

Acridine Orange Encyclopedia Article

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Acridine Orange

Acridine orange is a fluorescent dye. The compound binds to genetic material and can differentiate between **deoxyribonucleic acid (DNA)** and **ribonucleic acid (RNA)**.

A fluorescent dye such as acridine orange absorbs the energy of incoming light. The energy of the light passes into the dye molecules. This energy cannot be accommodated by the dye forever, and so is released. The released energy is at a different wavelength than was the incoming light, and so is detected as a different color.

Acridine orange absorbs the incoming radiation because of its ring structure. The excess energy effectively passes around the ring, being distributed between the various bonds that exist within the ring. However, the energy must be dissipated to preserve the stability of the dye structure.

The ring structure also confers a **hydrophobic** (water-hating) nature to the compound. When applied to a sample in solution, the acridine orange will tend to diffuse spontaneously into the membrane surrounding the **microorganisms**. Once in the interior of the cell, acridine orange can form a complex with DNA and with RNA. The chemistries of these complexes affect the wavelength of the emitted radiation. In the case of the acridine orange-DNA complex, the emitted radiation is green. In the case of the complex formed with RNA, the emitted light is orange. The different colors allow DNA to be distinguished from RNA.

Binding of acridine orange to the nucleic acid occurs in living and dead **bacteria** and other microorganisms. Thus, the dye is not a means of distinguishing living from dead microbes. Nor does acridine orange discriminate between one species of microbe versus a different species. However, acridine orange has proved very useful as a means of enumerating the total number of microbes in a sample. Knowledge of the total number of bacteria versus the number of living bacteria can be very useful in, for example, evaluating the effect of an antibacterial agent on the survival of bacteria.

Acridine orange is utilized in the specialized type of light microscopic technique called fluorescence microscopy. In addition, fluorescence of DNA or RNA can allow cells in a sample to be differentiated using the technique of flow cytometry. This sort of information allows detailed analysis of the DNA replication cycle in microorganisms such as **yeast**.