QuadraChem Laboratories Ltd

Evaluation of new features (VDK, yeast vitality) of the CDR BeerLab® Analyser

Summary

The CDR BeerLab® Analyser was trialled for yeast vitality and VDK analysis.

Our study using the CDR BeerLab® Analyser showed that:

- The instrument was easy to use
- The user interface was logical and user friendly
- Compared to the acidification power yeast vitality and the reference VDK methods, the CDR BeerLab® methods were much quicker
- The system has a low environmental impact due to minimal waste production and the very low sample and reagent volumes required

Our assessment of the ability of the CDR BeerLab® to analyse for yeast vitality and beer VDK concentration showed that based on the data obtained in this study, the test instrument gave results with linear correlation to the reference methods with correlation $R^2 \geq 0.90$. Analysis of ten replicates of the same sample showed that the CDR BeerLab® is similarly precise to the reference method both for VDK and yeast vitality analysis.

Introduction

QCL are distributors of the CDR BeerLab® Analyser, an instrument able to analyse a number of beer parameters (pH, bitterness, colour, alcohol). The instrument was previously evaluated by Campden BRI and was found to give comparable results to reference methods. The manufacturer has added some new features to the equipment – VDK analysis and determination of yeast activity.

CDR BeerLab® Instrument

The CDR BeerLab® Analyser is a self-contained unit and only requires a power supply. Set-up is very straightforward. The machine is turned on, warms up to the correct operating temperature and then is ready to use. The instrument is controlled through a simple touch-screen menu and the included software has the capacity to store many test methods.

Detailed step by step instructions for each method are provided through the touch screen menu. During any test the user can easily refer back to the instruction steps by clicking on the question mark in the top right of the screen. The four reading cells of the CDR BeerLab® each read absorbance at a different wavelength. An extremely useful tool is that, when it comes to reading the absorbance, the appropriate cell will flash blue.

The cuvettes, reaction vials, pipette tips, reagents etc. required to perform the tests are all provided in sealed bags by the manufacturer. The VDK test pack needs to be stored in a freezer, the vitality test kit is stored at room temperature (except for reagent R1 which is stored in a fridge).

A mini-centrifuge was provided by the client for the purpose of this study. This does not come as standard with the CDR BeerLab® so would need to be purchased separately and is a relatively low-cost item.

Minimal waste is produced, which along with the small sample and very low reagent volumes required, provides analysis with a low environmental impact.

Results are printed off automatically but are also stored within the machine and can be accessed by a USB port for export into Excel and Ethernet for LIMS connection although this is subject to compatibility.

The only maintenance action required was the daily automated start up procedure which only took a few minutes to perform. All the tests are performed in disposable vials and cuvettes.

Methods

Five beer samples for VDK analysis and 5 yeast slurries for yeast vitality analysis were provided by the client. All samples were held cold until the point of analysis.

Following training on the CDR BeerLab® instrument, the 5 beer samples for VDK analysis were degassed and then distilled. The first 15ml of distillate were diluted to a final volume of 25ml according to the CDR BeerLab® instructions. The samples were held in crimped vials and held cold until analysis. Analysis was carried out in triplicate on the CDR BeerLab® instrument according to the manufacturer's instructions and using the VDK reagent kits provided. In parallel, the samples (not distilled) were analysed in triplicate by the reference UKAS accredited VDK method (Campden BRI Method AM/008 based on Analytica-EBC, 9.24.2, 1999).

The 5 yeast slurries were analysed in triplicate for yeast vitality on the CDR BeerLab® following the manufacturer's instructions. In parallel, the samples were analysed in triplicate for their vitality using the yeast acidification power test (one of the most common vitality tests used).

To establish repeatability of the analyses and allow calibration of the equipment, one sample each of the VDK beer and yeast sample sets was analysed in 10 replicates by the CDR BeerLab® and the Campden BRI methods described above.

Results

Yeast Vitality Analysis

Yeast vitality was determined using the CDR BeerLab® (absorbance measurements) and the reference method (acidification power test). The correlation, R^2, between the 2 datasets was found to be 0.9042 (see Figure 1).

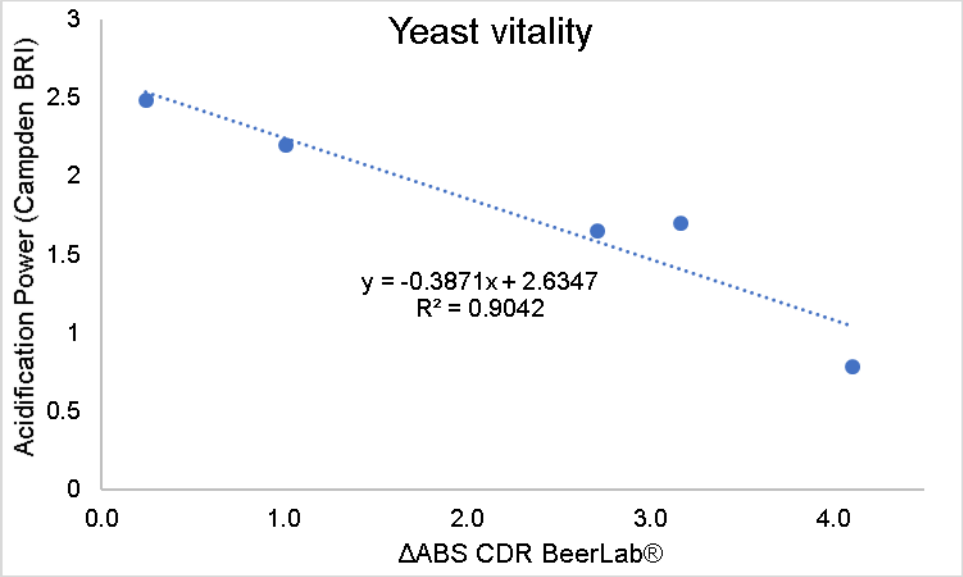

Figure 1 Correlation between Acidification Power and Yeast Vitality absorbance values (CDR BeerLab®)

In order to convert the CDR BeerLab® absorbance measurements to yeast vitality measurements, the instrument uses a simple linear equation as shown below:

Yeast vitality = **K** x (ABS) + **Q**

In this assessment the instrument was calibrated, i.e. the K and Q values determined, using the reference data obtained for the 5 yeast samples. These values will then be used in the instrument's software, so that absorbance measurements can automatically be converted to yeast vitality values.

Once calibrated against the reference data (5 values), and using the determined K and Q values, the CDR BeerLab® and reference results were similar and the standard deviations of the triplicate samples showed that the precision of the CDR BeerLab® Analyser was comparable to the precision of the reference vitality method (acidification power test) (see Table 1).

	CDR BeerLab®					Campden BRI				
Sample				**Mean**	**StdDev**				**Mean**	**StdDev**
1	1.14	0.99	1.00	1.04	0.08	0.83	0.74	0.8	0.79	0.05
2	2.54	2.54	2.54	2.54	0.00	2.46	2.49	2.50	2.48	0.02
3	2.24	2.23	2.27	2.24	0.02	2.17	2.20	2.22	2.20	0.03
4	1.62	1.58	1.55	1.58	0.04	1.66	1.61	1.68	1.65	0.04
5*				1.40	0.09				1.70	0.07

Table 1 Yeast vitality of 5 yeast slurry samples by CDR BeerLab® (calibrated values) and by acidification power test (Campden BRI)
* Sample 5 was analysed in 10 replicates (see Table 3)

VDK Analysis

VDK concentration was determined using the CDR BeerLab® (absorbance measurements) and the Campden BRI reference method. The correlation, R^2, between the 2 datasets was found to be 0.9893 (see Figure 2).

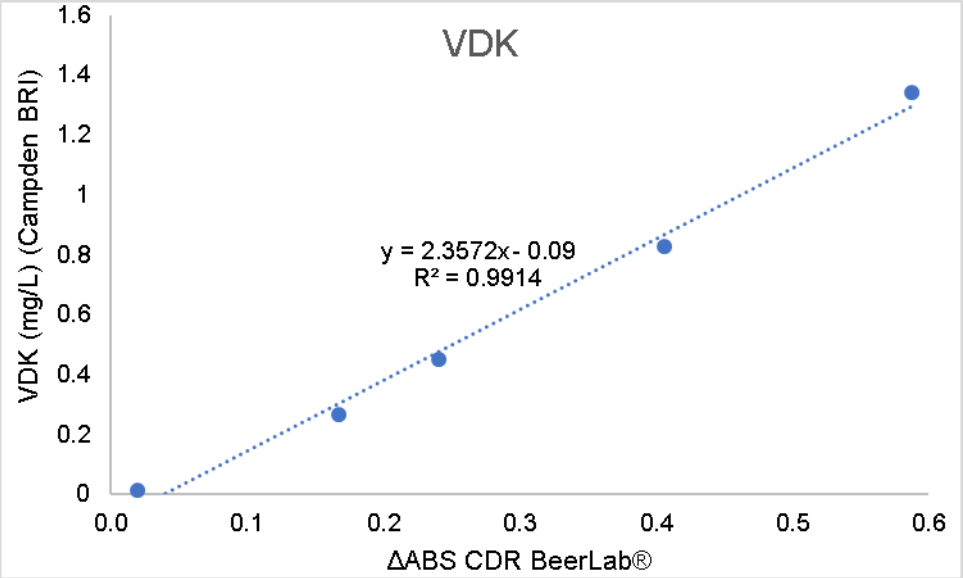

Figure 2 Correlation between VDK measurements using CDR BeerLab® (absorbance values) and the Campden BRI method

In order to convert the CDR BeerLab® absorbance measurements to VDK concentrations, the instrument uses a simple linear equation as shown below:

VDK concentration (mg/L) = **K** x (ABS) + **Q**

In this assessment the instrument was calibrated, i.e. the K and Q values determined, using the reference data obtained for the 5 beer samples. These values will then be used in the instrument's software, so that absorbance measurements can automatically be converted to VDK concentrations.

Once calibrated against the reference data (5 values), and using the determined K and Q values, the CDR BeerLab® and reference results were similar. However, the standard deviations of the triplicate samples showed that the CDR BeerLab® Analyser was less precise than the reference VDK method (see Table 2).

	CDR BeerLab®					Campden BRI				
Sample				**Mean**	**StdDev**				**Mean**	**StdDev**
1	< 0.020	0.044	<0.020	0.044	-	0.016	0.000	0.019	0.012	0.010
2	0.344	0.309	0.234	0.295	0.056	0.253	0.248	0.246	0.249	0.004
3*				0.500	0.075				0.449	0.020
4	0.824	0.140**	0.885	0.855	0.043	0.798	0.816	0.806	0.807	0.009
5	1.309	1.204	1.328	1.280	0.067	1.342	1.330	1.326	1.333	0.008

Table 2 VDK concentrations (mg/L) by CDR BeerLab® (calibrated values) and by the Campden BRI Method of 5 beer samples
* Sample 3 was analysed in 10 replicates (see Table 4)
** This result was considered an outlier and not used in the further calculation

Repeatability

To assess repeatability of the instrument more thoroughly, one sample of yeast and one sample of beer were analysed ten times using the CDR BeerLab® and the relevant Campden BRI reference methods. The data for yeast vitality and VDK concentration is shown in Tables 3 and 4.

Sample	**Yeast vitality**	
	CDR BeerLab® (Calibrated values)	**Campden BRI (Acidification Power)**
5	1.59	1.78
5	1.50	1.64
5	1.35	1.66
5	1.39	1.7
5	1.37	1.65
5	1.37	1.84
5	1.46	1.66
5	1.31	1.7
5	1.33	1.59
5	1.33	1.74
Mean	1.40	1.70
Std Dev	0.09	0.07

Table 3 Yeast vitality measurements of 1 yeast slurry in 10 replicates by CDR BeerLab® and by acidification power test

Sample	VDK	
	CDR BeerLab® (Calibrated values)	Campden BRI (concentration mg/L)
3	0.543	0.425
3	0.531	0.471
3	0.541	0.434
3	0.534	0.436
3	0.306*	0.432
3	0.512	0.453
3	0.187*	0.458
3	0.531	0.428
3	0.484	0.481
3	0.517	0.469
Mean	0.524	0.449
Std Dev	0.019	0.021

Table 4 VDK measurements of 1 beer sample in 10 replicates by CDR BeerLab® and by Campden BRI Method

* These datapoints are outliers (confirmed by Grubbs' test, α = 0.05) and were not used any further

The repeatability data produced by the CDR BeerLab®, as expressed in standard deviations of the eight/ten replicates showed that the CDR BeerLab® VDK and yeast vitality analyses have good repeatability compared to the reference method.

Conclusions

In this study the performance of the CDR BeerLab® for the analysis of yeast vitality and beer VDK concentration was evaluated. Five yeast slurry samples and five beer samples were analysed in triplicate (one sample in 10 replicates) for yeast vitality and VDK respectively using the CDR BeerLab® equipment and reference methods. The two CDR BeerLab® analyses were calibrated using the data obtained with the reference methods. The calibrated values were compared to those from the reference methods and the precision/repeatability of the two methods was also compared.

For yeast vitality the CDR BeerLab® results were similar to those for the reference methods (correlation $R^2 = 0.90$). Both methods were equally precise/repeatable.

Comparison of the analysis results of the 5 beer samples for VDK using both, the CDR BeerLab® (calibrated values) and the reference method, showed that the results were similar (correlation $R^2 = 0.99$). Thus the CDR BeerLab® method had good accuracy and is good for analyses requiring distillation and spectrophotometric measurement.

In summary, the CDR BeerLab® yeast vitality and VDK analyses show a linear correlation with the results obtained by the reference methods and the values obtained were similar (correlation $R^2 \geq 0.9$).