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Development of PCL/PMMA and PCL/PEG Polymeric Film as Potential for Algae Removal [Pembangunan Filem Polimer PCL/PMMA dan PCL/PEG Berpotensi sebagai Penyingkiran Alga]

(2024) *Sains Malaysiana*, 53 (6), pp. 1309-1320.

DOI: 10.17576/jsm-2024-5306-07

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Abstract
Human activities generate excess nutrients that can lead to harmful algal blooms (HABs), which are increasing in number and severity worldwide, causing significant ecological problems and substantial economic losses. Cost-effective polymeric films with ease of operation represent a promising and sustainable alternative to traditional HABs mitigation methods in various aquatic systems. In this study, composite polymer films, specifically polycaprolactone with poly(methyl methacrylate) (PCL/PMMA) and polycaprolactone with polyethylene glycol (PCL/PEG), were employed for algae mitigation. To the best of our knowledge, no prior studies have explored the application of PCL/PMMA and PCL/PEG composite polymer films for algae mitigation. These films were prepared using solvent casting methods. The successfully prepared film ratios were 1:0.2, 1:0.4, and 1:0.6. ATR-FTIR analysis confirmed the successful preparation of PCL/PMMA and PCL/PEG by detecting characteristic functional group peaks corresponding to each pure polymer, suggesting the possibility of non-covalent bond interactions between the polymers in the composites. Thermal analysis (TGA) indicated increased thermal stability for all film ratios. Algae mitigation studies form light microscope analysis showed the presence of algal cells within the composite. Removal efficiency improved with higher ratios of these composite polymer films, with PCL/PMMA outperforming PCL/PEG. Notably, the 1:0.4 PCL/PMMA film exhibited highly efficient algae removal, with interactions between microalgae cells and the film observed within a shorter time. This film achieved the highest removal efficiency of 10.6% within a 15-min interval compared to others. From this preliminary study, the composite polymer films show good potential and promising candidate for mitigating algae-related issues.

Author Keywords
Harmful algal blooms; mitigation; PCL; PEG; PMMA; polymeric films

Index Keywords
algal bloom, film, FTIR spectroscopy, polymer, solvent

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Publisher: Penerbit Universiti Kebangsaan Malaysia

ISSN: 01266039
Language of Original Document: English
Abbreviated Source Title: Sains Malays.
2-s2.0-85197882488
Document Type: Article
Publication Stage: Final
Source: Scopus