Optimization of prime parameters for textile dye decolorization by design of experiments (DOEs) using Lysinibacillus fusiformis M1

Palanivelan R.\textsuperscript{a}, Rajakumar S.\textsuperscript{b}, Suresh S.S. Raja\textsuperscript{c}, P.M. Ayyasamy\textsuperscript{a,\ast}{\textsuperscript{a}}

\textsuperscript{a}Department of Microbiology, Periyar University, Salem 636011, Tamil Nadu, India, Tel. +91 9952517712; email: starvel2005@yahoo.co.in (R. Palanivelan), Tel. +91 9486327103; Fax: 0427 2345124; email: pmayyasamy@gmail.com (P.M. Ayyasamy)
\textsuperscript{b}Department of Marine Biotechnology, Bharathidasan University, Tiruchirappalli 620024, Tamil Nadu, India, Tel. +91 9600342290; email: kodairaj@gmail.com (S. Rajakumar)
\textsuperscript{c}Department of Microbiology, Bharathidasan University College, Perambalur 621107, Tamil Nadu, India, Tel. +91 9486160107; email: sudalaimuthuraja@yahoo.co.in (S.S.S. Raja)

Received 1 February 2014; Accepted 29 June 2014

\textbf{ABSTRACT}

Bacterial strain M1 isolated from soil contaminated with dye was found to be a potential dye decolorizer in the screening studies. The strain was identified as \textit{Lysinibacillus fusiformis} by 16S rDNA sequencing method. While, the bacteria required 72 h to achieve maximum decolorization of dye in yeast extract broth, it needed 48 h of incubation for achieving 97.1\% decolorization in Luria Bertani broth. Plackett–Burman design (PBD) was used to study the effect of most important variables that influence the dye decolorization process under static conditions. In PBD model, 12 experiments were made with seven process variables and the remazol golden yellow decolorization was within the range from 1.01 to 69.29\%. From statistically analyzed data, lactose, yeast extract, and pH were found as most important variables that influence the dye decolorization process. These three variables and their combined effect of levels was studied by response surface methodology for an optimization of dye decolorization through central composite design and the outcome varied from 2.05 to 83.80\%. The optimized level of lactose, yeast extract, and pH was found to be 0.40\% (w/v), 1.30\% (w/v), and 7.5, respectively, to achieve maximum dye decolorization of remazol golden yellow (89.66\%) in validation of model. This study specifically explored factors influencing the dye decolorization through statistical tools and suggests their appropriate level with interactions playing a key role for an effective dye decolorization process.

\textbf{Keywords:} Remazol golden yellow; Statistical optimization; Textile dye decolorization; Carbon and nitrogen sources; Plackett–Burman design; Central composite design