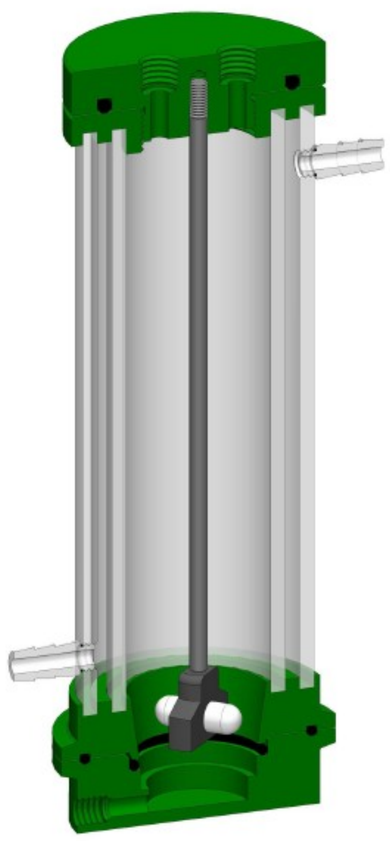
Prediction of Beer Filterability on Crossflow Membrane Filters by Modified Raible Test

Mika Unting, Stabifix; Thomas Heinrich, Stabifix
Stabifix Brauerei-Technik KG, Lochhamer Schlag 17, Munich-Graefelfing, Germany

Introduction

Laboratory filtrations and industrial scale filtrations can correlate well when run in comparable mode. Precoat filtration, membrane crossflow and membrane dead-end filtrations are common modes at industrial scale. At laboratory scale only precoat mode (i.e. Raible test) or membrane dead-end mode (i.e. Esser test) is common. A Stabifix Filtercheck was modified to a stirred cell filter to model crossflow membrane mode. The data in this poster compare laboratory filtrations in all three modes with a focus on the crossflow membrane mode.



Apparatus

Filtercheck: Double wall cylinder, jacket cooling, gas pressure inlet at the top, holder for filter sieves or membrane pads at the bottom.

Modified Filtercheck: Includes a magnetic stirrer (see picture).

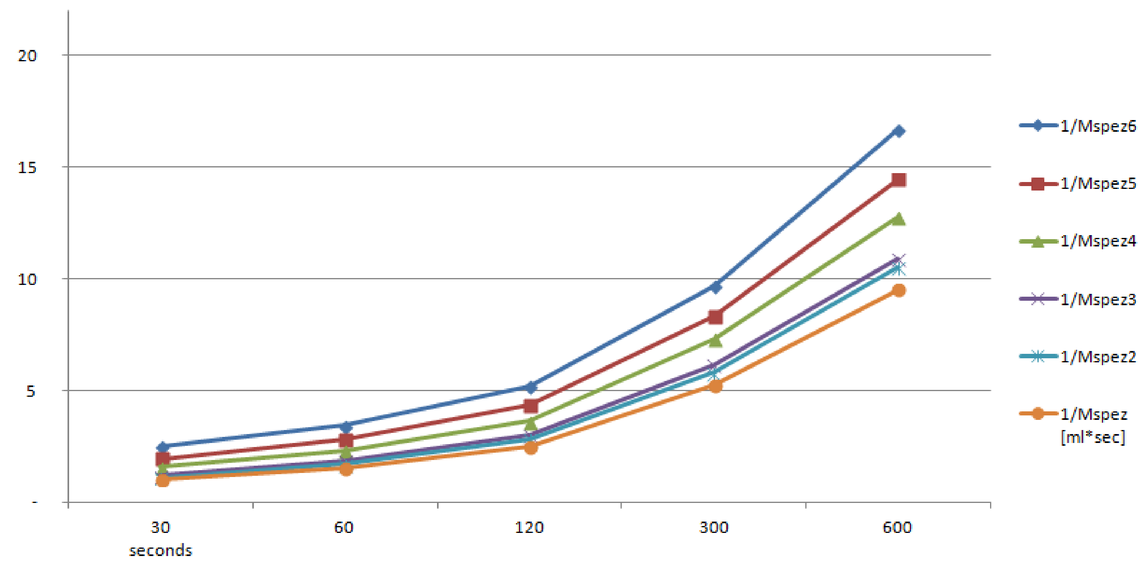
Modified Filtercheck can force defined partial flows accross (0-1,2m/s) and through membrane (0-200 l/m^2/h) by stirring rate and pressure settings.

Methods

1. Precoat mode: Raible test (MEBAK); Value = Fspez.
2. Dead-end mode: Esser test (MEBAK but 1 bar and 0,45 micron PES membrane); Value = Vmax.
3. Crossflow membrane filtration mode: Stirring rate 500 rpm / 1 bar pressure / report ml filtrate after 10 minutes; Value = Mspez.
4. Backflush: Turned over membrane flushed with water or caustic.
5. Treatments: **blank:** 2days 0°C, resusp. sediment / **lager:** 3 days 0°C, decantation / **beta:** 4g/hl beta glucanase, 1day 0°C.
6. Beer test temperature: 0°C

Modelling Pressure Increase

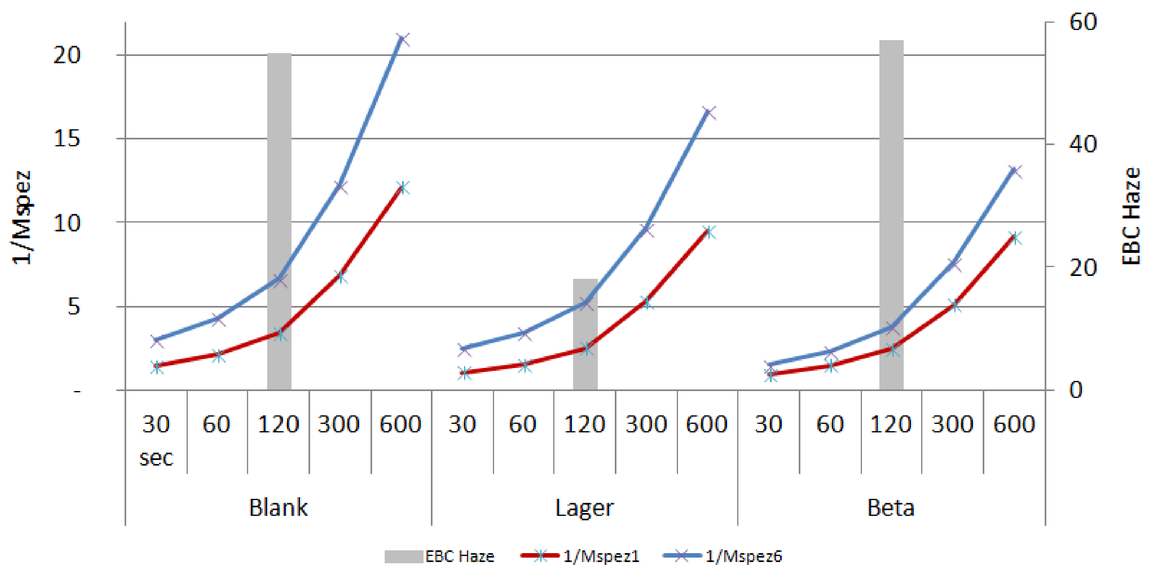
Six filtrations as described under Methods 3. were carried out with the same beer to evaluate the development of volume throughput within each and between filtrations, interrupted by backflushes.



The inversed values of the flux rates (1/Mspez) are modelling pressure increase curves. Differences in pressure curves after backflushes could indicate backflush / cleaning efficiencies.

Modelling Pressure Increase after various Beer Treatments

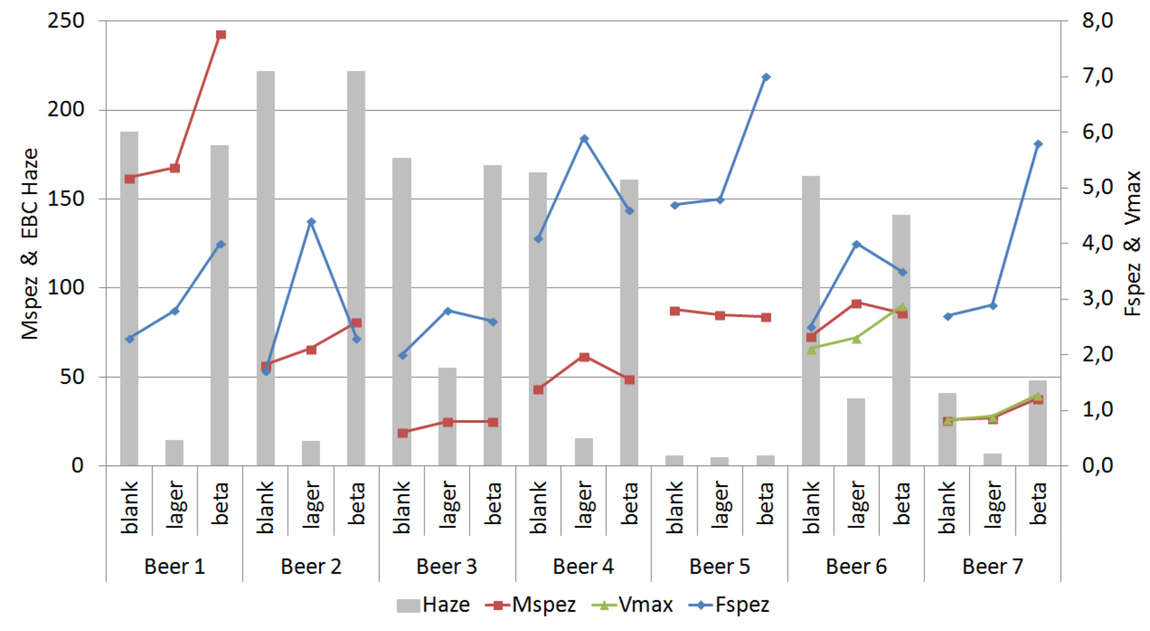
Flux rates and backflush efficiencies have been measured for the same beer in three different status: Blank, lager and beta.



The tested Pils beer shows improved flux rates when beta-glucanase treated or lagered and decanted. Backflush efficiency of this beer is then also improved.

Modelling and Comparing Precoat, Crossflow and Dead-end Mode

Flux rates of seven different unfiltered beers were measured by Raible method (Fspez), stirred method (Mspez) and for two beers also by Esser method (Vmax). Again each beer in the status blank, lager and beta.



Precoat and membrane filtration flux rates usually change when beer is lagered/decanted or enzyme treated but these changes are not always significant. Sometimes flux rates of precoat and membrane mode react similar on treatements, sometimes not. This is not surprising and confirms, that it makes sense to model industrial scale filtration modes with equivalent modes at lab scale.

Summary

Although a direct comparison of industrial and laboratory scale filtration in crossflow membrane mode yet has to be carried out, the data at hand suggest, that a stirred Filtercheck filtration can model typical industrial scale filter behaviour: Calculated pressure increase curves make sense, such as the gradual flux rate deterioration after several filtrations and backflushes. Also, the different response to reduced haze or beta-glucane levels compared to precoat or dead-end mode, corresponds to observations at industrial scale, so rather is a confirmation, that crossflow membrane filtration characteristics can be modelled with modified Filtercheck. Comparative data to industrial scale filtrations will be published soon.