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Research Letter

RESEARCH LETTER – Biotechnology & Synthetic Biology

Fluconazole treatment enhances extracellular release of red pigments in the fungus *Monascus purpureus*

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One sentence summary: Fluconazole facilitates increased *Monascus* red pigment production by modification of fungal cell membrane.
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ABSTRACT

Traditional methods for the production of food grade pigments from the fungus *Monascus* spp. mostly rely on submerged fermentation. However, the cell-bound nature and intracellular accumulation of pigments in *Monascus* spp. is a major hurdle in pigment production by submerged fermentation. The present study focused on the investigation of the effect of the antifungal agent fluconazole on red pigment production from *Monascus purpureus* (NMCC-PF01). At the optimized concentration of fluconazole (30 μg ml^{-1}), pigment production was found to be enhanced by 88% after 96 h and it remained constant even after further incubation up to 168 h. Ergosterol, a sterol specific to fungi, was also extracted and estimated as a function of fungal growth. The concentration of ergosterol in fluconazole-treated fermentation broth was reduced by 49% as compared to control broth. Thus it could be responsible for facilitating the release of intracellular and cell-bound pigments. Nevertheless, the role of cell transporters in transporting out the red pigments cannot be ignored and deserves further attention. Qualitative analysis of red pigment by thin layer chromatography, UV spectroscopy and mass spectrometric analysis (ESIMS) has confirmed the presence of the well-known pigment rubropunctamine. In addition, this fermentation process produces citrinin-free pigments. This novel approach will be useful to facilitate increased pigment production by the release of intracellular or cell-bound *Monascus* pigments.

Keywords: fluconazole; *Monascus*; pigments; extracellular; antimycotic; citrinin

INTRODUCTION

Monascus is an ascomycete fungus widely used as a microbial source for natural pigment production. In particular, *Monascus* is known to produce food grade polyketide pigments such as red (monascorubramine and rubropunctamine), yellow (monascin and ankaflavin) and orange (rubropunctatin and monascorubrin) pigments (Lopes *et al.* 2013). *Monascus* pigment production has been reported from different *Monascus* spp., e.g. *Monascus purpureus* (Babitha, Soccol and Pandey 2007), *Monascus ruber* (Hajjaj, Goma and Francois 2015) and *Monascus anka* (Su *et al.* 2003). Among these, *Monascus purpureus* is the main source for red pigment production (Srivastav *et al.* 2015). Red

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