Biodegradability of reduced azo dyes – exploring the second stage of sequential anaerobic-aerobic treatment of azo-dye-containing wastewater

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Sequential anaerobic-aerobic treatment is the most logical biological strategy for the removal of azo dyes from wastewater. In the anaerobic stage, azo dyes, which generally resist aerobic biodegradation, are fortuitously reduced under anaerobic conditions, yielding colorless aromatic amines. In the aerobic stage, aromatic amines, which generally do not undergo further transformation under anaerobic conditions, are prone to oxidative (bio) transformation under aerobic conditions. Since research on aromatic amine biodegradation has been usually conducted with relatively stable, not easily autoxidizing aromatic amines, representing only a part of the aromatic amines from azo dyes, still much is unknown about the aerobic fate of azo dye cleavage products.

In this screening study we investigated the biodegradability of seven chemically reduced azo dyes and two aromatic amines. The compounds were incubated with dyestuff-adapted sludge in the presence of either oxygen, perchlorate, nitrate, Fe(III) or Mn(IV) as the electron acceptors. CO_2-production, O_2-consumption and changes in HPLC-chromatograms and UV/vis-spectra were monitored. Results indicated that biodegradation had been limited to that of relatively simple benzene-based aromatic amines. There was no sign of mineralization of any of the naphthalene-based aromatic amines.

KEY words: aromatic amines, azo dyes, biodegradation, autoxidation

Session 1, poster number 130