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Optimizing beer filtration through the use of single pre-coat free of kieselguhr

Hadi Sai[1], Leila Abbassi[2], Philippe Cario[3], Jalloul Slimi[2], Alberto Ostinelli[4]

[1] AEB AFRICA Ltd, 18 Track Crescent Cor. Station Road – Montague Gardens – 7441 Cape Town, South Africa.
[2] SFBT - Société de Fabrication de Boissons de Tunisie, Bd de la Terre Centre Urbain Nord – 1080 Tunis, Tunisia.
[3] SPINDAL AEB Group, 3 Rue Ampère ZI - 77220 Gretz-Armainvilliers, France.
[4] AEB Iberica, Av. Can Campanya, 13 – 08755 Castellbisbal Barcelona, Spain.

Email:: [1]hadi@aeb.co.za ; [3]pcario@aeb-group.com Phone : 00 27 215512700 , Fax : 00 27 215511919 WEB: http://www.aeb-group.com

INTRODUCTION

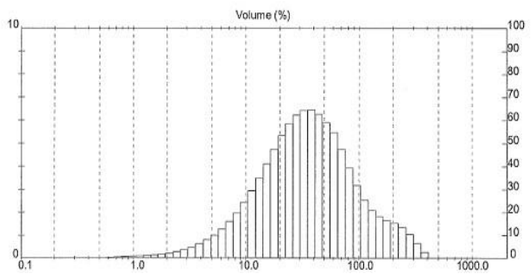
The development of a single pre-coat free of kieselguhr has allowed a number of African breweries to improve their beer filtration performance. The auxiliary mainly composed with cellulose fibers on perlite support, has been developed, tested and validated on frame, horizontal plate and candle filters through industrial application.

La Société de Fabrication des Boissons de Tunisie (SFBT), major producer of beer in Tunisia (1.6MhL), has applied Fibroxcel®Uni on a 77,5m² Filtrox candle filter. The qualitative and efficient parameters of beer filtration have been followed and optimized: turbidity (EBC 90° and 25°), microbiology (cells/ml), evolution of pressure (Δp/hour), continuous dosing (g/hL of bodyfeed) and sludge volume, length of cycle and economical performance.

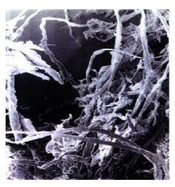
The unique pre-coat has been analysed in terms of granulometry (Malvern), permeability (Darcy), soluble heavy metals.

The facility of AEB Africa in Cape Town has been adapted in order to produce this innovative technology for African brewers.

Production and control of DE free auxiliaries



Malvern of free DE single pre-coat. AEB Lab.



Electrocinetic power from cellulose fibers (left), the dilution in dosing vessel (right) remains 1/10 with water, 5 minutes in solution before starting the transfer to the filter.

In order to produce qualitative and standardised lots of DE free filteraid, an automated production line has been built, also supported by laboratory equipments to validate the quality of raw materials and measure the essential parameters of the auxiliaries : distribution of granulars (Malvern) allowing a reproductive permeability (Darcy or Lit/m²/min), pH, physical and chemical conformity.

The analysis of the DE free single pre-coat and bodyfeed are complying with the FCC (Ed. 3.2012) and EU regulations, in water (pH 6-7) or in beer (pH 4). It is possible to note a lower amount of soluble iron, in comparison with DE, which might have a positive effect on beer oxydation.

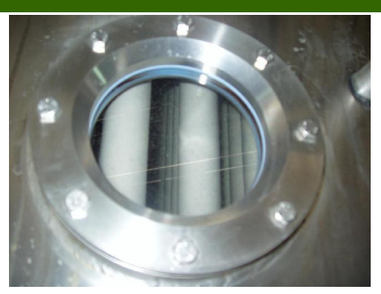
Analysis		FCC/EU requirements	**Unique pre-coat**
Basis of analysis	***pH***	***For 100g/hL of beer***	***4***
Soluble aluminium EBC	mg/kg	< 100	**<80.0**
Soluble iron EBC	mg/kg	< 200	**<35.0**
Soluble calcium	mg/kg	< 2000	**<120**
Arsenic	mg/kg	≤10	**<1.0**
Cadmium	mg/kg	≤3	**<0.015**
Copper	mg/kg	≤50	**<0.60**
Lead	mg/kg	≤10	**<0.20**
Magnesium	mg/kg		**<35.0**
Manganese	mg/kg	≤300	**<3.0**
Sodium	mg/kg	≤100000	**<300**
Vanadium	mg/kg	≤50	**<0.150**
Zinc	mg/kg	≤1000	**<0.60**

AEB Africa production unit.

Minalite®, a company of AEB Group based in Spain.

The raw materials are prepared in Spain from a facility of 10,000 ton/year capacity, then sent to AEB Africa.
The major success of DE free filteraids is due to the quality of granulation between mineral and cellulose powder, allowing major benefits developed in the brewing industry for more than 30 years :
-Better pressure resistance working on compressibility performance;
-Adsorption power from the cellulose fibers, which allows a more efficient management of permeability to reach quality and maximum quantity of filtered beer.
These 2 factors are the key of success allowing to prepare a pre-coat for beer filter in only one step, able to play a role of support (same as a traditionnal 1st pre-coat) and ready to receive the beer (2nd traditionnal pre-coat) with a permeability >120Lit./min/m².

DE free single pre-coat : safer and more efficient for the brewery



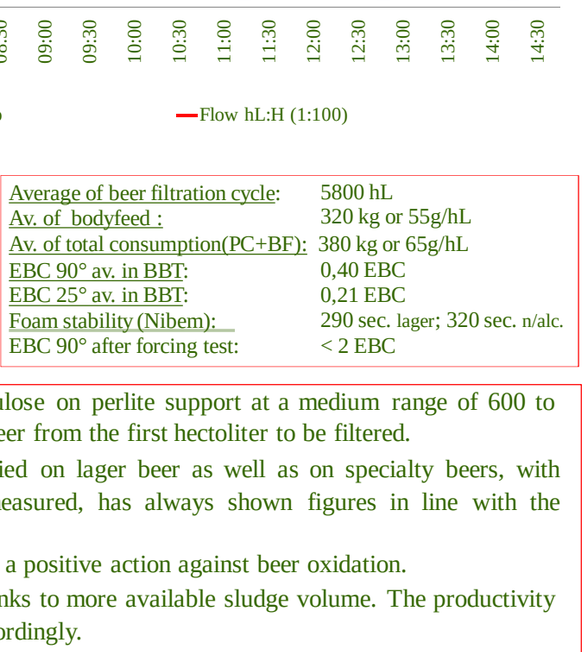
Candles 20 minutes after starting pre-coating. 10 more minutes in closed circuit are necessary before launching beer filtration with EBC 90° < 0,2 and EBC 25° < 0,15.

Filtrox candle filter at SFBT.
Size of filter : 77,5m².
Sludge volume : 1990 Lit.
Beer filtration flow : 400 hL/hour.
Admissible pressure : 7 bars (5Δp).

Application of a single pre-coat on candle filter allowed to dose 60 kg for 77,5m² in one addition :
-SFBT brewery prepares its pre-coat in the stabilising vessel, so that the bodyfeed is immediately ready to be sent only 30 minutes after the end of the filter sterilisation;
-dosage was reduced by 40% compared with traditionnal pre-coating, down to 774g/m², allowing more sludge volume for the continuous dosing : 1 ½ hour more or 600 hL of bright beer per cycle;
- closed circuit after 30 min.: 0,2 EBC 90 °– 0,11 EBC 25°;
- Residuals from the filter have been reduced;
-Quality of filtration is similar to a traditionnal filtration from the first hectoliters filtered.

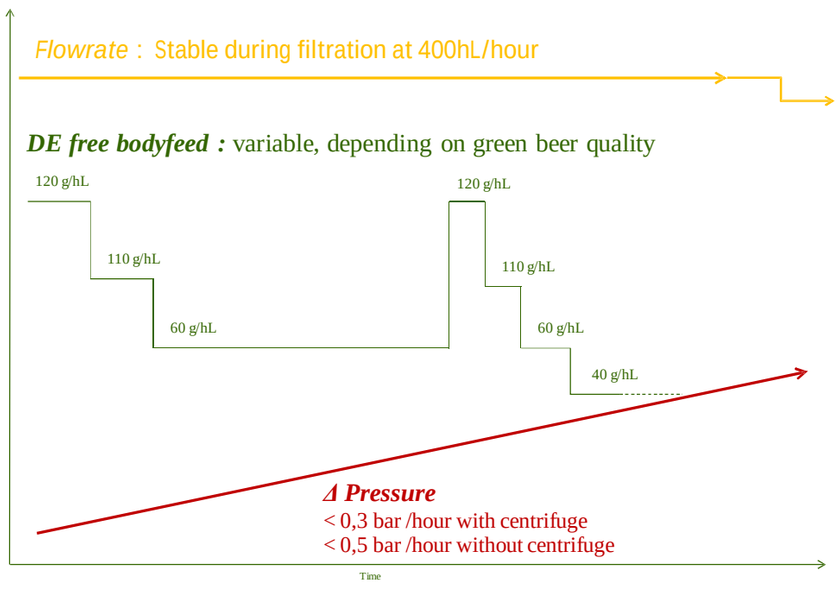
SFBT has been applying this technique for the production of all the brands : Celtia®, Celestia®, Beck's® and Löwenbräu®.

Green beer is usually centrifuged, allowing to repeat every day the same performance during filtration :
-The dosage of bodyfeed varies between 50 and 60g/hL;
- the colloidal stabilisers being added in the kieselguhr filter, every space within the filter is important to reach the best possible performance : the reduction of volume for the pre-coat allowed to maximise the filtration by 10 to 15%, from 5200hL up to 6000hL. Even at the end of filtration it is possible to inject only stabilisers until the ratio between Δ pressure and admissible volume has been maximised.

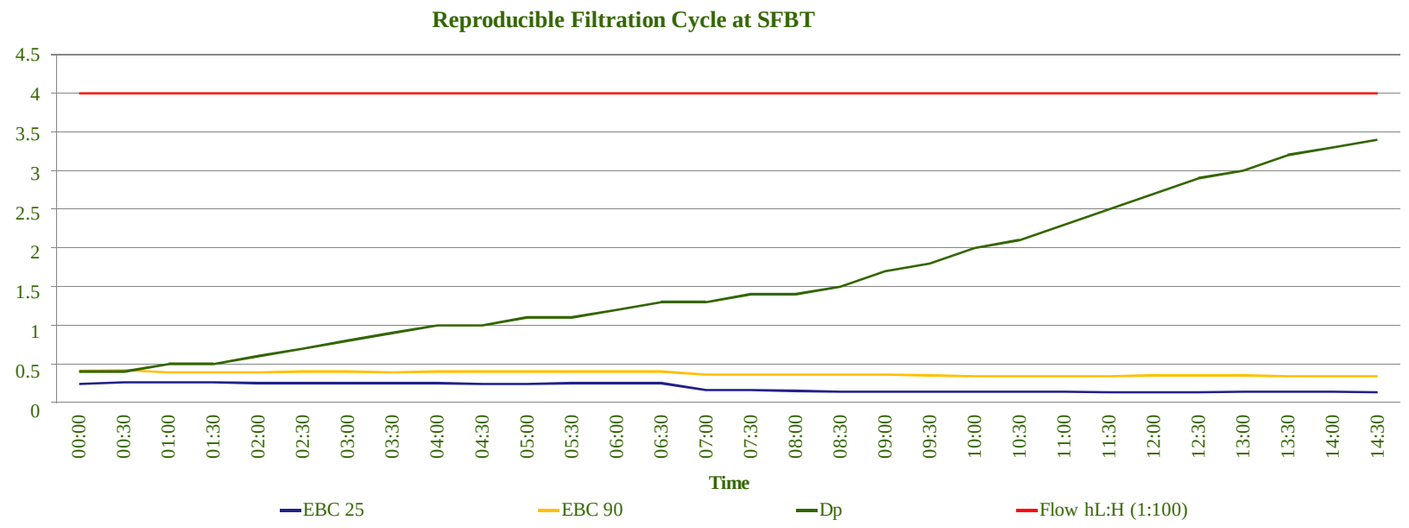


The technical direction contantly follows the quality of beer through analytical tests and organoleptic trial.

Theoretical management of a filtration run



Practical results within SFBT : quality and repeatability



2012 results: quality and yield

Average of beer filtration cycle:	5800 hL
Av. of bodyfeed :	320 kg or 55g/hL
Av. of total consumption(PC+BF):	380 kg or 65g/hL
EBC 90° av. in BBT:	0,40 EBC
EBC 25° av. in BBT:	0,21 EBC
Foam stability (Nibem):	290 sec. lager; 320 sec. n/alc.
EBC 90° after forcing test:	< 2 EBC

CONCLUSION

1. It has been technically demonstrated that a single pre-coat, composed of cellulose on perlite support at a medium range of 600 to 850g/m² could bring time, energy and cost savings while insuring a quality of beer from the first hectoliter to be filtered.
2. The quality of filtration from DE free pre-coat and bodyfeed has been verified on lager beer as well as on specialty beers, with turbidity of around 0,40 EBC90° for lager (11°P). The EBC 25°, when measured, has always shown figures in line with the traditional method, below 0,25 EBC.
3. Analysis of heavy metals has shown a major reduction of soluble iron, allowing a positive action against beer oxidation.
4. The ΔP evolution is less important, allowing a reduction of filtration yearly, thanks to more available sludge volume. The productivity of the filter line can be improved consequently, the filtration team managed accordingly.
5. The production and the instruments of control permit within AEB Group a standardised quality of Fibroxcel®Uni, as well as for the entire range of DE free filteraids.
6. **Société de Fabrication de Boissons de Tunisie** has been using this filtration alternative for all their beer production.

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