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**RADIOLYSIS OF REACTIVE AZO DYES
IN AQUEOUS SOLUTION.**

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ABSTRACT

RADIOLYSIS OF REACTIVE AZO DYES IN AQUEOUS SOLUTION. The effects of irradiation on aerated reactive dye solutions have been studied. The uv-vis absorption of solutions were observed before and after irradiation. HPLC with uv-detector was used to analyze the products of degradation. Oxalic acid was the main degradation product and a small amount of succinic acid was also detected. Less effective degradation at higher pH might be caused by any structural changes of the azo compound.

ABSTRAK

RADIOLISIS ZAT WARNA REAKTIF AZO DALAM LARUTAN AIR. Telah dipelajari pengaruh iradiasi pada larutan zat warna reaktif azo yang diiradiasi dengan aliran udara. Pengukuran absorbansi larutan sebelum dan sesudah iradiasi dilakukan dengan spektrofotometer uv-vis. Hasil penguraian dianalisis dengan menggunakan HPLC yang dilengkapi dengan detektor uv. Asam oksalat merupakan hasil utama dari penguraian tersebut dan asam suksinat yang terdapat dalam jumlah sedikit. Penurunan penguraian pada pH tinggi mungkin disebabkan oleh perubahan struktur dari senyawa azo.

INTRODUCTION

The increase of textile industry in Indonesia gives impact on the environment. The waste that contain some non-biodegradable materials such as reactive azo dyes cannot be degraded by conventional treatment. Radiation-induced degradation and decoloration of disperse and acid dyes have been reported by some researchers (1-2). The results were promising, so that radiation technology should be an alternative for the treatment of the waste.

This paper summarizes studies on radiation degradation and decoloration of reactive azo dyes in water as a model system of textile industrial waste.

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MATERIALS

Reactive azo dyes used in this study were cibacron violet (CV), cibacron orange (CO) and cibacron golden yellow (CGY) (Fig 1). Cibacron golden yellow has the chemical index-reactive orange 45 but the structure is not known due to the industrial patent (Fig 1c). The dyes samples were used without purification. A 50 ppm of each dye solution was prepared by dissolving the dye in pure water. Gamma-rays irradiation was carried out while the solution was aerated. The dose rate was determined by Fricke dosimeter, total absorbed dose were varied from 0 to 10 kGy (5 kGy/h). Irradiation was also carried out in various pH. Shimadzu UV 1600 spectrophotometer was used to measure the uv-vis absorption of the solutions, and pH-meter was used to measure the pH. The degradation products were determined using HPLC with a biograd column, and uv detector. The standards ^{of} organic acids ^{used} were oxalic, succinic, formic, acetic and propionic acids.

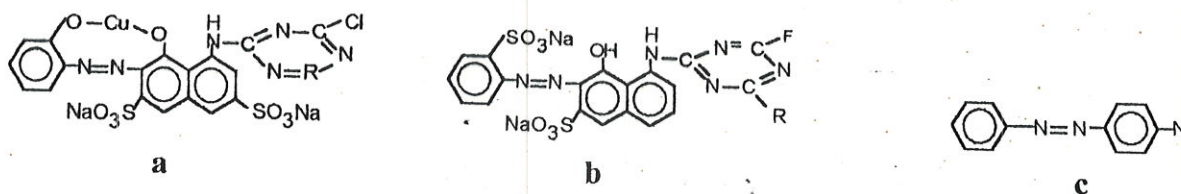


Fig. 1. Structure molecules of Cibacron Violet (a), Cibacron Orange (b) and Cibacron Golden Yellow (c)

RESULTS AND DISCUSSION

Degradation products. Figure 2 showed that the initial solutions had different pH due to their chemical structures. The decline of pH upon irradiation indicated the formation of acidic product, and the identified products were compared with acids standards (oxalic, succinic, formic, acetic and propionic acid). Figure 3 showed the chromatogram of CGY radiolysis products (a) and the acids standards (b). Oxalic acids was the main radiolysis product, and small amount of succinic acid was also formed.

Degradation of the dye molecules is induced by the reaction with oxidative species from water radiolysis. The oxalic acid might be formed by the oxidation of benzene which is