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Notice for the PhD Viva Voce Examination

Mr Kondapalli Vamsi Krishna (Registration Number: 1940089), PhD scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore will defend his PhD thesis at the public viva-voce examination on Wednesday, 23 October 2024 at 11.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029.

Title of the Thesis	:	**Process Development for Mass Production of Cordycepin Using Fermentation Technology**
Discipline	:	**Biotechnology**
External Examiner - I	:	**Dr S R Senthilkumar** Associate Professor Department of Botany St Joseph's College Tiruchirappalli - 620002 Tamil Nadu
External Examiner - II	:	**Dr R Lakshminarayana** Professor Department of Microbiology & Biotechnology Jnana Bharathi Campus Bangalore University Bengaluru - 560056 Karnataka
Supervisor	:	**Dr Alok Kumar Malaviya** Associate Professor Department of Life Sciences School of Sciences CHRIST (Deemed to be University) Bengaluru – 560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar

Place: Bengaluru
Date: 18 October 2024

ABSTRACT

Cordyceps is a rare and exotic medicinal genus that has been utilised for generations in traditional Chinese medicine. China, Bhutan, Nepal, the Tibetan Plateau, and the northeastern parts of India are the main areas where they may be noticed. Cordycepin, ($C_{10}H_{13}O_3N_5$), an adenosine derivative generated naturally by *Cordyceps militaris*, has essential pharmacological effects. Cordycepin has been shown to have anti-tumor/anti-proliferative, anti-metastatic, apoptosis-inducing, anti-malaria, anti-microbial, anti-fungal, anti-diabetic/hypoglycemic, and anti-inflammatory qualities, among other things. The scarcity of native *Cordyceps* spp., as well as illicit commerce and a lack of growing methods in natural habitats, limit the supply of this prized fungus for therapeutic applications. As a result, we attempted to standardize the technique for large-scale cordycepin manufacturing in a laboratory setting. To measure the cordycepin, we have established analytical methods by using High-performance liquid chromatography (HPLC) and Ultraviolet-visible spectroscopy (UV Spec.) Furthermore, different methods were optimised and established to successfully extract cordycepin from biomass. Solid state fermentation (SSF) was performed to grow the fruiting bodies of *C. militaris* in jars.

A novel technology was developed using cotton in the SSF which improved the cordycepin content by 138.42 %. Different liquid culture methods (static, submerged, and mix) were also studied; the Static mode was chosen for future media optimization studies. Initially, different parameters like the effect of pH, light, media volume, and inoculum percentage were optimised that affect the cordycepin production. Further, numerous media components, including carbon sources, nitrogen sources, metals, salts and also the impact of vitamins, amino acids, and adenosine that can influence the cordycepin production were optimized employing the One Factor at a time (OFAT) method. Response surface methodology (RSM) was used for further optimization to enhance cordycepin production. With both of these approaches, we were able to increase the yield from the control Potato dextrose broth (PDB) medium, which had a yield of 60.35 mg/L, to 1356.46 mg/L in just 10 days, a 2118.85% improvement. Apart from cordycepin improvement, other metabolites like adenosine, carotenoids, and fibrinolytic enzymes were also checked. The antioxidant property was also checked by using DPPH. Silver nanoparticles using cordycepin were synthesized and used for the estimation of 2,4-dichlorophenol in water samples. The developed SSF and liquid culture methods in this study will overcome the dependency on climatic conditions and natural fungal growth for cordycepin% production and can improve the availability of the molecule that can be used for commercial and clinical exploitation for the general well-being of diverse population

Keywords: *Cordyceps, cordycepin, solid state fermentation, liquid culture, One factor at a time, Response surface methodology*

Publications:

1. **Krishna, K.V.**, Devasia, J. & Malaviya, A. Development and Validation of the UV-Spectrophotometric Method for the Determination of Cordycepin, a Nucleoside. *J Appl Spectrosc* (2024). https://doi.org/10.1007/s10812-024-01710-2
2. Comparison of cultivated Cordyceps militaris and wild Ophiocordyceps sinensis using high-performance thin-layer chromatography – Accepted in Research Journal of Biotechnology.
3. **Kondapalli VK**, Rutwick SU, Malaviya A. Bioactive compounds from Cordyceps and their therapeutic potential, Critical Reviews in Biotechnology. 2023. DOI: 10.1080/07388551.2023.2231139
4. An up-to-date review on artificial cultivation strategies for conservation and sustainable production of endangered Cordyceps spp.– A review – Accepted in Molecular Biotechnology.
5. Development of different solid state fermentation strategies for improvement of cordycepin in Cordyceps militaris – submitted to World Journal of Microbology and Biotechnology.
6. **Vamsi Krishna K**, Bharathi N, George Shiju S, Alagesan Paari K, Malaviya A. An updated review on advancement in fermentative production strategies for biobutanol using Clostridium spp. Environ Sci Pollut Res Int. 2022 May 13. https://doi: 10.1007/s11356-022-20637-9.
7. **Krishna KV**, Koujalagi K, Surya RU, Namratha MP, Malaviya A. *Enterococcus* species and their probiotic potential: Current status and future prospects. J App Biol Biotech. 2023;11(1):36-44. https://doi.org/10.7324/JABB.2023.110105.
8. **Krishna, K. V.**, Bhavana, S., Koujalagi, K., & Malaviya, A. (2023). Biofuels From Bio-Waste and Biomass. In Biomass and Bioenergy Solutions for Climate Change Mitigation and Sustainability (pp. 75-118). IGI Global.
9. Malaviya A., Paari K.A., Malviya S., **Kondapalli V.K.**, Ghosh A., Samuel R.A. (2021) Gut Microbiota and Cancer Correlates. In: Kaur I.P., Deol P.K. (eds) Probiotic Research in Therapeutics. Springer, Singapore.
10. **Krishna K.V.**, Malaviya A., Malviya S., Nimisha Das T. (2022) Gut-Skin Axis: Role in Health and Disease. In: Kaur I.P., Beri K., Deol P.K., Sandhu S.K. (eds) Probiotic Research in Therapeutics. Springer, Singapore
11. **Krishna. K.V.**, Malviya, S., Bhattacharyya, D., & Malaviya, A*. (2022). Gut–Brain Axis: Role in Hunger and Satiety. In K. Chopra, M. Bishnoi, & K. K. Kondepudi (Eds.), Probiotic Research in Therapeutics (pp. 1–27). Springer Nature Singapore.

Patents:

1. A method of culturing *Cordyceps* – Application no. - 202341039466 A
2. Electrochemical detection of 2,4-dichlorophenol using cordycepin mediated silver nanoparticles – Application no. - 202441015737 A