



Session II: Process Development

Technology for the Continuous Manufacture of Azo Dyes



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Prof. Zhang completed her M.S. and Ph.D. in Fine Chemicals from Dalian University of Technology in 1992 and 1995 respectively. She then joined her alma mater as a Lecturer and is currently a Distinguished Professor since 2006. Her research is in the field of dyes, photochemistry, development of bio-mass resources and novel synthetic technologies for making fine chemicals. She has developed a series of novel reactive dyes exhibiting more than 90% fixation. She has also developed high performance polycarboxylic acid dyes for leather dyeing to achieve nearly 100% dye utilization. For these developments she was awarded the National Technology Invention second and first prize. Prof Zhang has been invited by the Chief Editors of both Kirk-Othmer Encyclopedia of Chemical Technology and Ullmann's Encyclopedia of Industrial Chemistry to rewrite chapters on reactive dyes, azo dyes, anionic dyes and direct dyes.

Abstract

Manufacture of azo dyes on a large scale is typically done by carrying out diazotization and coupling reactions in 70 m³ or larger reactors. In view of the huge volume involved it is difficult to ensure uniform mixing which results in an uneven distribution of molar proportions of raw materials in the reactor space. Moreover, because of heat transfer restrictions in such a big reactor it is difficult to rapidly remove the heat of reaction which results in side reactions leading to unsatisfactory product quality and performance. The dyestuff industry has been exploring continuous diazotization and coupling reactions for a long time for improving the quality and performance of dyes.

In recent years, we have invented continuous coupling reaction technology through chaotic mixing in helical tubes and continuous preparation of water-soluble azo dyes by atomizer-pipeline coupling. Among them, the continuous coupling reaction technology through chaotic mixing in helical tubes realizes no residual flow of the mixed fluids. Thus, no pipeline blockage occurs. Also, because there is no diazo salt residue, the continuous coupling technology is safe. In the coupling reaction of Reactive Black KN-B, the content of the main product is increased by 26.7%, and 37% of the dye is saved in the dyeing process