



CSIR-IHBT

सी.एस.आई.आर. - हिमालय जैवसंपदा प्रौद्योगिकी संस्थान

CSIR - Institute of Himalayan Bioresource Technology

Post Box. No. 06, Palampur - 176061 (H.P.) INDIA



28th August, 2024

To Whom It May Concern

Justification Letter in Favour of Mr. Nabab Khan's Application for the Sun Pharma Science Scholar Fellowship – 2024

Dear Members of the Selection Committee,

It gives me immense pleasure to recommend Mr. Nabab Khan's application for the **Sun Pharma Science Foundation Science Scholar Fellowship – 2024**. Mr. Khan is currently a CSIR - Senior Research Fellow (SRF) and has been pursuing his Ph.D. under Academy of Scientific and Innovative Research (AcSIR) since January 2021 at the CSIR – Institute of Himalayan Bioresource Technology (IHBT), Palampur, under my supervision.

Throughout his doctoral studies, Mr. Khan has exhibited an exceptional level of commitment, intellectual curiosity, and a meticulous approach to research. He has independently conceptualized, executed, and analyzed a series of complex experiments, demonstrating a deep understanding of the scientific process and a strong aptitude for addressing intricate research questions. Moreover, Mr. Khan is adept in data analysis and interpretation using a wide array of analytical techniques, including dynamic light scattering (DLS), scanning electron microscopy (SEM), transmission electron microscopy (TEM), powder X-ray diffraction (P-XRD), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), UV-Visible spectroscopy, nuclear magnetic resonance (NMR), matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS), and Fourier-transform infrared spectroscopy (FT-IR). He has also conducted extensive studies on drug content quantification, encapsulation efficiency, in-vitro release profiles, dissolution studies, antioxidant assays, in-vitro cell culture techniques, stability assessments, and the evaluation of various physicochemical parameters such as conductivity, rheological behavior, mechanical strength, and surface hydrophobicity. Mr. Khan's dedication and perseverance have resulted in the publication of both research and review articles in internationally reputed peer-reviewed journals. Notably, he was awarded the prestigious **IGSTC-PhD Industrial Exposure Fellowship - 2023** by the Department of Science and Technology (DST), Government of India, and the Federal Ministry of Education and Research (BMBF), Government of Germany. This fellowship provided him with a valuable 6-month industrial exposure at **Lionex GmbH - Diagnostics and Therapeutics, Germany**.

Significance of Mr. Khan's Research for Clinical Applications

Mr. Khan doctoral work emphasis on understanding the interaction mechanism and complexation chemistry of cyclodextrin derivatives with phytochemicals (flavonoids) utilizing various solid-state characterization, molecular simulation and molecular dynamics studies. In recent years, dietary phytochemicals have garnered significant interest due to their high nutritional and medicinal value, attracting the attention of both the pharmaceutical and food



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industries. The development of cyclodextrin-based delivery systems to enhance the therapeutic potential of phytochemicals represents a promising strategy for addressing the technological challenges associated with these bioactive compounds, such as chemical instability in the gastrointestinal tract, low aqueous solubility, poor permeability, chemical degradation, hepatic first-pass metabolism, and efflux transporter specificity.

Mr. Khan's submission for this prestigious award, titled **"Deciphering the Interactions and Complexation Mechanisms of flavonoids with β -Cyclodextrin Derivatives: Experimental Insights and Anticancer Implications"** showcases interdisciplinary research pivotal for advancing the application of cyclodextrin inclusion complexes (ICs) in phytochemical delivery systems. His work involved preparing CD inclusion complexes via spray-drying and lyophilization technique, followed by detailed characterization using advanced techniques such as NMR, FT-IR, PXRD, and SEM, TGA/DSC confirming the successful inclusion of flavonoid molecules (genistein and phloretin) within the cyclodextrin cavities. **For the first time, this experimental evidence was correlated with microsecond-scale molecular dynamics simulations (up to 1000 nanoseconds),** elucidating the dynamic process of genistein complex formation. Enhanced sampling simulations provided deeper insights into the underlying complexation mechanisms. Additionally, **the complexation chemistry between phloretin and sulfobutylether- β -cyclodextrin (Captisol®) was unveiled for the first time,** revealing its impact on phloretin's anticancer efficacy against MiaPaCa-2 and A549 cell lines.

I wholeheartedly recommend Mr. Khan for this prestigious award and have full confidence in his ability to continue excelling in his academic and research pursuits. Should you require any further information or verification, please feel free to contact me.

Thank you for your consideration of Mr. Khan's application.

Yours sincerely,

Ankit Saneja
28/02/2019
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