Technical Article

EzDrop 1000 vs NanoDrop ™ One (2000) and DS-11 Series:

Performance Comparison among Micro-Volume UV/Vis Spectrophotometers

EzDrop 1000 Micro-Volume UV/Vis spectrophotometer features fast nucleic acid/protein measurement in 3 seconds. Compared to the widely used spectrophotometers of the same level as EzDrop 1000, including NanoDrop ™ One, NanoDrop ™ 2000 and DS-11 Series, EzDrop 1000 not only performs with equal accuracy and precision in nucleic acid concentration and quality detection but also processes larger wavelength range.

Introduction

Spectrophotometers are widely used for scientists to detect the concentration of substances in samples. When selecting the right spectrophotometer, the key features of wavelength range, accuracy and the sample volume often play important roles.

The EzDrop 1000 Micro-Volume UV/Vis Spectrophotometer provides fast nucleic acid and protein measurement in 3 sec. Only 1 µL of micro volume sample is required. The ratio of A260/A280 calculated simultaneously is convenient for confirming the quality of nucleic acid (DNA and RNA). Moreover, with the aid of low optical path length design, the detection concentration of dsDNA with EzDrop 1000 can be up to 20,000 ng/ µL. EzDrop 1000 possesses larger wavelength range, from 190 to 1000 nm, than competitor spectrophotometers such as NanoDrop™ ONE (Thermo Fisher®), NanoDrop ™ 2000 (Thermo Fisher®) and DS-11 (DeNovix®).

On this note, we compared the performance of EzDrop 1000 to NanoDrop ™ ONE, NanoDrop ™ 2000 and DS-11 in nucleic acid sample detection – you'll see how the EzDrop 1000 can help accelerate your research efficiency.

Technical Spec Comparison

Here, we chose three other models to compare with EzDrop 1000. Table 1 shows key the specifications of EzDrop 1000, NanoDrop ™ ONE, NanoDrop ™ 2000 and DS-11. It indicates that the specifications of these micro-volume UV/Vis spectrophotometers are similar. EzDrop 1000 even possesses the largest wavelength range (Table 1).

Brand	Blue-Ray Biotech	DeNovix®	Thermo Fisher®	Thermo Fisher®
Micro-volume model	EzDrop 1000	DS-11	NanoDrop™ ONE	NanoDrop™ 2000
Sample Volume	1 -2 µL	0.5 µL	1 - 2 µL	0.5 - 2 µL
Wavelength Range	190 - 1000 nm	190 - 840 nm	190 - 850 nm	190 - 840 nm
Pathlength	0.5 mm / 0.05 mm	0.5 mm (auto ranging to 0.02 mm)	1.0 mm (auto ranging to 0.03 mm)	1.0 mm (auto ranging to 0.05 mm)
Detection Range	0.06 mg/mL BSA; 2 ng/µL dsDNA	0.04 mg/mL BSA; 0.75 ng/µL dsDNA	0.06 mg/mL BSA; 2 ng/µL dsDNA	0.1 mg/mL BSA; 2 ng/µL dsDNA
	600 mg/mL BSA; 20000 ng/µL dsDNA	1125 mg/mL BSA; 37500 ng/µL dsDNA	820 mg/mL BSA; 27500 ng/µL dsDNA	400 mg/mL BSA; 15000 ng/µL dsDNA
Light Source	Pulsed Xenon flash lamp	Pulsed Xenon flash lamp	Pulsed Xenon flash lamp	Pulsed Xenon flash lamp
Detector Type	2048 element CMOS	2048 element CCD	2048 element CMOS	2048 element CCD
Wavelength Accuracy	1.0 nm	0.5 nm	1.0 nm	1.0 nm
Spectral Resolution	1.5 nm (FWHM at Hg 253.7 nm)	1.5 nm (FWHM at Hg 253.7 nm)	1.8 nm (FWHM at Hg 253.7 nm)	1.8 nm (FWHM at Hg 253.7 nm)
Absorbance Precision (raw)	0.0015 A (0.5 mm) or 1%, whichever is greater	0.0008 AU (0.5 mm) or 1%, whichever is greater	0.002 A (1 mm) or 1%, whichever is greater (SD of 10 individual measurements at 0.97 A)	0.002 A (1 mm)
Absorbance Precision	0.03 A (1 cm equivalent) or 1%, whichever is greater	0.015 AU (1 cm equivalent) or 1%, whichever is greater	0.02 A (1 cm equivalent) or 1%, whichever is greater (SD of 10 individual measurements at 0.97 A)	0.02 A (1 cm equivalent)
Absorbance Accuracy	3.0% at 0.75 A at 300 nm	1.5% at 0.75 AU at 260 nm	3.0% at 0.97 A at 320 nm	3.0% at 0.74 A at 350 nm
Absorbance Range	0 (0.04) - 400 A (1 cm equivalent)	0.015 - 750 AU (1 cm equivalent)	0 (0.04) - 550 A (1 cm equivalent)	0 (0.04) - 300 A (1 cm equivalent)

Table 1. Specification comparison of four micro-volume UV/Vis spectrophotometers.
The characteristics of four UV/Vis micro-volume spectrophotometers, EzDrop 1000 (Blue-Ray Biotech), NanoDrop ™ ONE (Thermo Fisher®), NanoDrop ™ 2000 (Thermo Fisher®) and DS-11 (DeNovix®).

Accuracy Comparison

The accuracy tests show the ability to measure the true concentration of a substance in a sample. Model sample (10 mg/mL salmon sperm DNA, Invitrogen, Thermo Fisher®) was twofold serial diluted and the concentration and A260/A280 ratio of each sample were detected with the EzDrop 1000, DS-11 and NanoDrop ™ 2000, shown in Table 2, and with the EzDrop 1000 and NanoDrop ™ ONE, shown in Table 3. The R2 was also calculated from Table 2 and Table 3 and both displayed above 0.99 (Figure 1 and 2). The results prove that the accuracy of these micro-volume UV/Vis spectrophotometers was similar, demonstrating that EzDrop 1000 is a great competitor to other micro-volume spectrophotometers.

Brand		Blue-Ray Biotech		DeNovix®		Thermo Fisher®	
Model		EzDrop 1000		DS-11		NanoDrop™ 2000	
Sample concentration		Nucleic Acid (ng/µL)	A260/A280	Nucleic Acid (ng/µL)	A260/A280	Nucleic Acid (ng/µL)	A260/A280
2X serial dilution	10000	9430.7928	1.89	9457.141	1.88	9473.4	1.9
	5000	4774.432	1.90416	4756.202	1.8	4765.7	1.89
	2500	2531.412	1.82	2464.629	1.77	2448.1	1.89
	1250	1228.88	1.88329	1264.469	1.73	1270.7	1.91
	625	654.5	1.89	748.736	1.77	650.8	1.88
	312	337.1	1.79972	326.869	1.68	338.5	1.85
	156	170.51	1.82	163.486	1.71	171	1.81
	78	92.29	1.76494	82.788	1.67	85.9	1.79
	39	47.58	1.96	41.053	1.66	43.5	1.74
	20	24.62	1.67696	20.494	1.6	21.4	1.8
	10	12.41	1.63	10.028	1.6	11	2.04
	5	6.56	2.84123	4.689	2.17	5.6	2.05
	2.5	3.81	2.09	2.615	6.56	3	1.75

Table 2. The accuracy test among EzDrop 1000, DS-11 and NanoDrop ™ 2000.
The model sample was twofold serial diluted. The concentration and A260/A280 ratio of each sample were detected by EzDrop 1000, DS-11 and NanoDrop ™ 2000.

Brand		Blue-Ray Biotech		Thermo Fisher®	
Model		EzDrop 1000		NanoDrop™ ONE	
Sample concentration		Nucleic Acid (ng/μL)	A260/A280	Nucleic Acid (ng/μL)	A260/A280
2X serial dilution	10000	9710.536	1.91	9932.729	1.86
	5000	5033.347	1.9	4938.379	1.88
	2500	2538.602	1.86	2618.794	1.87
	1250	1307.317	1.83	1324.658	1.82
	625	634.667	1.84	667.683	1.79
	312	319.044	1.79	325.346	1.77
	156	158.433	1.77	163.22	1.69
	78	80.729	1.65	80.947	1.62
	39	41.712	1.54	39.352	1.62
	20	21.835	1.46	19.02	1.52
	10	11.297	1.21	9.429	1.55
	5	4.4	1.66	3.86	1.61
	2.5	2.222	1.57	1.72	1.64

Table 3. The accuracy test between EzDrop 1000 and NanoDrop ™ ONE.
The model sample was twofold serial diluted. The concentration and A260/A280 ratio of each sample were detected by EzDrop 1000 and NanoDrop ™ ONE.

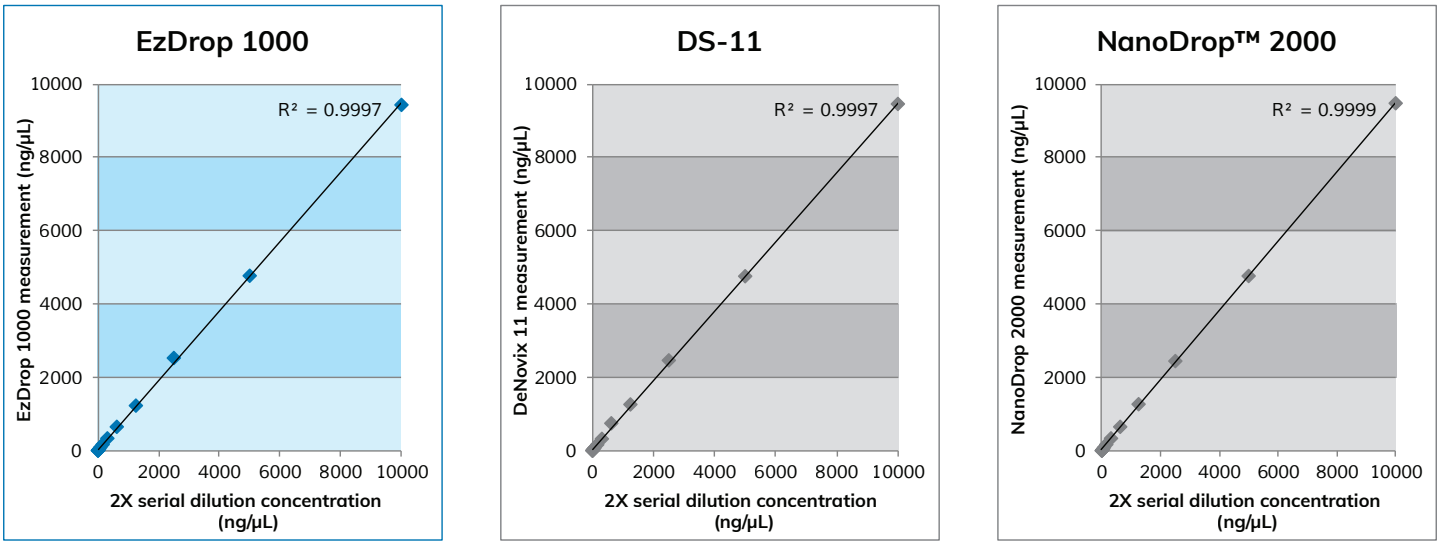

Figure 1. The accuracy test between EzDrop 1000, DS-11 and NanoDrop ™ 2000.
The model sample was twofold serial diluted. The concentration of each sample was detected with the EzDrop 1000, DeNovix® DS-11 and NanoDrop ™ 2000. The R^2 was calculated to represent the accuracy.

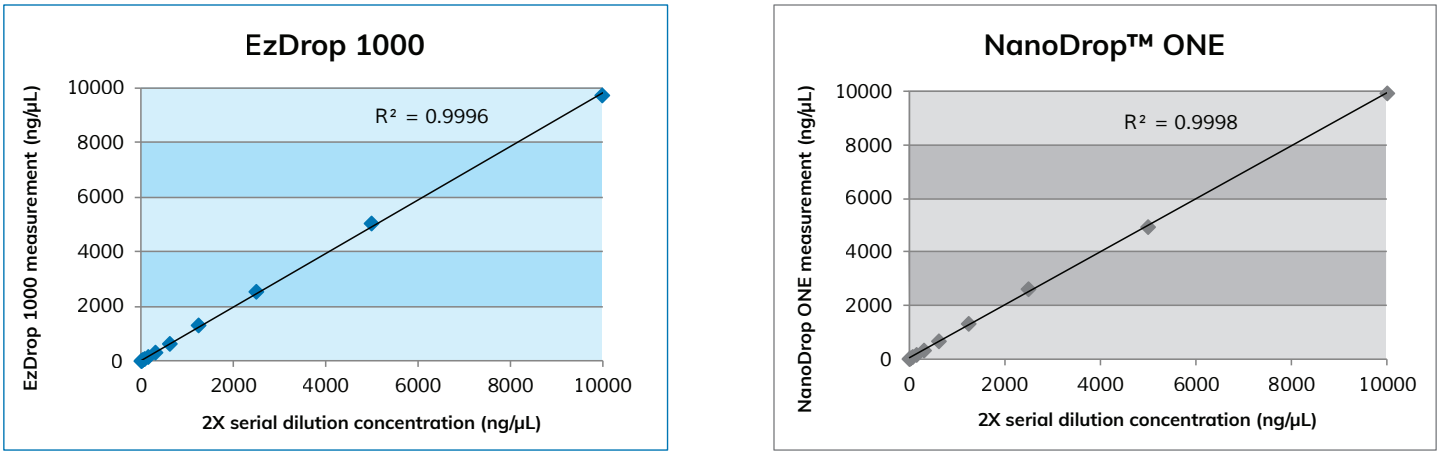

Figure 2. The accuracy test between EzDrop 1000 and NanoDrop ™ ONE.
The model sample was twofold serial diluted. The concentration of each sample was detected with the EzDrop 1000 and NanoDrop ™ ONE. The R^2 was calculated to represent the accuracy.

Precision Comparison

The precision tests show the ability to obtain similar results by repeating analysis on the same sample. The concentration of the model sample labeled as 2500 ng/ μL or 312 ng/ μL was detected three times with the EzDrop 1000 and DS-11 individually. The concentration detected from two spectrophotometers were similar; however, the CV value from the EzDrop 1000 was more stable than that of the DS-11 under different concentrations of model sample detection (Table 4 and Figure 3). These results indicate that EzDrop 1000 is more reliable.

Brand	Model	High concentration sample comparison				Normal concentration sample comparison			
		2500 (ng/μL)	Average	Standard deviation	CV value	312 (ng/μL)	Average	Standard deviation	CV value
Blue-Ray Biotech	EzDrop 1000	2521.92	2522.85	6.64	0.26%	335.44	336.65	0.87	0.26%
		2531.41				337.1			
		2515.22				337.42			
Denovix®	DS-11	2464.63	2459.54	12.33	0.50%	326.87	326.25	0.63	0.19%
		2442.56				325.39			
		2471.44				326.49			

Table 4. The precision test between EzDrop 1000 and DS-11.
The concentration of sample with same volume was measured three times to show the reproducibility of EzDrop 1000 and DS-11 (n=3).

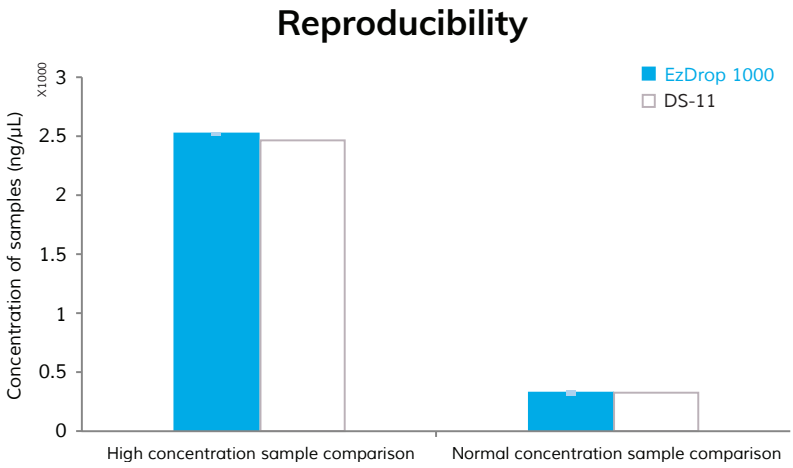

Figure 3. The precision test between EzDrop 1000 and DS-11.
The concentration of sample with same volume was measured three times to show the reproducibility of EzDrop 1000 and DS-11 (n=3).

Summary

NanoDrop ™ ONE, NanoDrop ™ 2000 and DS-11 are widely used micro-volume UV-Vis spectrophotometers by scientists. Although EzDrop 1000 is a newcomer, our results revealed that the accuracy was well matched to these popular micro-volume spectrophotometers. Moreover, the more stable CV value during the precision test demonstrated that EzDrop 1000 possesses better reproducibility. Additionally, though the performance of the EzDrop 1000 and DS-11 were better than the technical specifications, the measurement results of the EzDrop 1000 were more stable.

In conclusion, EzDrop 1000 not only performs with equal accuracy and precision in nucleic acid concentration and quality detection, but it also possesses larger wavelength range compared with competitors.

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