

**DEGRADASI METILEN BIRU SECARA FOTOLISIS DI BAWAH  
PAPARAN SINAR ULTRAVIOLET DENGAN AKTIVATOR KALSIUM  
NITRAT**

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**INTISARI**

Limbah cair dari industri tekstil yang tidak dioleh dengan baik akan mencemari lingkungan perairan karena limbah cair mengandung zat warna toksik dan persisten. Fotolisis dipilih sebagai metode alternatif karena dinilai sederhana, ramah lingkungan, dan efisien, khususnya dengan dukungan senyawa penghasil radikal seperti  $\text{Ca}(\text{NO}_3)_2$ . Penelitian bertujuan untuk mempelajari pengaruh  $\text{Ca}(\text{NO}_3)_2$  terhadap penurunan konsentrasi zat warna metilen biru di bawah sinar UV.

Degradasi fotolisis dilakukan dengan variasi penyinaran, sumber nitrat, pH, konsentrasi, mol total nitrat, waktu kontak dengan sinar UV, serta variasi zat warna kationik. Perlakuan variasi bertujuan memperoleh kondisi optimum pengaruh penambahan  $\text{Ca}(\text{NO}_3)_2$  terhadap degradasi zat warna metilen biru, serta membandingkan laju degradasi dengan zat warna kationik lainnya.

Hasil penelitian menunjukkan bahwa degradasi optimum metilen biru terjadi pada pH 6 dengan waktu kontak 15 jam dan mol  $\text{NO}_3^-$  sebesar 1,032 mmol. Penambahan  $\text{Ca}(\text{NO}_3)_2$  secara signifikan meningkatkan efisiensi degradasi, terutama di bawah sinar UV, karena terbentuknya spesies reaktif seperti radikal hidroksil ( $\bullet\text{OH}$ ) dan nitrogen dioksida ( $\bullet\text{NO}_2$ ). Urutan laju degradasi zat warna dari tercepat hingga terlambat adalah: kristal violet > Rhodamin B > metilen biru, yang dipengaruhi oleh struktur molekul dan interaksinya dengan spesies reaktif.

Kata Kunci :  $\text{Ca}(\text{NO}_3)_2$ , degradasi, fotolisis, metilen biru, sinar UV

## **METHYLENE BLUE DEGRADATION VIA PHOTOLYSIS UNDER ULTRAVIOLET LIGHT EXPOSURE WITH CALCIUM NITRATE ACTIVATOR**

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### **ABSTRACT**

Untreated textile industry wastewater poses a serious threat to aquatic ecosystems due to its content of toxic and persistent dyes. Photolysis has emerged as a promising alternative treatment method owing to its simplicity, environmental sustainability, and efficiency, especially when enhanced by radical-generating compounds such as calcium nitrate ( $\text{Ca}(\text{NO}_3)_2$ ). This study investigates the role of  $\text{Ca}(\text{NO}_3)_2$  in accelerating the photolytic degradation of methylene blue under ultraviolet (UV) irradiation.

A series of experiments were conducted by varying the irradiation conditions, nitrate sources, pH, initial dye concentrations, total nitrate molarity, UV exposure time, and types of cationic dyes. These variations aimed to determine the optimal degradation conditions and to compare the degradation rates of methylene blue with other cationic dyes.

The results indicated that the optimal degradation of methylene blue occurred at pH 6, with a UV exposure time of 15 hours and a nitrate molarity of 1.032 mmol. The addition of  $\text{Ca}(\text{NO}_3)_2$  significantly enhanced the degradation efficiency under UV light by promoting the formation of reactive species, including hydroxyl radicals ( $\bullet\text{OH}$ ) and nitrogen dioxide ( $\bullet\text{NO}_2$ ). Among the dyes tested, the degradation rate followed the order: crystal violet > Rhodamine B > methylene blue, which correlates with differences in molecular structure and reactivity toward radical species.

Keywords:  $\text{Ca}(\text{NO}_3)_2$ , degradation, photolysis, methylene blue, UV light