Technical note

Delta-8 multichannel microtensiometer: intra- and inter-assay precision

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Overview

This technical note describes the intra- and inter-assay precision of Kibron's Delta-8 multichannel microtensiometer. The intra-assay precision assesses the reproducibility of the eight individual parallel microbalances within one instrument, whereas the inter-assay data shows the repeatability of multiple Delta-8 instruments.

Experimental

Surface tension measurements were carried out on Delta-8 multichannel microtensiometers in standard configuration. The instrument utilizes eight parallel microbalances fixed to meet the positions of the wells in a 96 format. The surface tension measurement is based on the Du Nouy method, i.e the maximum force exerted by the surface tension is recorded as the probes are withdrawn from the solutions. The resolution of the balances is 0.05 mN/m. The probes have a diameter of 0.5 mm and the measurement solution is completely wetting their surface. The instrument features automatic cleaning of the probes by heating prior to the measurement of the 96-well plate. The measurement loop, i.e. the cleaning of the probes and the measurement of the 96-wellplate, takes less than 2 minutes. SDS for the experiment was obtained from SERVA and was used as received without further purification.

Intra-assay precision

To establish the intra-assay precision of Delta-8 instrument eight parallel serial dilutions of sodium dodecyl sulfate (SDS) in aqueous solution were prepared by manual pipetting into a disposable 96-well plate. Before the measurement the plate was allowed to stand under a lid for ten min in order to reach equilibrium for the partitioning of the compounds between the bulk and surface. Table 1 compiles the surface pressure readings recorded for individual channels. Also in this table are listed the standard deviations between the channels. Table shows only minimal variation between parallel channels, with standard deviations between 0.3 and 0.8 mN/m. Yet, the values reflect not solely the precision of the Delta-8 instrument, but rather the repeatability of the manual sample preparation procedure.

High precision as well, were obtained for the determination of molar cross-sectional area, critical micelle concentration, and maximum surface pressure. The statistics are summarized in Table 2. The lower CMC values recorded for SDS compared to the literature value of 8.3 mM [1] may be due to the salt impurities in the SDS or water that screens the electrostatic surface charge.

Inter-assay precision

The inter-assay precision was determined by measuring SDS isotherms with three different Delta-8 instruments. The same sample plate used in the intra-assay test was measured with two additional instruments.

Table 1: Surface pressures (mN/m) recorded with parallel channels (A-H).

c /mM	ch A	ch B	ch C	ch D	ch E	ch F	ch G	ch H	SD
0.23	2.1	1.9	1.9	1.4	1.3	1.3	2.1	1.5	0.3
0.36	5.1	4.3	4.0	2.7	3.2	3.7	4.3	4.6	0.8
0.58	8.3	7.2	6.9	6.9	6.1	6.0	7.7	7.2	0.8
0.93	11.6	10.6	10.3	10.5	10.5	10.5	10.8	10.7	0.4
1.49	15.5	15.6	15.4	15.6	15.4	14.9	15.0	14.3	0.4
2.38	19.9	19.9	20.3	20.4	20.7	20.0	20.3	19.2	0.5
3.81	26.9	27.1	26.7	26.9	27.4	27.3	27.2	25.6	0.5
6.10	34.1	32.6	33.3	33.3	33.5	33.7	34.1	33.2	0.5
9.77	33.2	32.3	32.6	32.4	31.9	32.5	32.7	32.4	0.4
15.63	32.6	32.0	32.5	32.4	31.7	32.1	32.2	31.5	0.4
25.00	32.6	32.6	33.7	32.3	32.0	32.5	32.5	31.9	0.5

Figure 1 shows all the isotherms plotted against the SDS concentration. The standard deviations for the surface pressure readings at each concentration are summarized in Table 3. The mean value of these deviations, 0.3 mN/m, demonstrates excellent inter-assay precision, which is also shown in the mean values and standard deviations for the parameters calculated from the resulting 24 SDS isotherms (Table 4).

Concluding remarks

The data show Delta-8 to have excellent intra- and inter-assay precision. In addition, the results demonstrate the suitability of the Delta-8 for reproducible and fast determination of CMC's and cross-sectional areas.

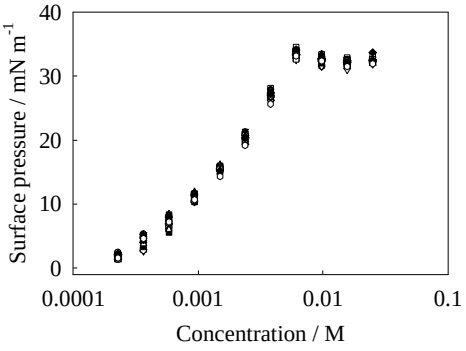

Figure 1: Inter assay comparison of 24 isotherms for SDS.

Table 2: Intra-assay statistics of characteristic parameters determined from the SDS isotherms.

	A_S(Å^2)	CMC (mM)	$\Delta\pi$ (mN/m)
Mean	33.5	6.1	32.7
SD	0.7	0.2	0.3

Table 3: Standard deviations (mN/m) for the surface pressures measured with three Delta-8 instruments.

c /mM	ch A	ch B	ch C	ch D	ch E	ch F	ch G	ch H
0.23	0.2	0.3	0.1	0.1	0.1	0.3	0.0	0.3
0.36	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.4
0.58	0.2	0.2	0.1	0.4	0.3	0.3	0.1	0.4
0.93	0.2	0.4	0.5	0.2	0.3	0.5	0.4	0.5
1.49	0.3	0.2	0.3	0.1	0.2	0.6	0.5	0.5
2.38	0.3	0.2	0.3	0.3	0.3	0.5	0.6	0.2
3.81	0.3	0.1	0.2	0.1	0.3	0.4	0.2	0.3
6.10	0.1	0.2	0.3	0.1	0.3	0.6	0.1	0.5
9.77	0.1	0.4	0.6	0.3	0.4	0.7	0.2	0.7
15.63	0.1	0.3	0.5	0.4	0.3	0.6	0.2	0.6
25.00	0.2	0.4	1.0	0.2	0.3	0.6	0.2	0.4

Table 4: Inter-assay statistics of characteristic parameters determined from 24 SDS isotherms.

	A_S(Å^2)	CMC (mM)	$\Delta\pi$ (mN/m)
Mean	34.0	6.0	32.6
SD	1.0	0.2	0.4

References

[1] J. Lyklema. *Fundamentals of Interface and Colloid Science*, volume III. Academic Press, 2000.