UTILIZATION OF CASSAVA RESIDUE BY-PRODUCT AS A C/N SOURCE FOR EFFECTIVE PRODUCTION OF PRODIGIOSIN VIA MICROBIAL FERMENTATION

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SUMMARY

Recently, prodigiosin (PG), a red pigment compound produced mainly by Serratia marcescens, has been applied in various fields. Thus, this microbial pigment has been extensively studied for biosynthesis and potential biofuntions. This study aimed to utilize cassava residue by-product (CRBP) as a C/N source for the eco-friend production of PG via fermentation. PG was produced at the highest yield when *Serratia marcescens* TNU1 was grown in the medium containing 1.5% CRBP, 0.2% casein, 0.05% $MgSO_4$, 0.1% K_2HPO_4, with an initial pH of 7.0, and fermentation was performed at 27.5° C for two days. Additionally, PG scale-up bioproduction was investigated in a 14 L bioreactor system, and PG was produced at a high yield (6450 mg/L) in a short fermentation time (12h). This study suggests CRBP is a novel and potential C/N for the cost-effective bioproduction of PG.

Keywords: *Cassava residue by-product, prodigiosin, bioreactor, Serratia marcescens, fermentation.*

1. INTRODUCTION

Prodigiosin (PG), a red pigment, is a ring compound belonging to the prodigionine group with a pyrrolylpyrromethane skeleton. The structure and physicochemical properties of PG are presented in Figure 1 (Nguyen et al., 2020a; Rafael et al., 2022). This microbial pigment was biosynthesised from various microbial strains, including *Serratia marcescens, Serratia rubidaea, Alteromonas rubra, Janthinobacterium lividum BR01, Rugamonas rubra, Streptomyces longisporus ruber 100-19, Serratia coelicolor, Serratia spectabilis BCC 4785, Streptomyces fusant* NRCF69, *Streptomyces* sp., *Vibrio* sp. C1-TDSG02-1, *Vibrio* sp. KSJ45, *V. gazogenes, V. psychroerythrus, Pseudomonas magnesiorubra, Pseudomonas putida* KT2440, *Streptoverticillium* sp. 26-1, *Streptoverticillium rubrireticuli, Pseudoalteromonas* sp., *Pityriasis rubra, Actinomycetes,* and *Pseudomonas putida*. Among them, the main source of PG producing is *Serratia marcescens* (Wang et al., 2020). PG attracted a lot of research due to its potential bio-activities in many fields, such as medicine, agriculture, industry, food, and the environment (Wang et al., 2020). Furthermore, its safety has also proved in many reports (Suryawanshi et al., 2014; Nguyen et al., 2022a; Tomas & Vinas, 2010; Guryanova et al., 2013; Siew et al., 2016; Li et al., 2021).

The study on PG production has been occurring for years. However, almost previous reports investigated the PG biosynthesis on minor scales of various Erlenmeyer flasks, and commercial substrates such as nutrient broth were used as C/N sources for cultivation by different strains of *S. marcescens* (Nguyen et al., 2022b). On the contrary, in this report, we used cassava residue by-product as C/N for fermentation, and a 14L bioreactor system was applied to scale up PG production in this report.

For lower-cost production of PG, several nontraditional media such as sesame oil, sesame seed, peanut oil, cassava, crude glycerol, corn steep, peanut seed, copra seed, coconut oil, and the complexes of mannitol/cassava, and steep were conducted for fermentation (Nguyen et al., 2020a). Some wastes and processed by-products were also utilized for cultivation to produce PG (Wang et al., 2020). Cassava powder and cassava wastewater were also previously used for fermentation to produce this pigment. However, it has not been reported that the cassava residue byproduct (CRBP) being used for PG production via fermentation (Tran et al., 2021).

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