Modeling internal filtering of fluorescent solutions

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The fluorescence of a molecule vs. concentration is generally described by applying Beer's law to the incident light and determining the amount of energy absorbed by the molecule. This simplification produces a function that is roughly linear at low concentrations, and then reaches a maximum. However, experimentally it has been shown that as concentration increases further, the fluorescence begins to decrease. This is caused by effects such as internal filtering. This study attempts to model the internal filtering that occurs when concentration increases. The inner filter effect occurs during the study of fluorescent molecules. Molecules at the edge of a cuvette block the fluorescence of the molecules in the middle. This model is based on a theoretical analysis of how light operates within a fluorescent solution. By applying Beer's law to both the incident light and the fluorescence, a function describing the amount of light within the cuvette was obtained. The fluorescence of the solution was then solved from this function. The model exhibits an initial linear increase of fluorescence as concentration increases followed by an eventual peaking and fall as internal filtering begins to take effect.