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BIOREMEDIATION OF DISPOSED X-RAY FILM FOR ENZYMES PRODUCTION

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ABSTRACT

Annually, the production of X-ray films sheets can utilize up to 1000 tons of total silver chemically produced worldwide and being wasted when these films are used. To avoid waste, the biological methods are used to study the effect of disposed X-ray on production of two different types of enzyme by using microbial power. Firstly, production of CMC_{ase} enzyme by using disposed X-ray as a carbon source. Secondly, production of nitrate reductase enzyme responsible to catalyse the reduction of silver nitrate inside X-ray film. Both bring the disposed X-ray as a substrate. Different bacterial isolates were used for production of both enzymes and being optimized by using several parameters. The protein and enzyme assay were analysed using optical density measurement. CMC_{ase} production found to be optimal in 140 rpm incubator with lactose as carbon source by 1.365 ± 0.026 (U/ml), malt extract as nitrogen source by 0.485 ± 0.028 (U/ml), pH 9.0 by 0.129 ± 0.007 (U/ml), 1.5 g substrate concentration by 0.217 ± 0.007 (U/ml), 2 ml inoculum size by 0.143 ± 0.029 (U/ml), and thiamine for vitamin by 0.208 ± 0.041 (U/ml). While nitrate reductase production, the most potent isolates achieved optimum condition in static incubation condition by $1.182 \pm 0.000 \mu\text{g/ml}$, 0.5g substrate concentration by $1.500 \pm 0.020 \mu\text{g/ml}$ with 15 days incubation periods in darkness, NaNO₃ as nitrogen source by $166.773 \pm 0.054 \mu\text{g/ml}$ and pH 3.0 by $0.773 \pm 0.001 \mu\text{g/ml}$. This study proved that the power of most potent isolates successfully used the disposed X-ray as substrate to produce valuable by-products using green technology to reduce environmental pollution.

Keywords

Bioremediation; Disposed x-ray film; CMC_{ase}; Nitrate reductase.

1. INTRODUCTION

Nowadays, the increasing number of industrialization sector has caused a lot of pollution around the world. That occurs due to lack of awareness about the harmful effects especially to aquatic environment. When the water pollution occurs because of chemical, physical, radioactive or pathogenic substances, the large scales illness and deaths will occur. Common examples of chemical water pollutants are mercury, certain nitrogen compound, chlorinated organic molecules and various acids [1]. To remove and neutralized pollutants from contamination, the bioremediation should be done. These mean that the natural treatment that uses organisms to breakdown hazardous substances into less or non-toxic substances. In this study, the bioremediation of disposed x-ray films were used for enzymes production. Firstly, production of CMC_{ase} (EC 3.2.1.4) by using disposed x-ray as a carbon source. Cellulose which act as a carbon source plays an important role as a substrate that enzyme can process to produce reducing sugar. Cellulose will be degraded by microorganisms that was isolated from waste. The importance of this research is to decrease hazardous waste and produce valuable