ATTO Spectrometer

AB-1850 LumiFL-Spectrocapture

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LumiFL spactrocapture

A Highly Sensitive Spectrometer for Bio/Chemiluminescence and Fluorescence

Usage/Features of product

LumiFluor Spectro Capture is a highly sensitive spectrometer that can measure the spectrum of weak light, which was difficult to measure with existing spectrometers using photo diodes or photomultiplier tubes.

A cooled CCD camera is used as the detector to detect the spectra wavelength in the measurement region.

Capable of detecting spectra of ultra low intensity light with high sensitivity

For spectrum measurement of luminescence and fluorescence detection used in the bioscience field
==> Investigation of molecular design of FRET (Fluorescence Resonance Energy Transfer)
==>Investigation of molecular design of BRET (Bioluminescence Resonance Energy Transfer)
==>Development and quality control of luminescent/fluorescent reagents
==>Analysis of fluorescent/luminescent reactions

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References

Authors	Literature
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Yoshihiro NAKAJIMA, et al.	Bioscience, Biotechnology, and Biochemistry Vol. 68 (2004) , No. 3 pp.565-570
Yoshihiro Ohmiya	Japanese Journal of Applied Physics Vol. 44, No. 9A, 2005, pp. 6368-6379
Tomomi Otsuji, et al.	Analytical Biochemistry 329 (2004) 230–237
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Specification

1. Luminescence fluorescence measurement part

F value	F3.0
Measurement wavelength region	400 to 800nm
Reciprocal linear dispersion	60nm/mm
Wavelength resolution	1.8nm
Repeatability	+-0.6nm
Slit width /	0.01mm - 5mm (11 steps)
Exposure time /	1/20sec.- 60min. (26 steps)
Light receiving part /	Electronic cooled CCD

2. Spectrograph

No. of diffraction grating /	1 (standard) diffraction grating: 150pcs./mm
Braze wavelength	500nm

3. Measurement sample part

Measurement vessel /	Quartz cell (4mm x 4mm)/0.2mLPCR tube/35mm dish
Sample volume	10ul to 100ul
Reagent injection part for instantaneous luminescence /	Present (septum)
Excitation light introduction part /	FC connector for incidence (standard)

4. Software

Function /	Measurement control/spectral data analysis
Interface	UBS2.0

5. Dimensions/weight

Size	510mm(W)x725mm(D)x390(H)
Weight	58kg
Power source	AC100V 50/60Hz 290V

6. Standard accessories

Lumifluor Spectro Capture main unit	1 set
35mm dish sample block	1pc.
Square cell sample block	1pc.
PCR tube sample block	1pc.
Filter holder for fluorescent	1pc.
AC cord	1pc.
USB connection cable	1pc.
Reagent injection connector for instantaneous luminescence	1pc.
Quartz square cell	1pc.
PCR tube	1 pack
Reagent injection rubber valve for instantaneous luminescence	1 pack
Control/data analysis software (CD)	1pc.
Instruction manual 1 copy	

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Features of product

Usage features

1. It disperses light and detects the wavelength of the measurement region simultaneously under the same conditions.
2. A cooled CCD camera is used as a detector so the detection sensitivity can be increased significantly by adjusting the exposure time.

LumiFluor Spectro Capture uses a highly sensitive cooled CCD camera as a detector and enables increasing sensitivity and simultaneous measurement over the entire wavelength range. This unit is composed of a spectrum splitting mechanism and detection device as a basic rule, and it is possible to combine an excitation light source device for fluorescence (option: please inquire) depending on the sample.
It is also possible to use a quartz cell as a fluorescent sample cell and a plastic micro centrifuge tube as a luminescence sample cell.

Features of hardware

1. An electronic cooled CCD camera is used as a detector.
2. A CCD is capable of receiving the light of the entire target wavelength region for measurement at one time and detecting it.
3. A CCD has higher quantum efficiency than a photomultiplier tube.
4. Detection time is shortened with all wavelength simultaneous detection.
5. Measurement wavelength range is 400 ~ 800nm.
6. Long-time exposure is available (highly sensitive detection of micro specimens)
7. When a fluorescent excitation light source is equipped, FRET or fluorescent substance can be measured.

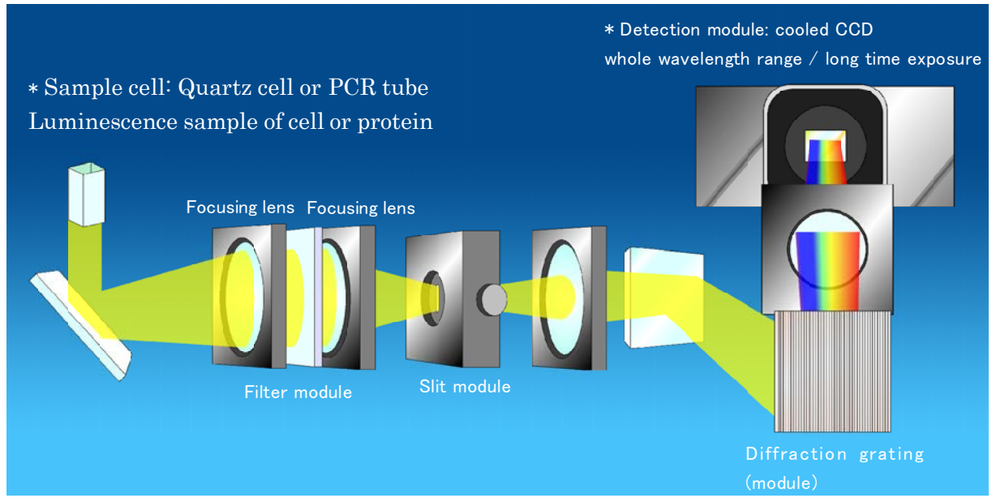
Comparison with general spectrometer

To capture a change in wavelength of weak light, a device that measures the spectrum of micro specimens in a highly sensitive manner is required. A general spectrometer scans the dispersed light wavelengths one by one with a photomultiplier tube and detects for each wavelength. With this method, because of the following facts;
(1) quantum efficiency of photomultiplier is lower than that of CCD, and
(2) measurement time for each wavelength is short
sensitivity becomes deficient, and a spectrum cannot be obtained unless a specimen has a certain level of density. Further, if the scanning time is extended in order to compensate for the lack of sensitivity, luminance or fluorescence attenuation is promoted during scanning and an accurate spectrum cannot be obtained.

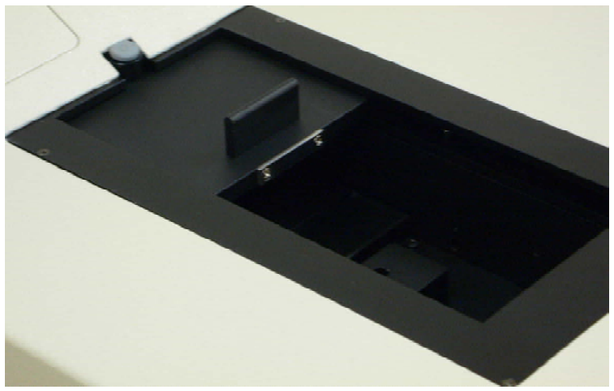
	LumiFL Spectro Capture	Common spectrometer
Detecter	Cooled CCD camera	Photomultiplier
Spectrum Detection	Simultaneous aquisition over the whole range of wave length	Stepwise scan at each wave length
Scanning Time	Short	Long
Target	Light emission of low intensity	Light emission of high intensity

Principle of sample measurement

Light emitted from a sample --> Spectrometry -->
Simultaneous detection over entire range of wavelength with cooled CCD



1. Sample cell: Quartz cell or PCR tube can be used. Luminescence sample of cell or protein
2. Focusing lens/filter: Excitation light cut filter for fluorescence can be set.
3. Slit module: For focusing the light of a sample
4. Diffraction grating: For dispersing light of a sample
5. Detection module: The entire spectrum of sample light dispersed is measured simultaneously with a cooled CCD. Measurement time is short and improvement in sensitivity for long-time exposures is easy.



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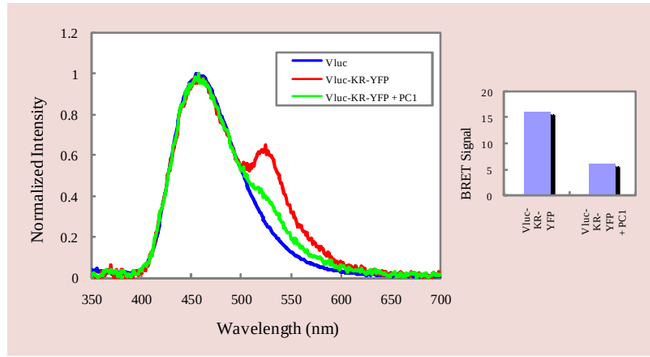
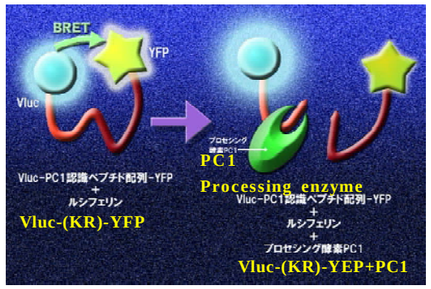


Measurement example of BRET

When luciferin is added to a fusion of blue luminescent luciferase Vluc and yellow fluorescent protein YFP, energy by luminescence reaction of Vluc is generated. A part of this energy transfers to YFP and a fluorescence resonance phenomenon (BRET) occurs. We inserted a peptide sequence containing the target seguence (KR) of processing enzyme PC1 into this fusion to compose Vluc-PC1 recognition peptide sequence-YFP. As a result of measurement of the luminescent spectrum of this fusion with AB-1850, spectrum with two extremely large wavelengths of 460nm by luminescence of Vluc and 527nm of YFP were detected and the occurrence of BRET was confirmed. Then, when PC1 was added to this, the peak of 527nm decreased.
It is considered that this decrease was caused by a decrease in BRET efficiency due to the cutting off of fusion by PC1, so when the decreased quantity is determined, it becomes possible to monitor PC1 activity.



Usage in biotechnology environment

Usage of FRET or BRET for evaluation of molecular design

To carry out experiments of FRET or BRET, it is necessary to examine various molecular designs at the preparation stage. At this time, with a general use fluorometer or luminometer using optical filters it is not possible to scan all the wavelengths of a sample, and efficiency of wavelength shift due to transfer of energy cannot be evaluated sufficiently. When LumiFluor Spectro Capture is used, it becomes possible to evaluate these molecular designs.

FRET and BRET

These days, FRET (Fluorescence Resonance Energy Transfer) and BRET (Bioluminescence Resonance Energy Transfer) attract attention as a technique to analyze interactions between proteins or between protein and nucleic acid or functions including modification, cutting and structural change of protein.
FRET is a phenomenon where light energy (fluorescent) from excited fluorescent molecules (donors) excites other fluorescent molecules (acceptors) and fluorescence is discharged from the acceptor molecules. This phenomenon occurs when the donor and acceptor have a specified distance and positional relationship, and by measuring the wavelength spectrum of discharged light, it can be monitored whether FRET occurs.
In BRET, fluorescent molecules (donors) of FRET are replaced with luminescent molecules, and instead of radiating excitation light on a donor, acceptor is excited by luminescence of luminescent molecules. In BRET, if luminescent substance is added at measurement, detection becomes possible, so no excitation light source device with powerful energy is required. Therefore, it is possible to reduce the risk of damage to the sample.