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Validation Report: Acetaldehyde Assay Kit (cat. no. K-ACHYD)

1. Scope

Megazyme's Acetaldehyde Assay Kit (K-ACHYD) is an enzymatic method used for the rapid measurement and analysis of acetaldehyde in beverages and foodstuffs. This method was developed in-house and measures acetaldehyde in g/L. Methods based on this principle have been accepted by MEBAK.

2. Planning

The purpose of this report is to verify and validate the current method as detailed by Acetaldehyde Assay Kit (K-ACHYD).

3. Performance characteristics

The selectivity, working range, limit of detection, limit of quantification, trueness (*bias*) and precision of this kit is detailed in this report.

3.1. Selectivity

This acetaldehyde dehydrogenase employed in this assay acts on aldehydes other than acetaldehyde but at a reduced rate. Under the assay conditions described, acetaldehyde and propionaldehyde are quantitatively converted, as is glycoaldehyde if the reaction time is extended to ~ 20 min. The presence of benzaldehyde and glyceraldehyde may lead to sample dependent creep reactions, that can be accounted for by extrapolation back to the time of addition of acetaldehyde dehydrogenase assay is specific for acetaldehyde.

Interfering substances in the sample being analysed can be identified by including an internal standard. Quantitative recovery of this standard would be expected. Losses in sample handling and extraction are identified by performing recovery experiments, i.e. by adding acetaldehyde to the sample in the initial extraction steps.

3.2. Working Range

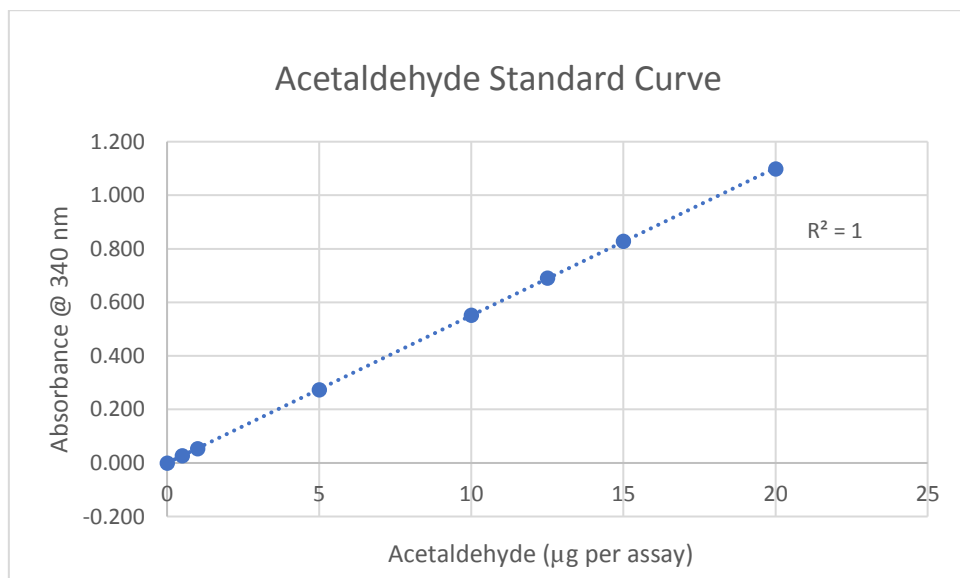
Assay follows the Acetaldehyde Assay Kit (K-ACHYD) standard procedure. 0.1 mL of acetaldehyde standard was used as sample, with a range of concentrations (0.005-0.2 g/L acetaldehyde) which corresponds to 0.5-20 µg of acetaldehyde per cuvette. Absorbance A₂ was read after 3-4 min, at 340 nm and at 25°C as recommended in the procedure.



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Acetaldehyde Concentration [$\mu\text{g}/\text{assay}$]	$\Delta A_{340\text{nm}}$
0	0.000
0.5	0.027
1	0.054
5	0.274
10	0.552
12.5	0.691
15	0.828
20	1.099





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3.3. LOD and LOQ

The **instrument limit of detection**, as per kit booklet, is 0.176 mg/L, which is derived from an absorbance difference of 0.020 with the maximum sample volume of 2.00 mL.

The **calculated limit of detection (LOD)** and the **calculated limit of quantification (LOQ)** for this report purpose is based on the analysis of samples that have been taken through the whole Acetaldehyde Assay Kit (K-ACHYD) measurement procedure.

- The LOD is the lowest concentration of the analyte that can be detected by the method. LOD is calculated as $3 \times s'0$; where $s'0$ is the standard deviation of a number of samples A1 reading.
- The LOQ is the lowest level at which the kit's performance is acceptably repeatable. LOQ is calculated as $kQ \times s'0$; where $s'0$ is the standard deviation of a number of samples A1 reading. The IUPAC default value for kQ is 10
- For Acetaldehyde Assay Kit (K-ACHYD)

LOD – For 2.0 mL of sample (maximum volume)

Acetaldehyde = 0.025 mg/L

LOQ – For 2.0 mL of sample (maximum volume)

Acetaldehyde = 0.100 mg/L

* **Note:** The above detection limits are for samples as used in the assay, after sample preparations if required (e.g. deproteinisation). The dilution used in pre-treatment must be accounted for while establishing the detection limits for specific samples.



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3.4. Trueness (Bias)

Comparison of the mean of the results (x) achieved with Acetaldehyde Assay Kit (K-ACHYD) method with a suitable reference value (x ref). For this report, Relative Bias is calculated in per cent as: $b(\%) = \frac{x - x_{ref}}{x_{ref}} \times 100$. The reference material for this purpose is acetaldehyde supplied with the Acetaldehyde Assay Kit (K-ACHYD) at 0.1 g/L

Relative Bias b(%)

	n	Ref Material (g/L)	Mean (g/L)	b(%)
Acetaldehyde	18	0.1	0.1051	5.14

3.5. Precision

This report details the reproducibility of the Acetaldehyde Assay Kit (K-ACHYD), it is a measure of the variability in results, on different days and by different analysts, over an extended period of time.

For the purpose of this report different lot numbers of the kit standard is used as the reference material.

Reproducibility

	n	Ref Material (g/L)	Mean (g/L)	Standard Deviation	%CV
Acetaldehyde	18	0.1	0.1051	0.0028	2.62

Repeatability of this kit can be assessed using wine samples. This is a measure of the variability in results by a single analyst, using real samples, using the same equipment and over a short period of time. The use of wine samples shows one of the many applications of this kit.

Repeatability

	n	Mean (g/L)	Standard Deviation	%CV
White Wine	12	0.0228	0.004	1.8
Red Wine	11	0.0113	0.003	3.0



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4. Conclusion

The method outlined in this document is a robust, quick and easy method for the measurement of acetaldehyde in various matrices. It has been used for many years and is fully automatable for high throughput analysis of samples. Data presented in this report verifies and validates that this method is fit for the purpose intended, which is summarised below.

Validation Summary	Acetaldehyde
Working range (μg in cuvette)	0.3-25
LOD (mg/L)	0.025
LOQ (mg/L)	0.10
Relative Bias <i>b</i> (%)	5.14
Reproducibility (%CV using kit standard)	2.62
Repeatability (%CV using white wine)	1.8
Repeatability (%CV using red wine)	3.0