Wan Abd Al Qadr Imad Wan-Mohtar, Med Mycol Open Access, 3:2, 2017
DOI: 10.21767/2471-8521-C1-001

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Upstream and downstream processing of *Ganoderma lucidum* mycelial extract: A road to natural remedies?

Humankind has experimented with various sources and techniques to counter global health issues that include drug resistance and newly-developed types of infections. In 2010, approximately 15 million people died from contagious infections, despite the readily-available extensive synthetic prescribed drug combinations in the market. Extra effort must be dedicated to the development of non-synthetic, natural-based remedies, particularly from medicinal mushrooms. To date, a safely established mushroom called *Ganoderma lucidum* shows the potential to be one of the best natural-based medicinal therapies combatting global health issues. This study describes the efficient production of the underutilised mycelium of *G. lucidum* and *in vitro* testing of potential therapeutic effects obtained from the sulphated glucan derived from such mycelial cultures. For *G. lucidum*, most of the reported positive bioactivities are obtained from the fruiting bodies and not from their mycelial cultures. Such cultures represent a much faster way to produce glucan from *G. lucidum* compared to extraction from the flesh. If *G. lucidum* derived materials, having multifunctional effects are to be used to combat global health issues, they will need to be produced in bulk, quickly, cheaply and to a consistent quality. A mycelial cultivation called repeated-batch fermentation (RBF) has been done in a bioreactor solving the typical long cultivation time and generated efficient productivities. An elegant sulfation technique was applied to the extracted glucan, thus enhancing the water-solubility and therapeutic responses via multiple aseptic *in vitro* assays: antimicrobial, antifungal, anti-proliferative and immunomodulatory. The reported upstream process of *G. lucidum* via RBF has successfully improved the glucan production with a shorter cultivation time. The downstream process has indicated the benchmarks in battling global health issues, introducing a novel "quad-functional" approach of this bioreactor-derived material. These two processes may lead to a natural remedy, thus overcoming the problem of using singular-function synthetic drugs in health industries.

Biography

Brian McNeil B.Sc. (1st Class Hons in Applied Microbiology, Strathclyde 1980), Ph.D. funded by Carnegie Trust in Fermentation Technology 1984. Lecturer in Department of Bioscience 1989-1997, Senior Lecturer 1997-2003, Reader 2003, Professor of Microbiology 2005-date, Assistant Head of Institute 2009-2012

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Wan Abd Al Qadr Imad Wan-Mohtar is a Senior Lecturer and Young Scientist in Institute of Biological Sciences, Faculty of Science, and University of Malaya, Malaysia. He is graduated from Strathclyde Institute of Pharmacy and Biomedical Sciences, Glasgow under the supervision of fungal fermentation expert Prof Brian McNeil and Prof Linda Harvey. His field of interest is on extended liquid fermentation and microbiology of mushrooms which rooted from BSc in Microbiology (Oyster mushrooms), MSc in Food Biotechnology (Local Basidiomycetes) and PhD in Fermentation Technology (*Ganoderma lucidum*). He has his expertise in mushroom liquid cultivation in order to boost the supply of the natural therapeutic compound thus improving health and wellbeing through *G. lucidum*. His optimisation of extended batch fermentation and sulphated glucan from *G. lucidum* mycelium creates potential pathways for replacing the singular-function synthetic drugs via quad-functional sulphated glucan. He has built this idea after years of experience in research, evaluation, teaching and administration both in laboratories and educational institutions.

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