ageous for its high energy content and high good-quality protein content and as a rich source of vitamins and growth factors.

Yeast is manufactured in various countries from a variety of raw materials. The efficiency of utilizing glucose in yeast 'synthesis' is of the order of 65%. Various raw materials used are molasses, sulphite waste liquor, wood sugar prehydrolysates, whey, potatoes and waste products of potatoes. Selection of the raw material depends upon its availability and cost. Molasses is supposed to be the best growth medium for yeast and the percentage of fermentable sugars in the molasses is also high (about 50%). Due to the shortage of sugar, raw materials other than molasses are used in Germany. In Jamaica, a process for the continuous production of food yeast from molasses has been developed and the yeast manufactured is added to the flour consumed on the island as a vitamin and protein dietary supplement. The Standard Yeast Co., Ltd., Essex, produces five to ten thousand tons of baker's yeast annually using molasses as the raw material.

Food yeast is mainly used as a substitute for meat and as a meat extender in the extracts, soups, sauces, sausages, and as a flavouring for vegetable dishes. It is used in dry condition in the form of powder or flakes. The production of food yeast has already been adopted on a large scale in some countries and it is technically and economically successful but does not rank as one of the 'preferred' foods. In Great Britain, food yeast in terms of its protein content is only one-tenth of the price of lean meat. However, its use, at present, is restricted largely to feeding horses, cattle, pigs and poultry where its price compares unfavourably with other feeding stuff. Good quality food yeast is largely used in medicine as a B Vitamin source.

In view of the present food situation in India the problem of the manufacture of food yeasts of high vitamin and protein content is of vital importance. As already mentioned, molasses is one of the best raw materials available for the manufacture of food yeast. In this country, molasses is produced in large amount as a waste material and presents problem of its disposal. The statistical data from 1947 onwards on the production of molasses are presented below:—

Year	*Molasses produced.*
1947-48	410,800 tons.
1948-49	369,800 „
1951-52	598,400 „
1952-53	508,500 „

Therefore, by utilizing molasses for the production of food yeast we can cut down our food import to an appreciable extent. However, to make the project a success some work will have to be done also to develop preparations of yeast more suitable to Indian palate.

Fluorescent or Optical Whitening Agents

C. V. PADMANABHAN*

THE phenomenon of absorption of light from an exciting source and re-emission as a light of a different wavelength by a substance is known as Luminiscence. If the emission of light ceases as soon as the exciting light is cut off the

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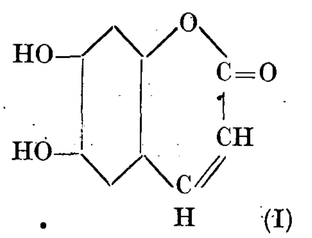
substance is said to be fluorescent. The relation between the absorption and re-emission of light is given by Stoke's law discovered empirically a hundred years ago. This law states that the fluorescent light is always of a greater wave-length than the exciting light. This is understandable since the higher the wave-length lesser is the energy and fluorescent substances re-emit only part of the light energy they absorb. If a colourless fluorescent substance is deposited on a substrate, then the substrate will appear brighter when exposed to diffused daylight which contains a fair amount of ultra-violet radiation. This is so as the light reflected from the substrate is augmented by the flourescent light from the deposited substance. If the substrate possesses a yellowish tinge and the fluorescent agent is bluish-green or violet, the "whiteness" of the substrate will be improved. This phenomenon of fluorescent whitening or optical whitening must be clearly differentiated from the employment of the usual blueing agents e.g. ultramarine blue wherein the character of the reflecting light is altered by the yellowish part of the reflected light being absorbed by the blueing agent. The total amount of light reflected by the substrate is cut down and the whiteness thus obtained is essentially a very pale shade of grey. With a fluorescent agent however, the whitening effect is achieved by super-imposition of the fluorescent light on the reflected light. Therefore, a brighter white is obtained.

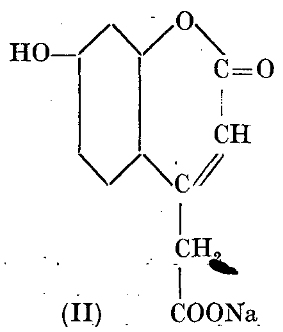
Krais discovered this phenomenon experimentally. He found that when semi-bleached linen is impregnated with an aqueous solution of Aesculin and dried, it has the appearance of full bleached linen in diffused daylight. Aesculin gives a colourless solution with a bluish fluorescence and is the glucoside of Aesculetin which is 6:7-dioxycoumarin (I).



(I)

This phenomenon has been described as Fluorescent or Optical Bleaching and substances producing this effect are described as Fluorescent or Optical Bleaching Agents in literature. Normally bleaching denotes whitening due to the destruction of the colouring matter by the bleaching agent. However, in the present case the whitening is due to the addition of the fluorescent light to the light reflected from the substrate. Blueing agents such as ultramarine blue achieved a similar effect by absorbing part of the reflected light and thus modified the appearance. So it appears to be more rational to call these new agents as "Optical" Blueing Agents" or "Fluorescent Blueing Agents." Another suitable alternative is to call them "Fluorescent or Optical Whiteners" and the process of application as "White Dyeing" since these substances are applied to the various fibres by the usual dyeing methods. In the following pages the term "Optical Whitener" will be used to describe these agents.

The fastness of Aesculin to washing and light is not satisfactory and further it has no affinity for the textile fibres. Still it attracted a great deal of attention.



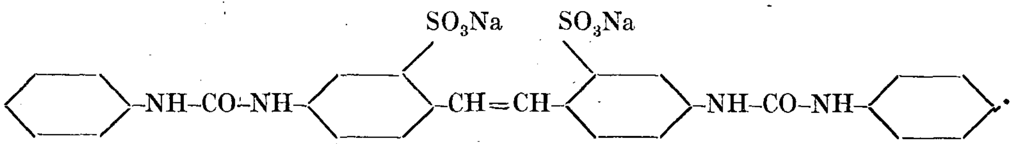
(II)

Umbelliferone acetate (II) was the first whitening agent put on the market by the German firm of Ultrazella G.m.b.H. However these umbelliferone derivatives do not possess affinity for the fibre.

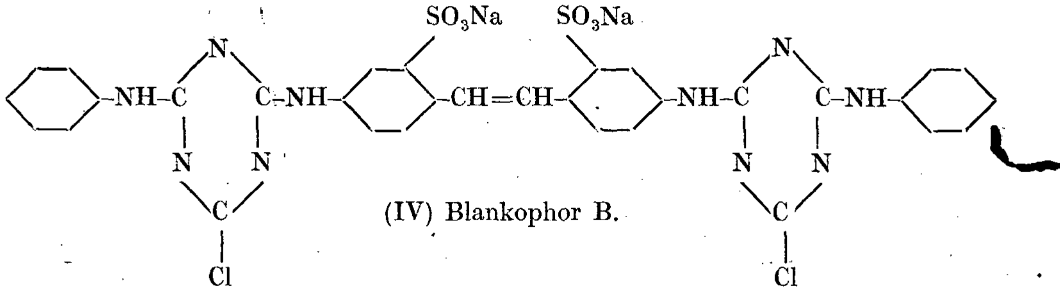
A different starting product was used by the I.C.I. who patented the use of derivatives of amino-stilbene sulphonic acid for the purpose. These possess substantive affinity for the textile fibres. In an example, cotton yarn is treated for 40 minutes at 175-185°F by the method used for application of direct dyes with 3% on the weight of the fibre of '4:4'-dibenzoylaminostilbene-2:2'-disulphonic acid. The yarn is then lifted out, rinsed and dried. The treated material showed a pale-blue fluorescence when exposed to ultra-violet light but in diffused daylight has the appearance of well bleached cotton. There is a growing patent literature relating to colourless organic substances which brighten white textiles and papers by addition of blue fluorescent light. A large number of these are derivatives of diaminostilbene disulphonic acids. Derivatives of pyrazolone, terephthallic acid, and anthraquinone, certain cyclic amidines, aminophthalimides, and pyrene derivatives are covered by various patents or mentioned in literature as fluorescent whitening agents. A few typical examples are given below.

Diaminostilbene disulphonic acid derivatives :— ...

Blankophor R (III) and Blankophor B (IV) are two products of this class marketed by the I.G.



(III) Blankophor R.

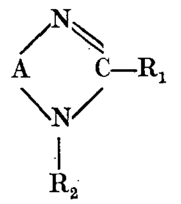


(IV) Blankophor B.

Blankophor R possesses a violet fluorescence and this was corrected by addition of 2½% Anthralan Green GG on the weight of the active product. This mixture was marketed as Blankophor RG. Discovery of Blankophor B rendered this obsolete. Blankophor B, R and G are now marketed in "Extra Highly Conc" brands by Farbenfabriken Bayer, Leverkusen. Blankophor G possesses a yellow fluorescence. The extra highly conc. brands are about 5 times as strong as the original product which was an admixture of 90% urea with 10% active component.

Other diaminostilbene disulphonic acid derivatives patented as optical whiteners include the (a) O-alkoxybenzoyl derivatives (American Cyanamide Co) and (b) condensation products with cyanuric chloride and monoethanolamine and (c) derivatives of nitroaminodisulphonic acid or Diazo fast yellow GG.

Cyclic amidines free from chromogens and of the general formula (V) have been

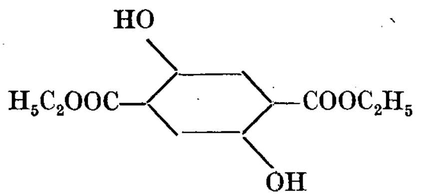


(V)

patented as *Optical Whiteners* by. Ciba (F).

[A=Aromatic nucleus with ortho carbon atoms linked to nitrogen atoms; $R_1 = (-CH = CH-)_n$ where $n > 3$; one $=CH-$ may be replaced by $=N-$ and more than one double bond is in a ring. R_2= H, alkyl or aralkyl.]

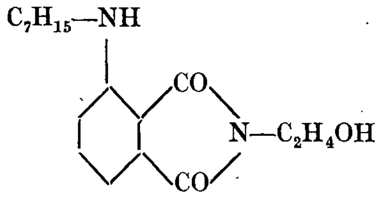
These amidines are rendered water soluble by (a) introduction of sulphonic acid groups, (b) conversion into quaternary ammonium salts and (c) where a —OH or =NH is present by treatment with an alkylene oxide.



(VIII)

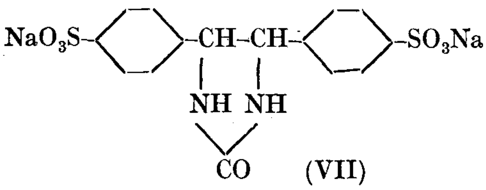
were applied to acetate silk from solvent naphtha, but the effect obtained was too strong. These substances unlike Blankophors are insoluble in water and lack affinity for textile fibres. A series

Substituted aminophthalimides have been claimed as Fluorescent Whiteners by the American Cyanamid Co. A typical product is (VI)



(VI)

To the Pyrazolone class of compounds belongs Blankophor (VII) marketed by the I.G. as a whitener for wool.

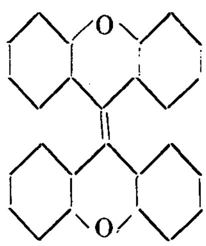


(VII)

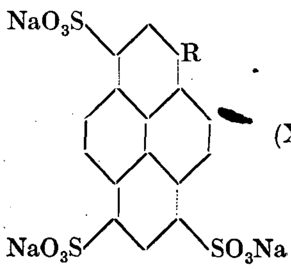
This product also gives good protection against action of light on the fibre, and for this purpose is marketed as "Ultrasan."

A number of other optical whitening agents have been studied by the I.G.

Lumogen Blue (2:5-dihydroxyterephthallic acid ester of ethyl alcohol), (VIII) and Lumogen Water Blue or dixanthylene (IX).



(IX)



(X)

of pyrene derivatives of the general formula (X) were prepared. However, the fluorescence was found to be too green to be useful. When R = CH_3.CO.NH—, —NH_2, —NHMe, —OH the compound gives a bluish fluorescence. Dihydroxypyrenedisulphonic acids are also highly fluorescent. However, none of the pyrene compounds studied was stable to light.

The optical whitening agents are marketed under various trade names *e.g.*, Tinopal (Geigy); Uvitex (Ciba); Blankophor (Farbenfabriken, Bayer); Luminol (Onyx International, U.S.A.) etc. The main use of optical whiteners is (a) for improving the degree of whiteness of bleached or half-bleached textiles or for brightening of unbleached textiles from vegetable fibres—where the ground shade is not too dark—*e.g.*, cotton, linen, artificial silk and spun rayon, (b) for attractive white tints on fully synthetic fibres as also acetate rayon, (c) for production of brighter and purer pastel shades *e.g.* Baby pinks and Baby blues (d) for clear white discharge prints and (e) as additives to finishing pastes for good brightening effects. These are also used as additives to laundry soaps, rinsing agents etc. For this purpose the non-substantivity of umbelliferone derivatives is claimed to be an advantage since there is no accumulation of the whitening agent on the fabric with repeated usage.

The optical whitening agents are applied by the normal methods of dyeing with direct dyes. Thus they may be applied from a neutral or slightly alkaline bath to cellulosic textiles and from an acidic bath to woolen textiles.

They may be applied in a continuous manner or from an exhausting bath as a batch process. They are used in concentrations varying from 0.001% to 0.5% depending on the product. Typical examples of the application of these to textiles are described below.

(a) Piece-goods are treated on the padding mangle with 0.01 to 0.2 gm. per litre. Blankophor extra highly conc. grade is added to the padding liquor.

(b) In discharge printing, 5-6 gms. of Blankophor extra high concentration brand or five times this quantity of the extra brand per kilogram of discharge paste are used.

(c) Wool which may with advantage be previously bleached with hydrogen peroxide, is treated after rinsing for ½ hour at 122-165°F with 0.25 to 2.5% Uvitex RT and 5% sulphuric acid (168°Tw) or formic acid (85%).

The optical whiteners may be applied from a hydrosulphite or peroxide bath but some of them are sensitive to hypochlorite or sodium chlorite. Blankophor G is also stable enough to hypochlorite to be applied from these bleaching baths. Their fastness to washing and light are comparable to those of very pale shades of "fast to light" direct dyes. Many softening agents (cation-active) precipitate them. Proofing liquors containing aluminium sulphate are also unsuitable for certain of these agents. A preliminary trial of combination with other treatment is always to be recommended.

Optical whitening agents have not yet captured the woollen market since white woollen fabrics are not as common as white cotton textiles. However, they give a cheap and safe method of obtaining white wool. Those with a bluish fluorescence are not very suitable for wool, but milky greenish shades are accepted. As a consequence, whitening agents for wool should give a greenish fluorescence, which combined with the natural colour of wool will give a white effect.

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Chemotherapy of Tuberculosis

D. S. BAPAT*

TUBERCULOSIS is a common communicable disease which causes a relatively high rate of mortality. It is regarded as one of the worst scourges of civilized communities. All over the world, tuberculosis has been the cause of untold economic waste and social disaster. In India too, malnutrition of the populace, insanitary living conditions, poverty and inadequate medical help prepare a ready background for its spread. About 2.5 million persons suffer from tuberculosis in this sub-continent of ours, and about half a million fall a prey to it annually.

In 1882 Robert Koch first published his brilliant investigations on the tubercle bacillus and differentiated the human and bovine types. Under the microscope, tubercle bacilli appear like straight or curved rods with slightly rounded ends. In the bacterial cell a higher alcohol "Mykol" is present which resists the decolourizing action of acids and alcohols when the bacteria are stained. Hence the tubercle bacillus is termed "acid fast." Like all other bacteria, bacillus tuberculosis is also readily destroyed by heat, but it is very resistant to bactericidal agents. Marked resistance is shown to 5% phenol, 15% sulphuric acid, caustic soda and antiformia[1]. In the human body tubercle bacillus penetrates deep, (in lungs and in other organs), creates a protective sheath (caseation) and makes the approach of the drug rather difficult.

In 1870 Sir Joseph Lister first postulated the principle of 'Microbial origin of diseases' which meant that an infection arises out of the invasion of tissues by micro-organisms and that it can be combated either by preventing the organisms from reaching a wound or by inhibiting their growth on the injured surface by the use of certain drugs. Since then attempts have been continually made to find out antibacterial agents which will have a maximum parasitotropic action and minimum organotropic action. Accepting this guiding principle of chemotherapeutic approach first propounded by the 'Father of Modern Chemotherapy,' Paul Ehrlich, investigations in the field of antibacterial therapy of tuberculosis were started during the thirties of the present century.

In the early stages of the development of chemotherapy, the chemical agents did not have a wide span of action. Chemotherapy made progress by leaps and strides only during the last two decades, when the sulpha drugs and the antibiotics came to the forefront. The first really effective and practicable antibacterial therapy of tuberculosis was

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