

## Intisari

### DEKOLORISASI LIMBAH CAIR INDUSTRI TEKSTIL MENGGUNAKAN IMOBILISASI ENZIM KASAR DAN BIOMASSA BAKTERI

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Limbah industri tekstil mengandung pewarna toksik sehingga diperlukan tahapan dekolorisasi untuk mengurangi konsentrasi warnanya. Pewarna dapat didegradasi melalui dekolorisasi menggunakan enzim kasar dan biomassa bakteri yang diimobilisasi. Tujuan penelitian adalah melakukan seleksi isolat, menguji kemampuan enzim kasar dan biomassa isolat bakteri yang diimobilisasi dalam dekolorisasi zat pewarna limbah industri tekstil, dan identifikasi isolat.

Sepuluh isolat bakteri lignolitik, yaitu PJ39, PJ40, S1, S53, PK48, PK29, PK31, PK32, PK63, dan PK65 digunakan dalam penelitian ini. Isolat bakteri tersebut diseleksi berdasarkan daya dekolorisasi dan daya serap terhadap zat pewarna *Methylene Blue*, *Rhodamine B*, dan *Orange G*. Enzim kasar dan biomassa dari isolat unggul diimobilisasi menggunakan kalsium alginat 2% dengan ukuran diameter *beads* 0.3 cm. *Beads* yang dihasilkan diaplikasikan ke limbah steril (3 *beads*/ml). Konsentrasi dan nilai pH limbah divariasikan berturut-turut dari 100%-25% dan 6,5-8,5. Identifikasi isolat yang terseleksi berdasarkan pengamatan makroskopis, mikroskopis, dan uji biokimia

Hasil penelitian menunjukkan isolat PK31, PK48, dan S53 merupakan isolat bakteri terseleksi. Variasi pH dan konsentrasi limbah mempengaruhi kemampuan enzim kasar dan biomassa bakteri yang diimobilisasi dalam mendekolorisasi limbah industri tekstil yang mengandung zat pewarna *Pigment Red 8* dan *Direct Yellow 50*. Tingkat dekolorisasi terhadap *Pigment Red 8* dengan enzim kasar tertinggi dicapai dengan variasi konsentrasi limbah 25% sebesar 93,75%, sedangkan untuk biomasanya tertinggi dicapai dengan variasi konsentrasi limbah 25% sebesar 85,42%. Tingkat dekolorisasi terhadap *Direct Yellow 50* dengan enzim kasar tertinggi dicapai dengan variasi konsentrasi limbah 25% sebesar 97,08%, sedangkan untuk biomasanya tertinggi dicapai dengan variasi konsentrasi limbah 25% sebesar 82,08%. Dekolorisasi zat pewarna *Direct Yellow 50* lebih cepat dibandingkan dengan zat pewarna *Pigment Red 8*. PK31, PK48, dan S53 berturut-turut diidentifikasi sebagai anggota genus *Bacillus*, *Klebsiella*, dan *Planococcus*.

Kata kunci: dekolorisasi, limbah industri tekstil, imobilisasi, bakteri, enzim kasar

*Abstract*

**DECOLORIZATION OF TEXTILE INDUSTRIAL WASTE WATER USING  
IMMOBILIZATION OF CRUDE ENZYME AND BACTERIAL BIOMASS**

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Textile industrial waste water containing toxic dyes that was difficult to be degraded in the environment due to its complexity of chemical structure. Dyes can be degraded by means of decolorization using immobilized crude enzyme and bacterial biomass with immobilization method. The aims of this research was: to select bacterial isolates, to test the capability of immobilized crude enzymes and bacterial biomass in decolorizing dyes of textile industrial waste water.

Ten lignolytic bacterial isolates, namely PJ39, PJ40, S1, S53, PK48, PK29, PK31, PK32, PK63, PK65, were used in this study. They were selected based on their capability to decolor and absorb of Methylene Blue, Rhodamine B, and Orange G dyes. Crude enzyme and biomass of the selected fungi were immobilized using 2% calcium alginate with a diameter bead of 0.3 cm. The resulted beads were applied to sterilized waste water (3 beads/ml). Concentration and pH value of waste water were varied from 100% to 25% and 6,5 to 8,5, respectively. Identification selected bacterial isolates based on macroscopic, microscopic, and biochemistry characteristics.

The results showed PK 31, PK 48, and S 53 are selected bacterial isolates. Variations of pH and concentration of waste water were affecting immobilized crude enzyme and bacterial biomass capability in decolorization of waste water textile industry containing Pigment Red 8 and Direct Yellow 50. The highest result of decolorization from Pigment Red 8 by crude enzyme immobilization is 93,75% with 25% waste water concentration, whereas by biomass immobilization is 85,42% with 25% waste water concentration. The highest result of decolorization from Direct Yellow 50 by crude enzyme immobilization is 97,08% with 25% waste water concentration, whereas by biomass immobilization is 82,08% with 25% waste water concentration. Decolorization of Direct Yellow 50 was faster than Pigment Red 8. PK31, PK48, dan S53 were determined as *Bacillus*, *Klebsiella*, and *Planococcus*, respectively.

**Keywords:** decolorization, textile waste water, immobilization, bacteria, crude enzyme