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A Study of Surfactants' Role in the Synthetic System of Anthraquinone-Series Colors

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Introduction: Solubility of dyes has been paid attention to since successive dyeing and printing operation of dyes widely applied in textile industry is carried out. However, solubility improvement of the studied dyes has seldom been reported with consideration of added relevant surfactants in the synthetic system of the dyes.

Contrary to surfactants' usage in commercialization of the concerned colors or aftertreatment procedures, their direct application in the synthetic dyes is often neglected. As for this respect, only aftertreatment of dyes has been taken in bulk. Disperse dyes, organic pigments, reactive dyes and even acid dyes have been manufactured only through adding some surface active agents to the systems prior to the products' being put into commercial production. For instance, an easily dispersible soft α-CuPc pigment could be obtained by adding the mixture of Rosin and OP-7, 4% and 1% by weight respectively, and an easily dispersible soft β-CuPc might be gained by adding Rosin, OP-7 and Ninol with proportional weight of 4%, 1% and 1% respectively. An excellent dispersibility of Disperse blue RL(C27H20O3N2), Disperse blue GBS(C27H20O4N2S),Disperse red 4BL(C21H16O6N2S) could be accomplished by adding disperse agent NNO, a usual surfactant. What is more, Qian proposed that solubility of acid dye such as Acid scarlet F3GL be improved by means of adding some auxiliary agents, accompanied by concerned commercialized processes. All these are always in connection with the surface active agents. But they are only aftertreatmennt behaviors, that is to say, the surfactants are all added only after the dyes have been manufactured.

Aftertreatment procedures of the concerned dyes can really help the dyes' application in succesive dyeing and printing processes, but it undoubtly decreases the dyes' yield and intensifies pollution to environment. Fortunately, the possibility to achieve outstanding solubility and relatively high yield of the synthesized acid dye has already been explored by adding a surface active agent OP-10 into the synthetic system in the reaction process. There is some data still in need to some extent, but this gives us great confidence to further research on the subject. Accordingly, we wish to obtain the following results: a series of surfactants are selected in the manufacture of Blue diphenyl-methane acid dye and added directly into the reaction system. And the ways performed in the process of the dye's preparation are expected to be utilized successfully in the disperse dyes, reactive dyes and organic pigments as well[1~5].

Experimental: A mixture of BAA (purity at 95%), 8.5g; MDA, 8g; (SnCl2/CuSO4) 0.1g/0.1g; OP-10, 0.20g etc.) and 140 mL of water were heated, and extra 8.5g of BAA was added at 85℃. And then the temperature was raised at 80 ~ 100℃ and pH 8 ~ 9 for 1 ~ 4 hr. After being washed twice with aqua HCl and twice with aqua NaCl, filtered, and dried in vacuum, 18.0 g of absolute dye was given (yield 87.0% on basis of BAA, purity at 97.6% detected by HPLC). The Blue diphenyl-methane acid dye of improved solubility was obtained. Anal. calc. C41H28N4 O10S2: C, 58.29; H, 3.08; N, 6.63; S, 7.58; found C, 58.48; H, 3.18; N, 6.60; S, 7.26.

Results: A series of surface active agents, such as the nonionic OP4, OP10, OP7, OP16, Span20, Span85, Tween 20, Tween 81 and Disperser NNO, the anionic C17H33COONa, C17H33COOK and Atlas G-3300, the cationic Atlas G-263 and amphoteric surfactants $C16H33N^{+}(CH3)2\ C2H4\ COO^{-}$, are added directly into the synthesized Blue diphenyl-methane acid dye which is made from bromamine acid(BAA) condensed with 4,4'-bis-aminophenylmethane (MDA). Among the mentioned agents, OP10 and Disperser NNO play a key role in the advancement of the dyes' yield and solubility. Besides, some anthraquinone series colors including disperse dyes(Disperse blue GBS, Disperse blue RL, Disperse red 4BL), reactive dyes (Reactive brilliant blue K-3R, Reactive brilliant blue M-BR) and organic pigments(C.I. PY123 and C.I. PR 177) are processed in the same manners as that of Blue diphenyl-methane acid dye. Solubility of acid and reactive dyes in water and diffusivity of disperse dyes and pigments in water are improved, and also their yields enhanced generally.

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