APPLICATION REPORT

Reducing rinsing water costs and increasing filtration process efficiencies using depth filter sheets

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Introduction

Today's difficult economic climate is forcing all breweries worldwide to examine ways of reducing their costs more closely and the BECOPAD® depth filter sheet has been setting new standards in filtration.

One of the major parts of the beer brewing process is filtration as it is crucial for producing high quality beer with excellent flavor and color, and with good shelf stability. Filtration has always placed high demands on the filter media and until a couple of decades ago depth filter sheets were being changed after every filtration. However, the brewing industry has now discovered new ways to increase profitability and significantly reduce filtration costs: through backwashing and regeneration of the filters.

But with increased pressure to optimize processes, how can brewers improve their filtration methods further and backwash more efficiently. And how much savings potential can be realized by using the BECOPAD depth filter sheet?

Opportunities for optimization in backwashing

Backwashing and rinsing filter media at the end of filtration cleans the fiber matrix and removes residual particles, micro-organisms and colloids, so they can be used more than once effectively for further filtration. The process is often overlooked, but through investigating the backwashing process, brewers can increase the cost-effectiveness.

In the filter rinsing process, the filter plate and frame is usually considered fully rinsed when the water leaves the filter without foam. However, this subjective view can be measured easily to determine the minimum required rinse time by calculating:

1. Chemical Oxygen Demand (COD) value in the rinsing water

2. Turbidity in the filter outlet

To calculate the optimum rinsing water requirement for regeneration of BECOPAD 450 depth filter sheets compared with conventional depth filter sheets, the process in a German brewery was examined to determine the particle turbidity and COD values at the filter outlet.

In the tests, the filter was rinsed against the filtration direction, first with cold water and then with increasingly warmer water. The flow rate of the rinsing water was 1.4 hl/m²/h and the filter was rinsed for approximately 45 minutes in total, corresponding to a water consumption of approximately 1 hl/m2 filter area.

The COD value, which is shown in Fig 1. decreases virtually identically for both media with a brief increase in the values after 15 minutes. As

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the temperature and rinsing duration increase, small increases were noticed in the COD value and turbidity, suggesting that the temperature change as well as the rinsing duration and volume is important for the success of the rinsing process.

After a total rinsing time of approximately 30 minutes, no further significant decreases in the COD values were identified. However, the values tend to continue to decrease when the BECOPAD 450 depth filter sheet is used. This indicates that rising temperatures promote filter regeneration, whereby a purely warm or cold rinsing process may hinder success, as colloids remain in the filter medium.

The particle turbidity of the rinsing water (see Fig. 2) shows a significant difference between the two filter media. Even after 17 minutes, the rinsing water from the BECOPAD 450 depth filter sheet is significantly clearer than that of the conventional depth filter sheet. With BECOPAD depth filter sheets, minimal turbidity values of 0.1 EBC are achieved after 30 minutes of rinsing, while particle turbidity of approximately 1 EBC can still be seen in the rinsing water when using a conventional filter sheet.

A significantly lower level of particle turbidity is achieved in the rinsing water more quickly with BECOPAD depth filter sheets and in just 25 minutes, this corresponds to an improvement of approximately 45 percent compared to conventional depth filter sheets.

Savings potential in figures

The results make it clear that the rinsing water consumption is significantly reduced and the associated setup time is shortened, and there is potential opportunity for cost savings as shown in Table 1.

In addition to a 15-minute reduction in setup time, the rinsing water consumption is reduced by 30 percent. Assuming costs for fresh and wastewater of EUR 4.50/m3, this corresponds to a saving of EUR 37.50 per filtration cycle compared to conventional depth filter sheets. With 15 filtration cycles, the rinsing water costs alone can be reduced by EUR 562.50 per deployment. This results in a cost saving of approximately EUR 4.50 per one 2-m folded sheet.

As an added benefit, this calculation does not take into account the time saving of approximately four hours per filtration cycle, which brings with it additional savings potential thanks to the improved utilization of the filters.

BECOPAD depth filter sheets were developed with regeneration in mind. The cellulose fiber structure allows for even distribution of flow during backwashing and regeneration, meaning better detection and significantly faster discharge of the particle load than with conventional depth filter sheets. Setup times and consumption costs for depth filtration are significantly reduced, and the water consumption can be reduced by at least 30 percent compared to conventional depth filter sheets of the same clarifying sharpness.

Eaton's BECOPAD depth filter sheet is a diatomaceous earth (D.E.) free, mineral-free filter sheet that is used for a wide range of applications, including coarse, fine and sterile filtration. In a special process, high-purity cellulose is cross-linked to form a unique structure that requires no inorganic ingredients. BECOPAD depth filter sheets are characterized by maximum purity and are biodegradable, with virtually no ash content.

BECOPAD depth filter sheets are ideal for back washing applications and also make it possible to combine the highest standards of

microbiological safety while fully maintaining the valuable flavor and color characteristics of the beer.

BECOPAD filters in action

Experience has also shown that customer expectations with regard to service life, handling and a reduced tendency to develop mold are met in full when using BECOPAD depth filter sheets. For example, since using BECOPAD filters at its craft brewery, Georgia-based Terrapin Beer Company® has been able to significantly optimize its process and make operational cost savings.

In 2002, the co-founders of the Athens, Georgia-based Terrapin Beer Company, John Cochran and Spike Buckowski, started their business with the concept of brewing up a new kind of beer. The plan worked. Six months later, after the debut of Terrapin Rye Pale Ale, they were awarded the American Pale Ale Gold Medal at the Great American Beer Festival.

Today, a variety of their distinctive beer is being poured in more than 10 states throughout the Southeast and East Coast areas of the United States. Sales of more than 52,806 hl were projected for 2014, which represents a 36 percent increase over the company's 2013 sales.

Terrapin is on track with the trend of increasing growth in the craft brewing industry. According to the U.S. Brewer's Association, domestic sales of craft beers reached an estimated $14.3 billion in 2013 with brewers selling an estimated 18.3 million hl of beer, up from 15.5 million hl in 2012. With this increased consumer demand comes new challenges to quality brewers.

With several different varieties being brewed year round, Buckowski says it's important to make sure the filtration process is closely monitored on a daily basis. Filtration is a key element in ensuring that all of the Terrapin beers are visually appealing and free of haze-producing proteins, tannins and yeast. Filtration is also critical to optimize a beer's shelf stability.

"A stable product will last longer while it sits on the shelf," notes Buckowski. "All beer has a life span, but if you put out a clean, stable product, it will have increased shelf life and stay fresher longer. Not only do we want our beer to look great, but we also want a stable product."

Cochran and Buckowski discovered early on the best filters available were the BECOPAD depth filter sheets.

"Once we started using the BECOPAD depth filter sheets, we knew we had the best solution on the market. Over the years, we've also identified several additional benefits from using the Eaton filters," continues Buckowski. His favorites? Ease-of-use, easy cleanup, reduced product loss and increased throughput are at the top of the list.

AFTEK, Applied Filtration Technology, Inc. in collaboration with Terrapin, did testing to find the correct BECOPAD filter that optimized their filtration process. As a result, filtration time per batch and the filter sheet usage were reduced significantly resulting in an overall reduction in the cost of filtration.

"We are yielding more hectoliters per day by using the Eaton product," says Buckowski.

"Cleanup is also much easier. Other filter sheets leave a residue on the plastic feed and filtrate plates that hold the sheets in place. The BECOPAD depth filter sheets are much easier and cleaner to remove."

Consequently, beer isn't the only thing flowing smoothly these days at the Terrapin Beer Company. Financial saving and increased profits for the brewery are flowing just as smoothly.

With 95 full-time and part-time employees, this award-winning company is now operating out of Terrapin's 40,000 square foot facilities and new brew house, taking full advantage of the space to brew new, innovative and exciting beers. The company's current year-round lineup includes Rye Pale Ale, Golden Ale and RecreationAle with two additional varieties, Hopsecutioner® and HI-5 IPA, distributed solely in their home state of Georgia.

"We are a very happy end-user," concludes Buckowski. "Short of seeing something spectacular coming along in the future, I can't see us moving away from using BECOPAD depth filter sheets."

Breweries suffer from constant cost pressure and are very grateful for effective and cost-saving innovations that do not involve capital costs. The high degree of flexibility of the BECOPAD depth filter sheets means that it can meet all customer requirements in applications ranging from coarse to sterile filtration.

	Conventional depth filter sheet	BECOPAD depth filter sheet	Savings
Rinsing volume [hl/m² filter area]	1.0	0.7	-0.30
Rinsing water costs [€/m² filter area]	0.45	0.30	-0.15
Rinsing water costs [€/filtration cycle]	112.50	75.00	-37.50
Rinsing water costs [€/deployment]	1687.5	1125.0	-562.50

Table 1: Table to show the rinsing water cost savings that can be made using BECOPAD depth filter sheet.

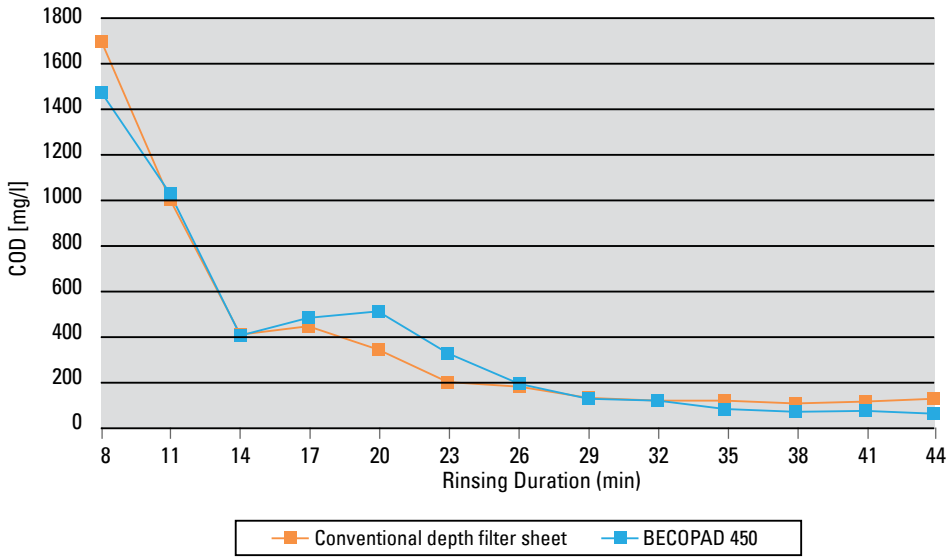

Figure 1: Graph of COD value over rinsing duration

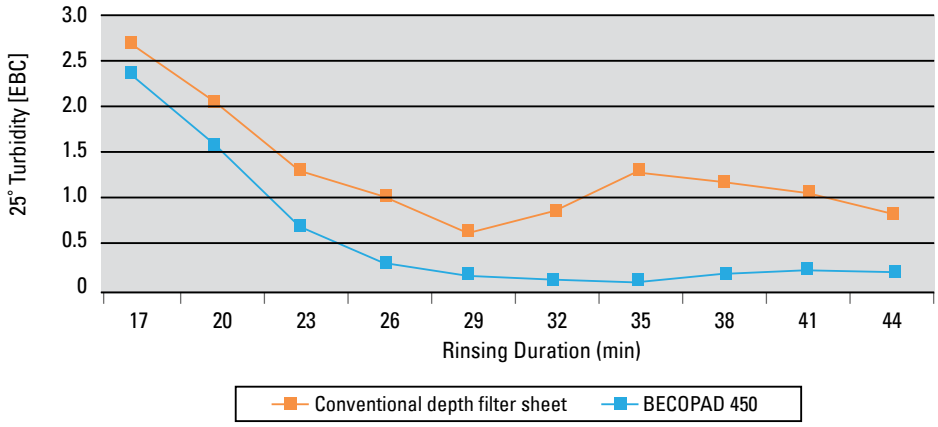

Figure 2: Graph of particle EBC over rinsing duration

BECOPAD **depth filter medium**

BECOPAD is characterized by maximum purity. It offers exceptionally high chemical resistance both in alkaline and acidic applications. BECOPAD depth filter sheet's range, high-purity celluloses form a unique structure, which even for microbe removal does not require mineral components.

Enclosed filtration systems
BECO INTEGRA PLATE

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