

## Function of Monochromator in Spectrophotometer



### Overview

Monochromators are used in many optical measuring instruments and in other applications where tunable monochromatic light is wanted. Sometimes the monochromatic light is directed at a sample and the reflected or transmitted light is measured. Sometimes white light is directed at a sample and the monochromator is used to analyze the reflected or transmitted light.

### Key Takeaways

The monochromator in a spectrophotometer isolates a narrow band of light wavelengths from a broad-spectrum source, enabling precise measurement of a sample's absorbance at specific wavelengths.

A monochromator is an optical device that selects a specific wavelength of light from a polychromatic (broad-spectrum) source, converting it into a nearly monochromatic beam. This is crucial in spectrophotometry because the absorbance of a sample depends on the wavelength of light, and accurate measurements require light of a single wavelength to interact with the sample .

### Components and Operation

The main components of a monochromator include:

- Entrance slit: Controls the size and intensity of the incoming light beam. Narrower slits improve spectral resolution but reduce light intensity .

- Collimating optics (mirrors or lenses): Transform diverging light into a parallel beam, which is necessary for precise wavelength separation .
- Dispersive element (prism or diffraction grating): Separates light into its constituent wavelengths. Prisms use differences in refractive index, while diffraction gratings exploit interference patterns to bend different wavelengths at unique angles .
- Focusing optics: Direct the dispersed light toward the exit slit or detector .
- Exit slit: Allows only the selected wavelength to pass through to the sample, blocking all other wavelengths . In modern spectrophotometers, the diffraction grating is commonly used due to its high efficiency and ability to cover a wide spectral range .

#### Role in Spectrophotometry

By isolating a single wavelength, the monochromator ensures that the absorbance measurement corresponds to a specific interaction between light and the sample, eliminating interference from other wavelengths. This allows for:

- Accurate determination of concentration using Beer-Lambert law.
- High spectral resolution, enabling detection of subtle differences in absorbance.
- Flexibility to scan across a range of wavelengths by mechanically adjusting the dispersive element, such as rotating a diffraction grating .

#### Summary

In essence, the monochromator is the key component that transforms broad-spectrum light into a controlled, single-wavelength beam, making precise spectrophotometric analysis possible. Its design and operation directly affect the accuracy, resolution, and sensitivity of the spectrophotometer .

## Article Content

### Monochromator

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Monochromators : Shimadzu (Europe)

A monochromator is incorporated into fluorescence spectrophotometers and emission spectrometers to determine the wavelength of

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Monochromator: Fundamental Principle and Methods

The monochromator supplies light of a certain wavelength that is specifically absorbed by a substance, and its concentration can

Monochromator

Monochromator in an x-ray beamline at the Advanced Photon Source, Argonne National Laboratory. A monochromator is an optical

13.4: Instrumentation

Single-Beam Spectrophotometer An instrument that uses a monochromator for wavelength selection is called a spectrophotometer.

Monochromator

Monochromator A monochromator provides a wavelength selection option in microplate readers, spectrophotometers and other

Monochromator M

Overview The main function of a monochromator is to separate the color components of a light. It can use either the optical

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