

Functional Colourants

Surendra U. Kulkarni
GE India Technology Center, Bangalore

Traditional uses of colourants for enhancing aesthetics are well-known for ages. We need colours for our clothes, cars, houses, white goods and lot more. Even Mother Nature uses colours everywhere, to enhance aesthetics of her creation.

However, colour is a phenomenon seen and interpreted by our eyes as a result of absorption of a fraction of light from the visible region. If we consider the entire spectrum of electro-magnetic waves, and see how the energy absorbed by a particular matter is transformed, the scope for colorants will be multiplied a million folds.

While the traditional uses of colourants are restricted to their aesthetics, the non-traditional uses range from electronics to life sciences. Optical data storage is one area where the colorants have already made enormous impact. Fluorescent markers used in diagnostics are another application that has changed the way diseases are detected in medical science. Storage of solar energy, viz. Photovoltaics, is yet another area holding promise for energy storage and supply.

Indian Dyestuff Industry has made tremendous progress during the last century. Name any color molecule, we can make it – not only in excellent quality, but also at competitive prices. However, as 20th century progressed, the global business scenario has transformed this industry from “Specialty” to “Commodity” status. It is high time this industry moved into Specialty category again, leveraging the technical expertise, built over the past century, in R&D as well as manufacturing.

Photodynamic Therapy (PDT)

Photodynamic therapy is based on selective tumor destruction via intravenous injection of suitable phototherapeutic colourants, followed by exposure to red light. It was observed that porphyrins are found in higher concentrations in malignant tumors than in normal tissue. Such porphyrins are quite harmless by themselves, but they may have a very toxic effect on the cells in which they are concentrated when exposed light. Thus, tumor can be destroyed by irradiation with light if it contains a relatively high concentration of porphyrins, while the surrounding normal tissue survives. Photosensitizers are used to light energy into chemical energy for therapeutic use.

Ideal photosensitizer candidates should be non-toxic, not a Mutagen / Carcinogen, easily removable, best selectivity/ targetability and best mode of activation at specific wavelength. Various photosensitizer used in photodynamic therapy is given in **Figure 1**.

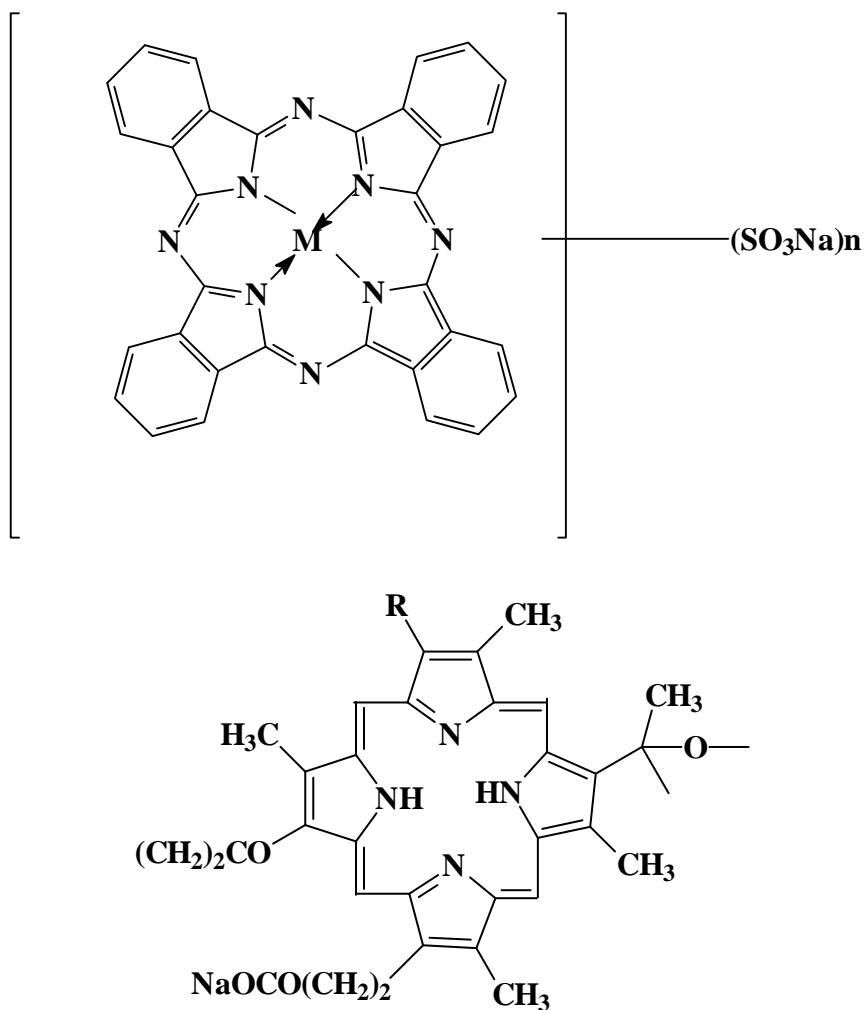


Figure 1: Photosensitizers for PDT

Clinical applications of PDT include dermatology, in the Bladder, in the Brain, in Gynecology and in the Lung & Ophthalmology.

Optical data storage

Optical data storage involves a medium which functions by means of the application of near infrared radiation or visible light for the recording and reading information. The use of a compact semiconductor laser, such as gallium-aluminium-arsenide, with its ability to produce a beam power of several mill watts and which can be focused to

a sub-micrometer spot size, makes it possible to record and replay data. One of the great benefits of the optical disk is that it provides large data storage capacity similar to a magnetic hard disk but is removable like a magnetic floppy disk. The dyes used for optical data storage with various speeds are given in Figure 2.

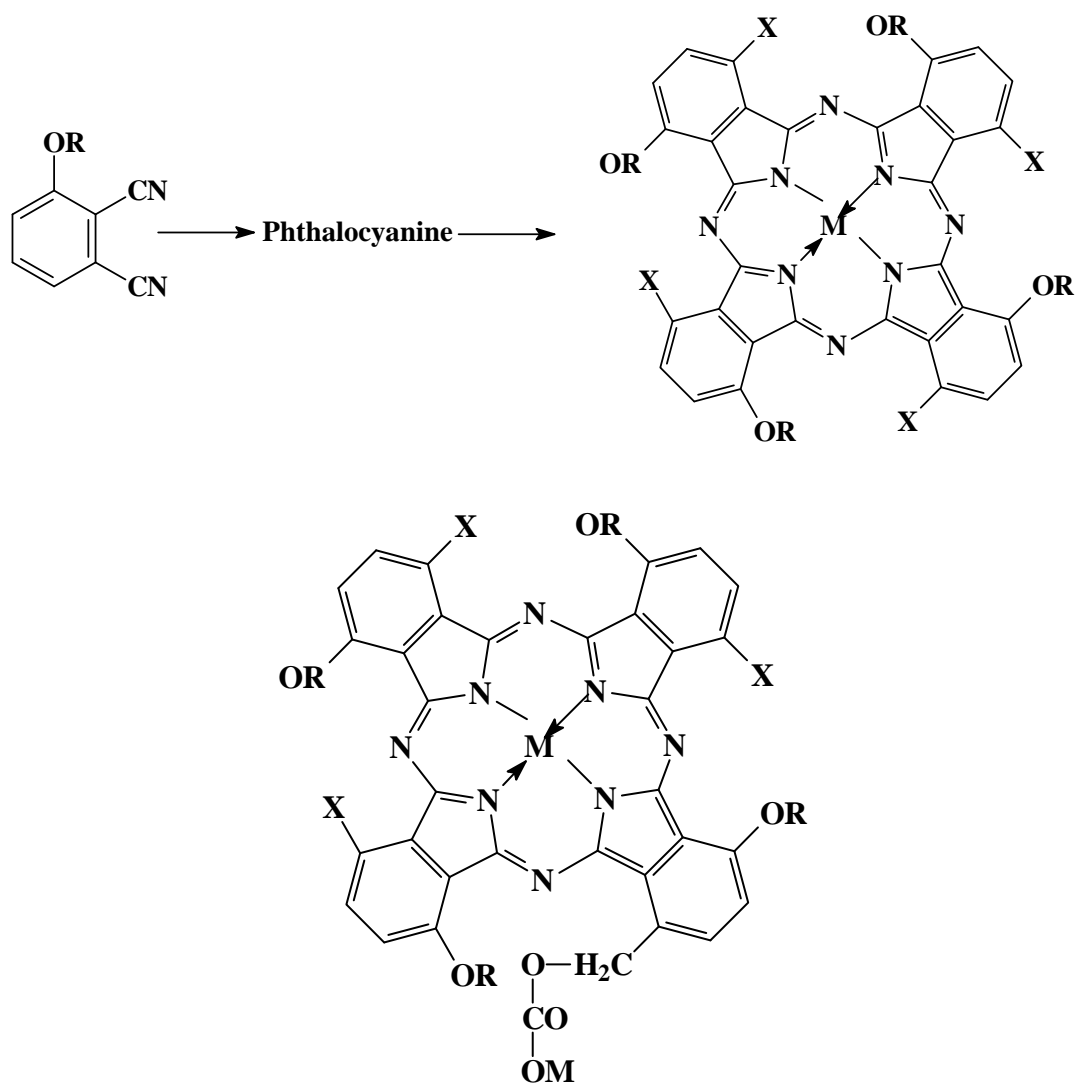


Figure 2: Dyes for optical data storage