3.3: Instrumentation

What would constitute the basic instrumental design of a fluorescence spectrophotometer?

In many ways the design of a fluorescence spectrophotometer is similar to an UV/VIS absorption spectrophotometer. We need a source of radiation and a monochromator to select out the desired wavelength of light. The device needs a sample holder and a detector to measure the intensity of the radiation.

Just like UV/VIS absorption spectroscopy, radiation is used to excite the sample. Unlike absorption spectroscopy, a fluorescent sample emits radiation, and the emission goes from the S_1 level to either the S_0 level or higher vibrational states of the S_0 level. Since fluorescence involves an excitation and emission process, and the wavelengths that these two processes occur at will almost always be different, a fluorescence spectrophotometer requires an excitation and emission monochromator. Also, since the emitted radiation leaves the sample in all directions, the detector does not need to be at 180º relative to the source as in an absorption instrument. Usually the detector is set at 90º to the incident beam and mirrors are placed around the sample cell 180º to the source and 180º to the detector to reflect the source beam back through the sample and to reflect emitted radiation toward the detector. A diagram of the components of a fluorescence spectrophotometer is shown in Figure 3.3.1.

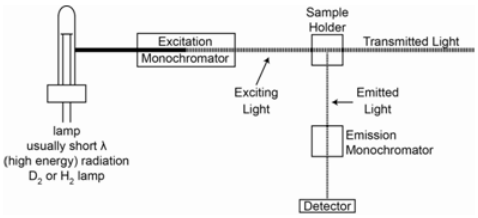

Figure 3.3.1: Diagram of the components of a fluorescence spectrophotometer.