ENHANCEMENT OF PRODIGIOSIN PRODUCTION FROM SOYBEAN RESIDUE BY- PRODUCT VIA FERMENTATION TECHNOLOGY

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SUMMARY

Prodigiosin (PG) is a red pigment compound originating from *Serratia marcescens*. Recently, this compound has been extensively studied for its production process and investigation of its potential bioactivities. However, most previous studies used commercial nutrient broth as a carbon/nitrogen (C/N) source for cultivation in small-scale flasks. Regarding the cost-effective and green production, we reused soybean residue by-product (SRBP) for the biosynthesis of PG on a large scale using a 14-L bioreactor system and reported its potent anti-nematode activity. The experimental results revealed that *Serratia marcescens* TNU2 produced PG at the highest yield (5700 mg/L) under fermentation conditions: 6 L of liquid medium containing 1.75% C/N (SRBP/casein at the ratio of 8/2), 0.05% $MgSO_4$, 0.1% K_2HPO_4, with an initial pH of 7.0, and the fermentation was performed at 27.5°C in 10 h. On the activity tests, the purified PG at the tested concentration of 1 mg/mL demonstrated a potential nematicidal effect against root-knot nematode on both *J2* nematodes (100%) and eggs hatching (87.43%) at 1 and 3 days after treatment with PG, respectively. This study suggested that SRBP is a good C/N source for the bioproduction of PG with potential use for managing root-knot nematodes.

Keywords: *Soybean waste , prodigiosin, bioreactor, Serratia marcescens, root-knot nematode.*

1. INTRODUCTION

Prodigiosin (PG), a red pigment that belongs to the prodiginine family is a metabolite of various bacteria. Of these, *Serratia marcescens* is a major producer of PG (Wang, S.L. et al. 2020). PG possesses numerous biological effects such as anticancer, antibacterial, algicidal, antioxidant, immunosuppressant, anti-Alzheimer, anti-inflammatory, antiparasitic, and insecticidal activities. This pigment is also commonly used in food colorants, cosmetics, textiles, candles, and solar cells (Nguyen, T.H. et al. 2021).

Various potential bioactivities and applications of PG have resulted in a dramatic increase in the investigation of PG production via microbial fermentation. However, in most of the previous works, commercial media were used as C/N sources for cultivation, such as yeast malt, casein, tryptone yeast, yeast extract, tryptone soy, nutrient broth, glycerol, glycerol-tryptone, peptone-glycerol, and Luria/Bertani broth (Nguyen, T.H. et al. 2022a). For lower cost production of PG, some nontraditional media, including sesame seed, cassava, sesame oil, crude glycerol, peanut oil, corn steep, coconut oil, peanut seed, copra seed, and the complexes of mannitol/cassava, and mannitol/corn steep have been used as C/N sources for fermentation (Chenqiang, L. Et al. 2019; Giri, A.V. et al. 2004; Wei, Y.H. et al. 2005). Some processed by-products and wastes have also been utilized for fermentation to produce PG in some previous works (Bhagwat, A.; Padalia, U. 2020; Sumathi, C. Et al. 2014; Aruldass, C.A. et al. 2014). Moreover, PG has also been mainly studied for bioproduction in a minor scale of flasks (Nguyen, T.H. et al. 20).

Concerning bioproduction of PG, we reported the production of this secondary metabolite from soybean waste via *Serratia marcescens* conversion. This pigment compound was scale-up produced using a 14-L bioreactor system and also investigated in its potential antinematicidal activity in this study.

2. THE STUDY CONTENT AND METHODOLOGY

2.1. Study contents

- Establishment of the fermentation process for production of prodigiosin in flask.

- Scale-up of PG production in a bioreactor system.

- Assessment of the potential antinematicidal activity of prodigiosin.

The contents and experimental stepts of this study were illustrated in the Scheme 1.

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