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# Exploring Filamentous Fungi Bio-Based Pigments as an Alternative to Synthetic Colourants

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## Abstract

Colour is an important facet of a product's retail marketability. As such, various industries including food, pharmaceutical, cosmetic, and textiles have extensively relied on synthetic colourants to achieve the colour objective of their products. However, due to the shift in consumer markets and the impact synthetic colourants have on health and the environment, these industries are seeking natural colour alternatives. Therefore, the current study aimed at characterizing the physicochemical properties (antioxidant and antimicrobial attributes) and evaluating the toxicity (through the Fish Embryo Toxicity assay) of pigments produced by *Penicillium multicolour, P. canescens, P. herquie, Talaromyces verruculosus* and *Fusarium solani.* Furthermore, the pigments were applied in a jelly-sweet model, and their stability was tested under ambient storage conditions. The study demonstrated that the crude pigment extracts had antioxidant capacity (against DPPH) ranging from 65.49-74.46% whereas the extracts by *P. canescens* and *F. solani* exhibited strong antimicrobial activity against some Gram + and - bacterial pathogens in the range of 1.5-2.5 mg/mL MIC. As far as the toxicity of the pigments is concerned, lethal endpoints comprising embryo coagulation, lack of somite formation, scoliosis, bent tail, and pericardial oedema were observed for all extracts at a concentration range of 3-5 mg/mL on zebrafish embryos. On the other hand, three key pigment compounds by *P. multicolour, T. verruculosus*, and *F. solani* were identified as sclerotiorin (yellow), rubropunctamine (red) and bostrycoidin (red) respectively. Finally, following the application of pigments in jelly sweets, there was no significant change in colour (visual observation) over the four weeks of incubation. This was also supported by nearly linear distributions of the L*a* and b* values with exceptions of the a* and b* for *P. multicolour* and *T. verruculosus* at week 1. Furthermore, the total colour change (TCC) and chromaticity were also affected over the four weeks for the same pigment extracts ranging from 4.71-5.78 and 4.71-8.32 (TCC), while the chromaticity ranged from 4.71-5.54 and 4.71-6.93, respectively. In conclusion, the study demonstrated the potential of filamentous fungi bio-pigments attributed to their inherent biological activities. Although more work needs to be done regarding fungal pigment toxicity, these pigments are fairly stable at normal storage conditions.

**PRESENTER BIOGRAPHY: TUMISI MOLELEKOA**

Tumisi Molelekoa recently completed a PhD in Food Technology focusing on the production of microbial metabolites (pigments) using green waste for ultimate application in food, pharmaceutical and textile industries. He is a University of Johannesburg lecturer at the Department of Biotechnology and Food Technology under the new generation of academic professionals program (nGAP). He is passionate about research with interests that span across fermentation science, microbial pigments, food waste valorisation, acetic acid and lactic acid bacteria, product development, cereal science and nutraceutical foods.