BEER STABILISATION IN COMBINATION WITH CROSSFLOW FILTRATION

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ABSTRACT

The Combined Stabilisation System (CSS) was first presented in Africa during the IGB Convention at Sun City in 2005.

The CSS became the new technology for the one step beer stabilisation of polyphenoles and proteins in beer in recent years. Today there are nine large-scale production plants in operation around the world. Thus the CSS, although still being called new technology, is at the same time an established and proven system.

The basis of the CSS is the use of regenerable, high grade cross-linked insoluble agarose beads which are permanently retained in one or more adsorber modules. Integrated behind an existing beer filter line, unstabilised beer is pumped through this module where both proteins and polyphenoles are being adsorbed within seconds. Finally, the adsorbed substances are removed by regenerating the agarose using caustic.

With the ever increasing interest in cross flow, rather than DE beer filtration, the method of beer stabilisation needs reviewing in order to achieve the full benefits of dosage-free beer filtration. A fully automated crossflow filter in continuous operation does not match well to a batch operated stabilisation plant. Adding stabilisation agents upstream can influence the crossflow filter in a negative way. This paper emphasises the use of a dosage-free (no dust) beer stabilisation system in combination with crossflow filtration. Both the filtration and the stabilisation can then be operated 24h/7 days a week without any powder dosing. Due to its vessel free design, the head and tail handling of beer/water is negligible. The CIP media requirements are also low, thus adding to the ecological benefit. The O_2 uptake is by far lower than with the DE filter/stabilisation agent dosage methods. The stabilisation system operates independently of the filtration system. This enables the brewer to select his filtration system from any of the crossflow filtration manufacturers. So far, well-known suppliers to the brewing industry have installed five beer stabilisation systems behind crossflow filtration systems. The paper shows the set-up, analytical results, costs and benefits of such a combination.

Keywords: combined protein and polyphenole beer stabilisation, regenerable, agarose adsorber, CSS, no dosage

INTRODUCTION

Until now, beers requiring extended shelf life to survive long distribution channels have been predominantly stabilised using silica gel and PVPP. Silica gel removes protein from the beer and PVPP stabilises tannin levels. Both stabilisation media can be dosed upstream of the crossflow filtration, yet need to be centrifuged out of the beer entering the crossflow filter, otherwise the filter will be adversely affected. Also a considerable amount of waste material of the stabilisation media is produced. Furthermore a dosage-free filtration does not really match a dosage based stabilisation method. Therefore there was a need for further development of the CSS.

Construction and function

The CSS is not a new variation on the silica gel or PVPP methods. It adsorbs proteins and tannins in a single step after DE or crossflow filtration. An adsorber module with special inlet and outlet strainers is filled with the adsorber material. One adsorber module has a capacity of 125 to 220hl/hr and a set-up of one, two or more modules cover the complete range of required flow rates and batch volumes. The modules feature a small dead volume, thus facilitating efficient beer type change-overs, in minimising pre- and post-runs, as well as relatively low consumption of water and cleaning agents.

Prefiltered beer flows through the CSS adsorber module where a contact time of only a few seconds is sufficient to remove defined amounts of proteins and tannins from the beer by adsorption. An elaborate dosing of stabilising media therefore becomes unnecessary. Upon completion of the daily stabilisation charge, the adsorber in the module is regenerated whilst remaining in the module without any losses.

The adsorber consists of natural agarose from seaweed origin. In a patented process it is modified to inert, insoluble beads by high-grade cross-linking. These spherical beads have defined particle size, porosity and adsorption features.

The flow rates across the adsorber and through the bypass are controlled automatically for each beer type according to the corresponding shelf life calibration curve. The total flow rate predetermined by the filtration system in front of the CSS remains unchanged. Fluctuating flow speeds on a crossflow filter pose no problem to the downstream CSS system.

After the daily charge has been stabilised, the adsorber is regenerated in place. An integrated CIP station removes the adsorbed polyphenoles and proteins by means of caustic soda. This regeneration may be repeated several hundred times without any losses: this is another notable quality that fundamentally differentiates the CSS from other stabilising systems available until now. The stabilisation, as well as the regeneration process, of the CSS is fully automated according to set values. The modular configuration of the CSS enables the brewery to set up a continuous stabilisation process, again more suitable to a fully automated and continuous crossflow filtration.

Beer shelf-life

As previously mentioned, the degree of stabilisation can be freely chosen to achieve a shelf-life of for example, six, nine, twelve months or longer.

CSS stabilisation is exceedingly gentle on the beer. Generally the CSS removes fewer total polyphenoles and proteins than PVPP and silica gel stabilisation systems. Beer quality is in no way negatively influenced by the CSS. The organoleptic properties, the foam stand, colour and bitterness units, especially, remain unchanged.

Stabilisation costs

The total costs of removing both polyphenole and protein haze precursors by CSS are Euro 0,07 to 0,09 per hl, depending on the individual system layout. Low investment and operating costs make the CSS a truly economical alternative to the combined stabilisation by traditional methods.

Environment

A comparison of waste material generated by the different systems underscores a further advantage of the CSS. If you assume 50g/hl of 'lost' stabilising media, irrespective of PVPP or silica gel , a brewery of 1 million hectolitres annual capacity will normally produce 50 tons of waste material. The CSS calculation at the same capacity will produce an annual waste of 160kg that can be removed with the household garbage. In practice, only 480kg of waste is generated by the CSS in approx. 2 to 3 years of operation.

CSS in operation

As of today, there are nine large-scale production plants in operation around the world. Four CSS have been placed behind DE filters and five behind crossflow filtration. For both filter methods, the CSS holds the advantages, such as:

- Stabilisation is independent of filtration
- filter capacity of the DE filter can be completely used for DE
- CSS regeneration takes place at the same time as the DE filter cleaning
- adapts to any filter step, *e.g.* circulation of DE filter; no flow required.

After crossflow filtration, the CSS offers the following additional benefits:

- continuous filtration and stabilisation is possible through Contiflow set-up
- changing flow rates or stops are unproblematic
- no powder dosing during filtration and stabilisation is required
- stabilisation is without negative influence of the crossflow membrane.

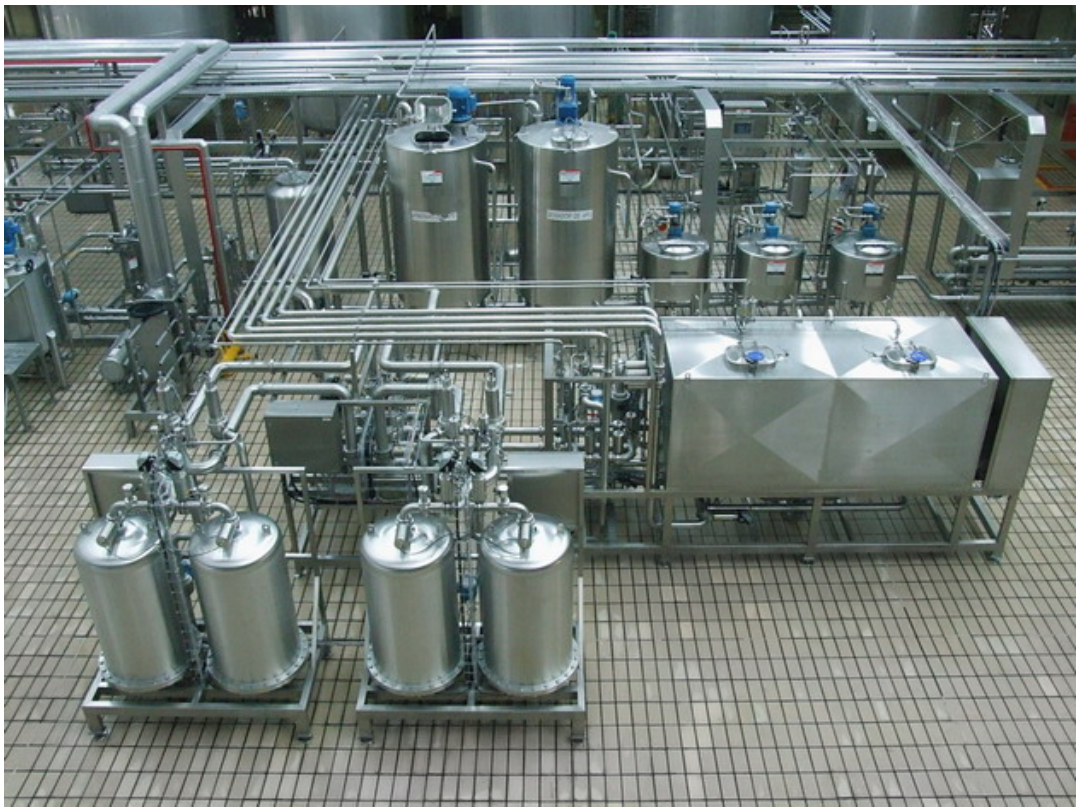

Fig. 1 CSS 450 contiflow

SUMMARY

A significant advantage of the CSS is its selective and gentle removal of haze forming tannins and proteins in a single step system. Simultaneously, every desired level of shelf-life can be achieved according to individual beer styles without affecting quality. The possibility of zero loss regeneration of the adsorber over a number of years and without elaborate dosing, makes the CSS a technological and economical alternative to existing beer stabilising systems.