Application Report
Turbidity in the Brewery Laboratory

SIGRIST PROCESS-PHOTOMETER

This application covers on the one hand the measurement of turbidity of bottled beer in the course of shelf life tests (forcing tests) and, on the other hand, the monitoring of single production steps (filtration and pressure tank releases etc.). For these applications, the SIGRIST LabScat is used. Based on its wide distribution and the fact that the values measured can be compared with the SIGRIST turbidity measurement in the filter cellar (TurBiScat), the LabScat is the benchmark.

Benefits

Beer is a product which tends to become turbid as a result of its composition (high protein contents for the foam). In the course of time, tests were developed simulating ageing. The results of this simulation have to be measured with a laboratory turbidimeter without opening the bottles since such tests last for several days / cycles.

Typical applications

Forcing test

Among other constituents, beer contains protein (from the malt) and tanning agents (from malt and hop). Both components are important for the full body, the foam and the pleasantly bitter taste of the beer. However, tanning agents have the tendency to accumulate protein and thus form increasingly large structures. These can then be seen – the beer is considered turbid, and finally sediment is formed. As the shelf life of today's beer extends from 6 months to one year, various measures for stabilizing this balance have to be taken and then monitored for each batch.

For this, bottled beer is stored alternately warm and cold, that means alternately 24 hours at 40 °C or 60 °C and then 24 hours at 0 °C. At the warm temperatures, chemical reactions between the protein and the tanning agents take place at a faster rate; at 0 °C protein precipitates better and becomes visible. This so-called forcing test simulates unfavourable storage conditions during transport and trade and at the end user.

How is a laboratory heat-forcing day of the forcing test (0 °C – 40 °C, or 0 °C – 60 °C) translated into practice (definition of the minimum shelf life)?

One heat-forcing day 0° C – 40 °C corresponds to about 12 real days.
One heat-forcing day 0 °C – 60 °C corresponds to about 28 real days.

The bottle is always measured with the LabScat at the end of the cold phase. The starting value of turbidity has to be considered here. The end of the test is reached at 2 EBC. So, if the values at the beginning of the test used to be around 0.3 EBC as a result of very high-quality raw materials, those values tend to be higher today, i.e. from 0.5 to 0.8 EBC. However, this will reduce the number of heat-forcing days and thus the months of shelf-life. As a consequence, the beer has to be stabilized to a higher extent and the brewers are more interested in turbidity at other stages, e.g. at the lauter tun in the brew house.

Picture 1: Forcing test cabinet

Picture 2: Turbidity measured in a bottle in the LabScat after the conclusion of the forcing test

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Monitoring production
In this application, samples from filtration and from the pressure tank cellar are measured.
With these measurements one has to take into consideration that this turbidity is clearly connected to temperature: the colder a (beer) sample, the higher the turbidity value. This problem becomes particularly significant if the kieselgur filter has to be checked. This filtration is carried out at temperatures around 0 °C. To solve this problem, some breweries adjust the temperature of the samples. Procedures between 4 °C (AB Inbev) and 20 °C (Bitburg) are customary.

Collaborative studies
For this, breweries exchange and measure samples on an anonymous basis. The aspect of comparability constitutes a considerable advantage for us. If practically all breweries use the SIGRIST LabScat, there will be no problems concerning comparability.

Other measurements
As a result of its broad measuring range, the SIGRIST LabScat can also be used for other kinds of measurements. What is interesting, for example, is the measurement of turbid wheat beers. In this case, the absolute value is relevant (mostly between 100 and 200 EBC) on the one hand, and on the other hand the ratio of the 90° to the 25° measuring angle is significant. The ratio 2:1 is desirable. The reason for this is the fact that the 90° value is mainly caused by the finest particles < 1µm whereas the 25° value is mostly caused by larger yeast cells. The fine particles sediment in the bottle at a slower rate than the larger ones. The beer's urbidity remains stable for a longer time. Thus, one can obtain a statement on the duration of the turbidity stability.

Savings/calculation of return
Savings in the strictest sense cannot be made. It is exclusively a quality measurement.

Product

SIGRIST products and configurations for this application:
- LabScat with checking unit
- Optional:
  Cuvette KPL50/190 glass with locking
  Cuvette KPL25/190 glass with locking
  Calibration up to 500EBC – 25mm cuvette, certificate included

Parameter settings
- Calibration in EBC (factory setting 200 EBC, optionally 500 EBC with 25mm cuvette)

Advantages of the SIGRIST LabScat
- Compact design
- Large measuring span
- Precise and reliable measurement also at 0 °C
- Colour compensated dual-angle measurement according to EBC / MEBAK-standard
- Bottle rotation and water bath to minimise interfering influences
- Monitoring of the water bath quality
- Integrated operation panel with colour touch screen display
- Quick adjustment with secondary standard
- Easy maintenance, no tools required
- Optimum comparability as a result of its wide distribution on the market and of the SIGRIST DualScat / TurBiScat

Picture 3: Measurement display with minimum/maximum values as well as standard deviations