added hops are also homogenized. An adapted agitator ensures sufficient mixing for the trub formation. In the next step the wort is clarified by a continuous Clarisaver. Clarification is necessarily done prior to stripping in order to avoid fouling the column with hot trub. From the clarification unit, the wort is then stripped by the Ecostripper, which is a single pass stripping column. The unwanted volatiles are stripped by a counter flow of live clean steam. From the bottom of the stripping column, the stripped wort is continuously pumped through.
- **Wort cooling:** Two wort coolers in parallel ensure continuous cooling of the wort.

Electrical Energy

A modern batch brewery consumes about 10-12 kWh per hl of beer brewed. The electrical consumption costs depend not only on the total consumption of kWh electricity per hl of beer, but also on the peak consumption. Thanks to the Meurabrew, electrical consumption peaks in the brewhouse are negligible. **Table III** shows the electrical energy consumption of the complete brewery of the future.

Table III: Electrical energy in kwh/hl		
Brewing process	3.50	kwh/hl
Bottling (excl. PET blowing)	1.17	kwh/hl
TOTAL	4.67	kwh/hl

Thermal Energy

The consumption of thermal energy in a state-of-the-art batch brewery is between 25 and 30 kWh per hl of beer brewed. **Table IV** shows the average thermal energy of the complete brewery of the future during July 2007. Steam is generated with natural gas as the fuel source.

Table IV: Thermal energy in kwh/hl		
Brewing process	11.03	kwh/hl
Bottling (excl. PET blowing)	1.22	kwh/hl
TOTAL	12.25	kwh/hl

Extract losses

The Meurabrew itself uses the Meura 2001 thin bed mash filters, producing at least the laboratory yield. In combination with the Clarisaver, which allows trub recycling, the brewhouse losses are negligible. Further, thanks to the membrane filtration in the cold block, there is no pre- or after-run, and no losses of beer as with beer filtered the traditional way with kieselguhr. Another cost-saving feature is that the brewery is designed to recover the beer from surplus yeast.

In total the final target of the average extract losses from malt intake up to the final bottle of beer is less than 2.5%. A state-of-the-art batch brewery loses more than twice this much.

Jan Martens, Martens Brewery with Patrick Boccard, C.E.O of Boccard Enterprises.

Conclusion:

The industrial results show that the Meurabrew combines a number of exceptional performance features responding to the demands of the breweries:

- **Consumption of water, electricity and steam cut in half at least.**
- **Considerable reduction of wastewater.**
- **No peak load in utilities.**
- **Better productivity (one CIP per week).**
- **Drastic reduction in oxidation of mash and wort.**
- **Improved consistency in the products parameters.**
- **Very limited extract losses.**

The MEURABREW, the brewhouse of the 21st Century!

ACKNOWLEDGEMENTS

We would like to thank the Martens family and their team for demonstrating their confidence in the first Meurabrew industrialized.
Furthermore we want to take this opportunity to congratulate the Martens Brewery for their 250 years anniversary!