Increase the S/N Ratio by Multiple Scanning and Readout Average

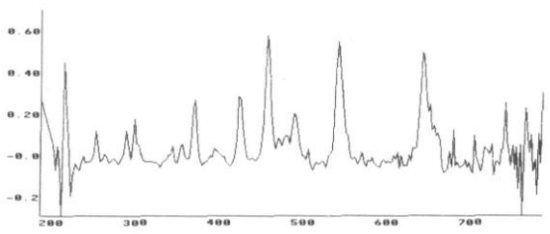
With SpectroArt 200 spectrophotometer you can measure absorbance or transmittance in the wavelength region of 200-800 nm, which makes SpectroArt 200 suitable for a wide range of applications within fields of molecular biology as well as analytical chemistry. With a xenon flash lamp, the whole wavelength region is conveniently measured using only one lamp, instead of conventional spectrophotometers which often utilise different lamps, e.g. deuterium and tungsten, for measuring UV and visible light. With SpectroArt 200, the light throughput of the xenon lamp can be adjusted to suit the whole wavelength region, simply by increasing or decreasing the flash setting. SpectroArt 200 is equipped with a diode array detector which applies reverse optics technology. This enables detection of all wavelengths in the wavelength-range simultaneously. With no moving parts for detecting or scanning wavelength/wavelengths of interest, the reliability and speed of the measurement increases.

Flash setting

When increasing the number of times the xenon flash lamp flashes for a single detection, the light throughput and hence the dynamic range for the reading increases. The ideal flash setting varies depending on the wavelength measured. When measuring at shorter wavelengths, a lower flash setting is sufficient to get a good dynamic range without saturation of the signal. At longer wavelengths, a higher flash setting is required to increase the signal to noise ratio of you readings.

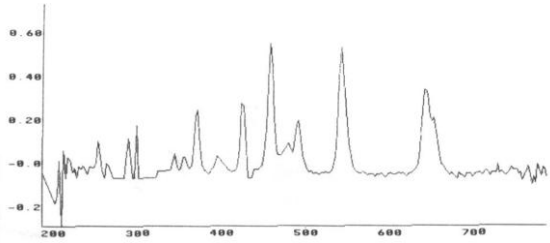
Average number

The average number represents the number of times in average, that the diode array detector reads, or scans, a measurement. A higher average number will lower random noise and also noise that may be generated by the xenon flash lamp. Thus, it will increase the signal to noise ratio. A high average number will generate a good signal to noise ratio, however it will also result in a longer measurement time.



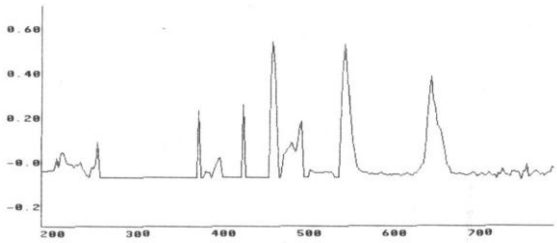
(i)

1 Flash 1 Average



(ii)

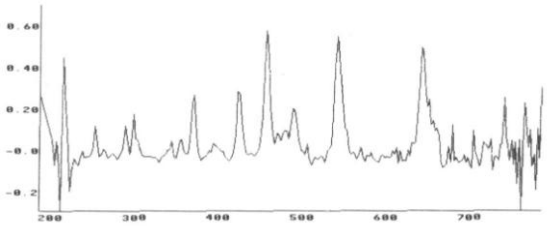
4 Flash 1 Average



(iii)

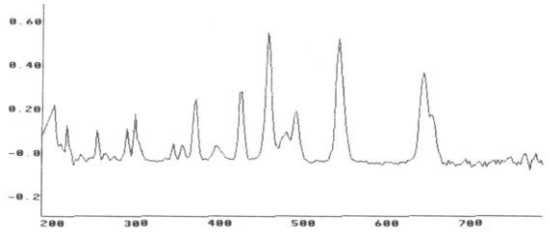
8 Flash 1 Average

Figure 1: *Holmium Oxide solution scanned utilising fixed average setting while varying the flash setting. The x-axis represents wavelength and the y-axis represents absorbance values. The flat appearance of the spectra in shorter wavelength regions in* ***(iii)*** *is indicative of detector saturation.*



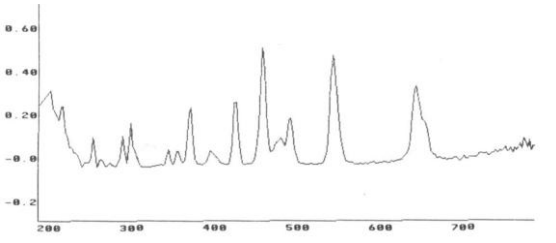
(i)

1 Flash 1 Average



(ii)

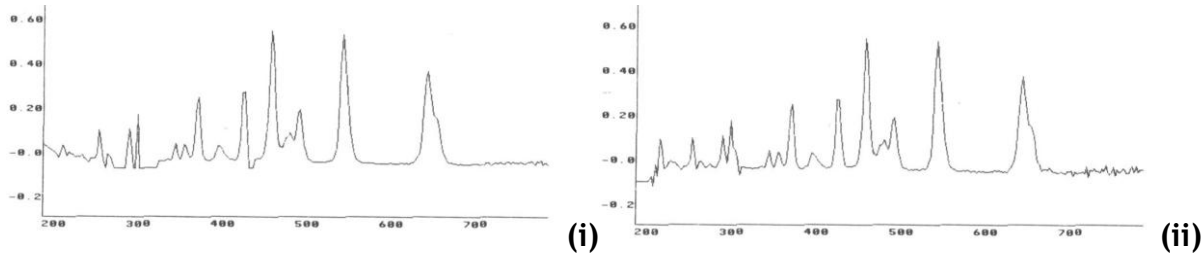
1 Flash 25 Average



(iii)

1 Flash 50 Average

Figure 2: *Holmium Oxide solution scanned utilising fixed flash setting while varying the average setting. The x-axis represents wavelength and the y-axis represents absorbance values.*



4 Flash 25 Average 4 Flash 10 Average

Figure 3: *Holmium Oxide solution scanned utilising 4 flash and 25 average scans in **(i)** and 4 flash, 10 average in **(ii)**. The x-axis represents wavelength and the y-axis represents absorbance values.*

RESULTS AND DISCUSSION

Figures 1-3 shows scanning spectra generated by Holmium Oxide when utilising different average and flash settings. As seen in figure 1 (i-ii), the level of noise is considerably lowered by increasing the flash count from 1 to 4. The improvement is seen throughout the spectra but is especially clear in the shortest and the longest wavelengths. Figure 1 (iii) shows the highest flash setting. A high flash setting has different effects depending on the wavelength measured, depending on the non-uniform intensity of the xenon flash lamp across the spectral range. At lower wavelengths (UV-region), the lamp intensity is high, and a low flash setting is therefore sufficient to generate a wide dynamic range. At longer wavelengths (visible region), the lamp intensity is lower, thus a higher flash setting is required in order to reduce noise and generate a good dynamic range. The flat appearance of the spectra in the shorter wavelength areas of the scan in figure 1 (iii) is indicative of detector saturation. Saturation lowers the reliability of the measurement and should therefore be avoided. Figure 2 (i-iii) shows scanning results when increasing the average number while using a fixed low flash setting. The signal-to noise ration appears significantly increased when utilising a setting of 25, compared to a setting of 1, but does not change drastically when increasing further. Figure 3 (i-ii) shows two different scans utilising 4 flashes and 25 average in (i) and 2 flashes and 10 average in (ii).
None of the scans show any saturation-tendency. The signal to noise appears relatively similar in the two scans and would both generate reliable measurement results throughout the wavelength range.

Tove Sivik
Application Manager
Email: info@wealtec.com

Wealtec BioScience Co. Ltd.
27Fl. No. 29-1 Sec.2, Jungjeng E. Rd., Danshuei Jen, Taipei, Taiwan 25170
TEL: +886-2-8809-8587 FAX: +886-2-8809-8589; http://www.wealtec.com