

To,
The Chairman,
Sarojini Naidu Vanita Pharmacy Maha Vidyalaya,
12-5-31/32, Vijayapuri Colony,
Tarnaka Secunderabad, Telangana- 500017.
Attn: Dr B. Prabha Shankar

Sir,

We are highly thankful to your management and also to the Indian Pharmaceutical Association Telangana State Branch for organizing a Symposium on the topic: "Simulation for Pharmaceutical Manufacturing" in coordination with Altair Engineering India Pvt Ltd, Bangalore on 21st September 2022 at the premises of Sarojini Naidu Vanita Pharmacy Maha Vidyalaya (SNVPMV) for the delegates from Pharma Industry and Academia.

In response to your letter dated 1st November 2022, requesting Altair Engineering India Pvt Ltd, Bangalore to provide Research and Development Grants to SNVPMV for carrying out the Research works in the field Altair is interested.

I have discussed with our management regarding your proposal for research grants.

I have the pleasure of informing you that our management has agreed in principle to provide a research in-kind grant worth Rs. 3,75,000/- to SNVPMV.

We would like SNVPMV to work on the Research Topic:

"Multiphysics Modelling of Drug Product Manufacturing Processes"

We are interested in the above research work because Achieving efficiency and reliability in pharmaceutical manufacturing processes that involve particulate solids requires fundamental micro and macro mechanical insight beyond that obtainable through experiments alone. In this context, numerical methods such as the Discrete Element Method (DEM) and Computational Fluid Dynamics (CFD) have significant



potential to deliver a deeper understanding of process mechanics at macro and micro scales and can be used to directly perform virtual process optimisation.

We are sure and confident that your institution with so many experts and infrastructure will be able to complete the research within the closure of this financial year 2022-2023.

Shortly we will be transferring the research grant to enable SNVPMV to start the project. The grant is intended to assist your Institution in covering research expenses against the expenditure. You are required to submit the project report along with the Statement of utilization of funds.

Best Regards,

For Altair Engineering India Pvt Ltd

Deepak Chandra Kumar



Ajay Pandey
Marketing Manager – India & GCC
Altair Engineering India Pvt Ltd

SAROJINI NAIDU VANITA PHARMACY MAHAVIDYALAYA
12-5-31/32 Vijayapuri Colony, Bathukammakunta
Tarnaka, Hyderabad.

Receipt Voucher

No. : 398

Dated : 7-Dec-22

Particulars	Amount
Account : Project Grant/Symposium	3,78,280.00
Through : UBI.BPhar.A/c.No.057811100002485	
On Account of : Being project grant received from Altair Engineering India Pvt Ltd	
Amount (in words) : INR Three Lakh Seventy Eight Thousand Two Hundred Eighty Only	
	₹ 3,78,280.00


Authorised Signatory

Sarojini Naidu Vanita Pharmacy Maha Vidyalaya
Vijayapuri Colony, S.Lalaguda, Tarnaka,
Secunderabad-500 017.



SAROJINI NAIDU VANITA PHARMACY MAHA VIDYALAYA

College for Women (Sponsored by the Exhibition Society, Tarnaka, Secunderabad)

Affiliated to Osmania University, Approved by AICTE & PCI

ISO : 9001:2015 Certified Institution

NBA Accredited B.Pharmacy Course

Ref.: SNVPMV/

Date :

Date:25.02.2022 ✓

To
Mr. Ajay Kumar Pandey,
Marketing Manager,
Altair Engineering India Pvt Ltd,
Prestige Trade Tower, No. 46,
I Floor, Palace Road,
Sampangiramanagar,
Bengaluru-560001, India.

Sir,

Sub: SNVPMV – Utilization Certificate for the Research Grant of
Rs.3,78,280/- Sanctioned for the conduct of Research Project on
“ Multiphysics Modelling of Drug Product Manufacturing
Processes” – Reg.

Ref: Your Letter dated:01.12.2022.

* * * * *

With reference to the letter cited above, we thank you for Research Grant to
conduct the research Project titled “Multiphysics Modelling of Drug Product
Manufacturing Processes “, symposium and relevant activities.

We are herewith enclosing the Research Project report along with Utilization
Certificate for the grant received.

Thanking you,

Yours Sincerely,


(Sri. V. Sainath Dayaker Shastri)

Hon.Secretary.



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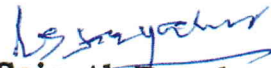
Date: 22.02.2023

UTILIZATION CERTIFICATE

This is to confirm that an amount of Rs.3,78,280/- (Rupees Three Lakhs Seventy Eight Thousand Two Hundred and Eighty Only) was received from M/s. Altair Engineering India Pvt Ltd, Bangalore as research grant for undertaking an academic research project titled "**Multiphysics Modelling of Drug Product Manufacturing Processes**", symposium and relevant activities.

The said grant was utilized for the said purpose and the detailed Statement of Utilization is enclosed along with Project Report duly signed by the Head of the Institution.

The above grant is fully utilized for the research activities of Sarojini Naidu Vanita Pharmacy Maha Vidyalaya, Tarnaka during the Academic year 2022-23.


(Sri V. Sainath Dayaker Shastri)

HON. SECRETARY

Project Report on Multiphysics Modelling of Drug Product Manufacturing Processes

Introduction

Multiphysics modelling is a powerful tool that integrates various scientific disciplines to simulate complex physical phenomena. In the pharmaceutical industry, multiphysics modelling can be applied to various aspects of drug product manufacturing processes, including:

- **Mixing:** Simulating the mixing of different components in a drug product to ensure uniformity and consistency.
- **Heat transfer:** Modelling the heat transfer during various stages of the manufacturing process, such as drying and sterilization, to ensure product quality and stability.
- **Fluid flow:** Simulating the flow of fluids during different stages of the process, such as pumping and filling, to optimize process efficiency and minimize waste.

This project was aimed to investigate the application of multiphysics modelling in drug product manufacturing processes. The specific objectives of the project were to:

- **Review the existing literature on multiphysics modelling in drug product manufacturing.**
- **Develop a multiphysics model of a specific drug product manufacturing process.**
- **Validate the model using experimental data.**
- **Analyze the results of the model to identify potential areas for improvement in the manufacturing process.**
- **Conclave with pharma industry for exploring possible solutions to the industry problems.**

Methodology

Literature Review:

A comprehensive review of the existing literature on multiphysics modelling in drug product manufacturing was conducted. This included searching scientific databases and journals for relevant articles, books, and conference proceedings.

Model Development:

A multiphysics model of a specific drug product manufacturing process was developed using a commercial software package (EDEM, Autodesk CFD softwares) and few open-

source platforms (COMSOL, OpenCFS etc). The model geometry, material properties, and process conditions were defined based on the specific process being studied.

Model Validation:

The model was validated by comparing its predictions with experimental data obtained from the literature or from laboratory experiments conducted as part of the project. The validation process involved evaluating the model's ability to accurately predict key process parameters, such as temperature, pressure, and concentration profiles.

Results and Discussion:

The results of the model simulations were analyzed to identify potential areas for improvement in the manufacturing process. This could involve optimizing process parameters, such as mixing time, temperature, or flow rate, to improve product quality, yield, or process efficiency. The crucial part of the said project is the deliberations of the project outcome which took place with professionals of different hierarchy from the pharmaceutical companies and Contract Manufacturing Organizations (CMO's) across the state of Telangana.

Conclusion

This project demonstrated the potential of multiphysics modelling for improving drug product manufacturing processes. The developed model can be used to optimize process parameters, troubleshoot problems, and design new and improved manufacturing processes. The conclave with professionals from the industry has evolved various research problems/challenges of pharmaceutical industry and CMO's for which possible solutions were offered based on the software simulations of pharmaceutical manufacturing processes.

Future Work

Further research is needed to explore the full potential of multiphysics modelling in drug product manufacturing. This could involve:

- Developing more complex models that incorporate additional physical phenomena, such as chemical reactions and biological processes.
- Using multiphysics modelling to design and optimize new drug delivery systems.
- Integrating multiphysics models with other tools, such as process control systems, to improve the real-time monitoring and control of manufacturing processes.