

A simple solution for regional analysis of acids in beer: same quality for every Heineken brewery

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To comply with new regulations and ensure Heineken quality all over the world, a universal solution for extraction of iso-alfa- and tetrahydro acids in beer has been developed. Reproducibility issues with traditional methods have led the way to this new front-end system used for sample loading and on-line extraction of beer.

Figure 1 shows the system configuration that consists of an isocratic LC-pump, autosampler with tray cooling and gas inlet, solvent organizers, SPE cartridge clamp and pre-programmed control software.

Its unique features, as described below, allow for reproducible on-line analysis of acids in beer around the world.

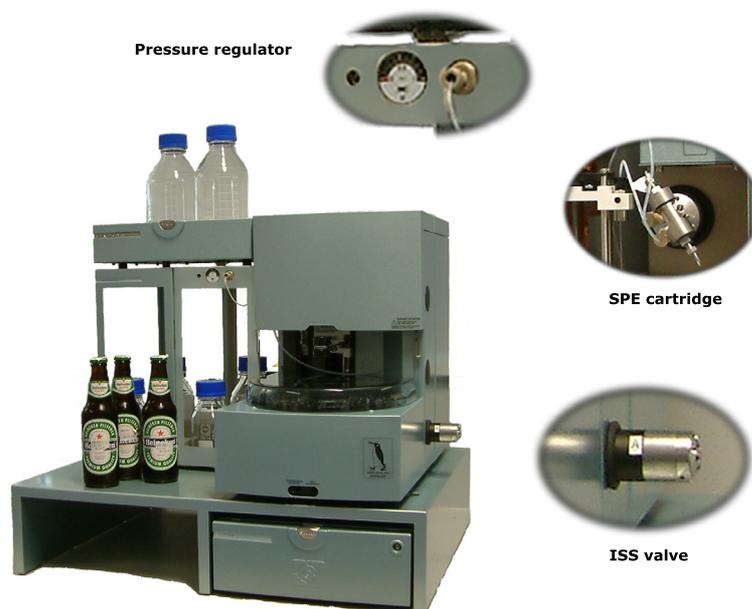


Figure 1: Pre-defined hardware configuration as installed at Heineken in Italy (Bergamo) and the Netherlands (Amsterdam).

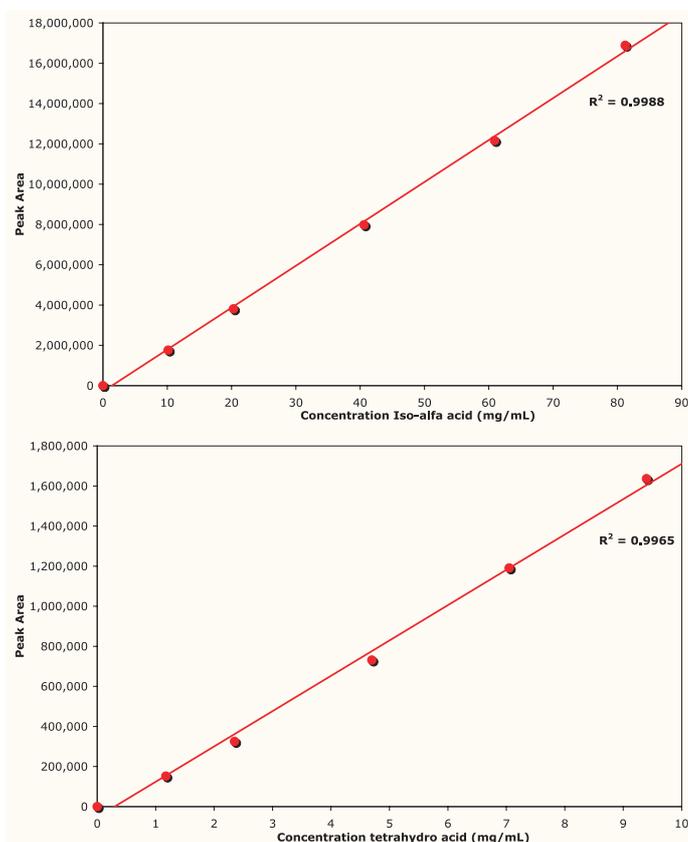


Figure 2: Calibration standards were prepared in accordance with the Heineken protocol.

- The pressure regulator is used to apply Nitrogen/Helium pressure on the sample vial while the beer is aspirated preventing formation of unwanted foam.
- A Baker C2 SPE cartridge is used to trap the analytes of interest and wash redundant beer ingredients to waste.
- After the sample is extracted the Integrated Stream Switching Valve (ISS valve) switches the cartridge in line with the LC column.
- The mobile phase delivered by the isocratic pump transfers the extract to a C18 LC column, providing a chromatographic separation of the individual analytes.
- The analytes are measured by an UV detector at 270 nm.

Figure 2 shows the standard curves for both, iso-alfa acids and tetrahydroacids, which were obtained.

The three chromatograms in figure 3 are an example of excellent repeatability.

The mean concentration for iso-alfa acids was determined at 24.27 mg/mL for iso-alfa-acids and 3.55 mg/mL for tetrahydro-acids.

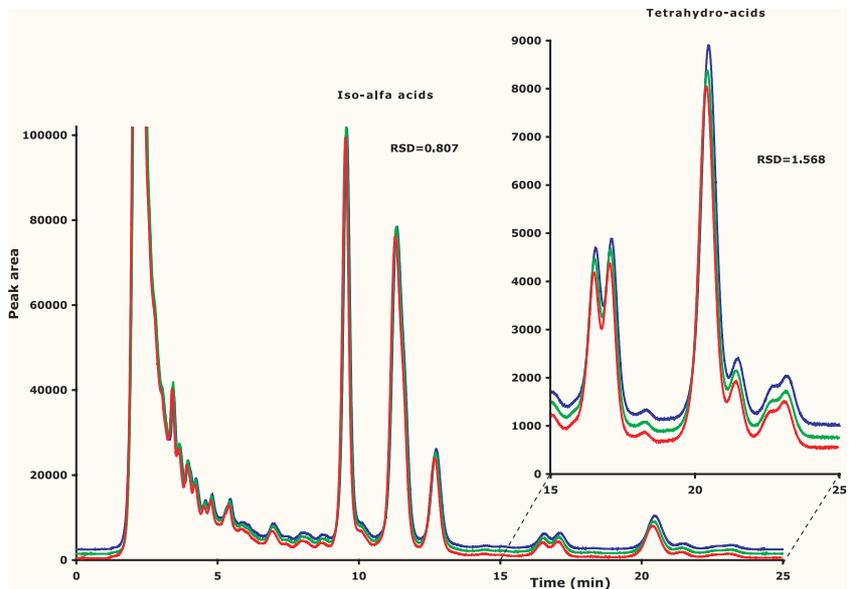


Figure 3: Chromatograms of 3 samples.

Further details about the sequence of steps are outlined in figures 4, 5 and 6.

Step 1 During aspiration of beer, nitrogen pressure is applied on the sample vial to prevent formation of foam. The sample is loaded in the buffer tubing of the autosampler.

Step 2 The injection valve is switched to the load position. The solvent in the buffer tubing is dispensed over the extraction cartridge into the waste position. During these steps the analytes are trapped on the cartridge.

Step 3 Injections valve switches back to the inject position and ISS valve switches the LC-pump in line with the extraction cartridge. The analytes are now eluted to the LC-column. Simultaneously, the next sample is loaded into the buffer tubing.

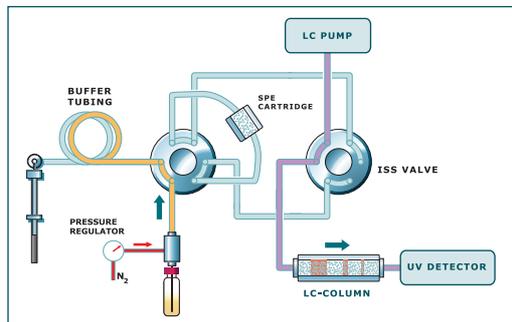


Figure 4: Draw sample in buffer tubing.

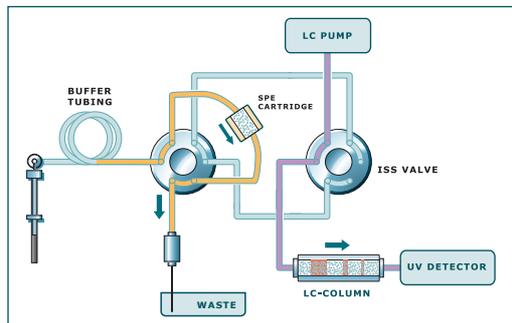


Figure 5: Load sample on cartridge.

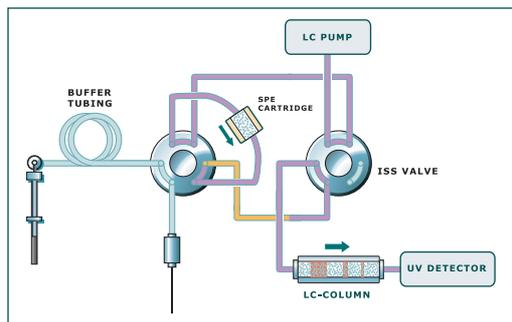


Figure 6: Elute to LC column.

Conclusions

This unique front-end solution allows for reproducible analysis of acids in beer at Heineken breweries around the world.

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