

Association of the Oxazine Azo Dye C.I. Basic Blue 3 with Humates

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The textile processing industry is the second largest consumer of water, following agriculture. The disposal of textile effluents and organic waste into land and water systems facilitates the movement of synthetic dyes through agricultural soils. Azo dyes, in particular, reduce microbial populations and decrease enzyme activity, richness, and diversity, negatively impacting soil environment and hindering plant growth; additionally, they can enter the food chain. When textile dyes are released into water bodies, they alter their color, causing aesthetic damage, and reducing photosynthesis and dissolved oxygen levels, further harming aquatic life.

Humic substances (HS) play a crucial role in ecosystems as a significant reservoir of recalcitrant organic carbon and nitrogen. They have a beneficial impact on soil structure and properties; they support physiological and metabolic processes in plants acting as growth promoters, biostimulants, and stress relievers. Due to their diverse surface functionality, HS can associate with a wide range of inorganic and organic substances, including metal ions, soil minerals, oxides, hydroxides, and xenobiotics, through complexation and chelation. This ability enhances nutrient bioavailability by binding HS to immobile nutrients, while chelation with toxic metals and persistent hydrophobic organic contaminants reduces their toxicity.

C.I. Basic Blue 3 (C.I. 51004) is a chloride salt commonly used for coloring paper and dyeing polyacrylonitrile fibers. The interactions between this cationic dye and three humate salts, each containing different levels of humic acid, were studied using spectroscopic techniques. All humates demonstrated high adsorption efficiency (~1 g dye/g HS). Factors influencing the adsorption were also evaluated. Several adsorption models were applied to the experimental data.

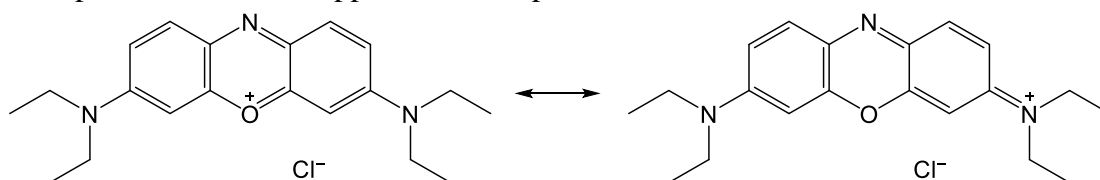


Figure 1: Structural formulae of C.I. Basic Blue 3.

References:

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