Dazzle your textiles to ultimate whiteness using Fluorescent Whitening Agents

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THE world of textiles changed significantly with the discovery and application of reactive and disperse dyes. However, the development of Fluorescent Whitening Agents or Optical Brightening Agents (FWA / OBA) happened without much fanfare through the impact it had on the industry was equally dramatic. OBA's commonly referred to as 'colorless dyes' or 'white dyes' spanned wide range of applications with their fluorescent, phototropic and thermotropic properties. The production of OBA's is done using completely different set of raw materials as compared to those for producing dyes. In addition to this the production process for OBA's involves more complexity as compared to that for dyes particularly in case of OBA's for Polyester

Numerous textile material both natural (cotton, wool, linen, silk) and man-made ones (polyester, polyamide, poly-acrylonitrile) are not completely white and efforts have been made since ancient times to free them from their yellowish tinge. Bleaching in the Sun and later chemical bleaching increased the whiteness significantly but some amount of yellowish tinge always remained behind and prevented the material from reaching the required whiteness. In the year 1852 a brilliant Irish physicist George Gabriel Strokes put forward the law of fluorescence which was later named after him. Strokes fluorescence theory is about the re-emission of longer wavelength photons (lower frequency/ energy) by a molecule that has absorbed photons ofshorter wavelength (Higher frequency / energy). According to the theory, OBA's absorb ultraviolet light and emit it in the blue-violet visible light range. In other words it absorbs light with a wavelength in the range 340-380 nm (nanometer) and emits it the visible range of 425-450 nm. OBA treated material emits more light in the visible range than does the untreated white textile and thus it appears 'whiter than original white'. The more whiter the treated textile looks, more is the fluorescence efficiency of the OBA used to treat it

The first synthetic OBA based on the Stokes principle was introduced by ICI in 1934 using a diacyl derivative of 4,4-diaminostilbene-2,2-disulphonic acid (DASDA). This was quickly followed by Hoffmann Ultracell who introduced an OBA using Umbelliferonacetic acid. I G Faben in 1940 introduced OBA's based on DASDA and Sulphonated 4,5 diphenylimidazolone which proved to be very successful. OBA's made with various chemistries were regularly introduced after the second world-war. Today there are more than 15 major structural types of OBA available in hundreds of variants. Over the years the application of OBA's spread beyond the textile industry. Today the major consumers of OBA's are the detergent and paper industry followed by textiles. Use of OBA's in the plastics and cosmetics industry is fast catching up

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Aromatic hydrocarbons like benzene, naphthalene and anthracene are called luminophores since they are basic fluorescing ingredients. Functional groups that promote fluorescence like -CH=CH-,-CO-, -CH=CH-COOH, or –CN are called fluorogens. A luminophore carrying a fluorogen is called fluorophore. Furthermore there are functional groups that enhance fluorescence like $–NH_2$ and –OH which are called Auxoflores and there are groups that diminish fluorescence like $–SO_3H$ and –COOH and are called diminoflores. The mutual positions of the auxoflores and diminoflores in the OBA molecule determine the fluorescence efficiency of the OBA

As in the case of dyes, the classification of OBA's are based on its chemical structure or on its method of application

From the point of view of their usage, OBA's are classified into two large groups : Direct (or substantive) OBA and disperse OBA. Direct OBA's are water soluble and used mainly for brightening natural fibers and select synthetic fibers like polyamide. Disperse OBA's are applied to textiles made of polyester, polyamide, polyacrylonitrile from an aqueous dispersion.

From the chemistry point of view, OBA's are classified according to their chemical structure like derivatives of Stilbene, Coumarine, 1,3 –diphenylpyrazoline, Napthalenedicarboxylic acids, Heterocyclic dicarboxylic acids, Cinnamic acid etc.

The commercial names of individual brands available in the market are variable and un-systematic. The name of the OBA does not give a clue on the suitability of application on textiles nor the chemical class that the OBA's belongs to. The alphabets used by suppliers as product brand extensions do not usually express the characteristics of the product. It is therefore necessary to read the product literature in detail before usage of the product.

OBA's are available in various physical forms like powders, pastes, Liquid and stable dispersions based on the requirements of different substrates they are intended to be applied on. Disperse OBA's are usually available as stabilized dispersions

OBA's are usually combined with other auxiliaries during application on textiles. The OBA must be fixed as far as possible in the outer zone of the substrate to attain maximum brightening. If the OBA diffuses into the substrate on application then the degree of brightening is reduced. The distribution of the OBA on the surface of the substrate is also important. If the distribution is not even then uniform whiteness along the surface of the substrate cannot be achieved.

Optical brightening of Polyester and Polyester blends

The optical brightening of Polyester and its blends are carried out either by continuous process – Thermosol or batch process – exhaust process. In the Thermosol process the textile material is given a fixation treatment for 30 – 45 seconds at 190°C. There are low temperature variants using which Thermosol can be carried out for 30 seconds at 170° C or for 20 seconds at 190° C.

In the exhaust process the treatment time is 30 minutes at 130°C. With low temperature variants the treatment can be carried out at boil (90°C to 100°C) without using a carrier. The OBA treatment is usually combined with cleaning / bleaching in the same bath. In the finishing bath OBA's are combined with resin finish. OBA's are available in shaded and non-shaded variants.

A good OBA for Polyester should have the following properties:

1. Exhibit good whiteness at low doses
2. Stable dispersion with uniform particle size of the ingredient that imparts fluorescence
3. Stable to oxidizing and reducing agents
4. Non-foaming
5. Stable in the pH range 2 to 12
6. Suitable for integration in Pretreatment and Finishing baths
7. Suitable for exhaust and Thermosol process
8. Good sublimation and migration properties
9. Stable in HT steam (170° C for 15 minutes)
10. Exhibit good re-dispersion property
11. Good light fastness (Xenotest -rating >5)
12. Wash fastness (rating – 5)
13. Sea water fastness (rating – 5)
14. Perspiration fastness (rating – 5)
15. Dry cleaning fastness (rating – 5)
16. Stable at Dry heat setting temperature of 210° C
17. Resistant to pollution gases
18. Ecologically friendly

Designing OBA's to fulfill the above properties is a challenging task and requires advanced technology in chemistry and manufacturing with stringent quality control. It was in 1929 nearly a hundred years ago that German scientist Dr.Paul Krais conducted an experiment to brighten linen cloth using a fluorescent ingredient Aesculin extracted from horse-chestnuts with a dream “Uber ein neues Schwarz und ein neues Weiss” meaning “the so far whitest white can be made still whiter…”.

It is with similar dream Leomine Organics Pvt Ltd. a pioneer in innovation and manufacture of OBA's, has recently launched a new series of OBA's for polyester and its blends with unbeatable properties in imparting dazzling whiteness :

Leomine Whitener HRN
Leomine Whitener HNI
Leomine Whitener TCI

…. The whitest of white can surely be made still whiter. ■