



Universiti  
Malaysia  
PAHANG

## Researchers Develop More Efficient Oleochemical Fractionation with AspenTech® Performance Engineering

“The use of process simulations is imperative to close the gap between concept and actual applications, minimizing setbacks during the early stages of development and accelerating industrial scale applications.”

– Dr. Ing. Mohamad Rizza bin Othman,  
Associate Professor, Universiti Malaysia Pahang

## AspenTech Performance Engineering

### Reduced CAPEX Requirements

- Column design \_\_\_\_\_ **3.1%**
- Reboiler design \_\_\_\_\_ **7.3%**
- Condenser design \_\_\_\_\_ **16.8%**

### Reduced Energy Requirements

- Cooling duty by **16.9%**
- Heating duty by **10.2%**

## CHALLENGE

UMP was researching oleochemical fractionation to see how to make the process more efficient and more sustainable, reducing process carbon footprint.

## SOLUTION

- Aspen Plus® to model the process to predict key oil properties and perform sensitivity analysis
- Activated Economics™ and Activated Energy Analysis™ to optimize the design and evaluate energy use and emissions
- Aspen Exchanger Design & Rating™ (EDR) to improve the design and reduce the cost of heat transfer equipment
- Aspen Plus Dynamics™ to design the control strategy for the pilot plant

## VALUE CREATED

Researchers found that technical, economic, and environmental analyses performed by AspenTech Performance Engineering:

- Reduced CO<sub>2</sub> process emissions by 10%
- Reduced equipment CAPEX requirements by making them more efficient (details above)
- Reduced OPEX cost by lowering energy requirements (details above)

In addition, designing and configuring the control loops ensured stable operations of the pilot plant.

# Overview

Universiti Malaysia Pahang (UMP), located in Gambang, Malaysia, was established as a technical university in 2002. Today, it is ranked as one of the best in research and innovation within the classifications of Malaysia Technical University Network (MTUN) and Non-Research University (Non-RU). In the field of research, UMP collaborates with local and international industries to focus on industry-related applications. Such research collaboration enriches the teaching and learning modules at the university, while promoting commercialization of research output and products.

With process economics and environmental challenges limiting successful commercialization of bio-based processes, chemical companies are looking at alternatives such as process intensification (a fairly new concept in oleochemicals, with limited operational experience) to make operations more profitable and minimize environmental impacts. Researchers at UMP have been studying AspenTech solutions for over 15 years and are well aware of AspenTech Performance Engineering's ability to design and scale up new processes. Most recently, in the interest of accelerating the adoption and commercialization of novel bio-based technologies, UMP researchers looked at the ability of AspenTech Performance Engineering to improve design and increase efficiency of a pilot plant for oleochemical as well as biochemical fractionation.





## Optimizing Across Design and Operations

To improve fractionation efficiency of biobased feedstocks, the UMP researchers designed a new divided wall column (DWC) as the core of the process. AspenTech Performance Engineering suite was used to create this innovative design. AspenTech models were also used to support the design and construction of a pilot plant to scale-up this process. Dynamic modeling helped to select control loop pairing and flowsheet optimization identified the main contributing parameters. Aspen Plus was used by researchers to predict key oil properties and to perform a sensitivity analysis for the pilot fractionation column which was later built and tested. Integrating economic and energy analyses enabled researchers to immediately evaluate the economic impacts of process design decisions.

Leveraging Performance Engineering, the researchers were able to lower CAPEX and OPEX, better evaluate energy use and manage emissions more effectively. Aspen Activated Exchanger Design & Rating (EDR) was used by researchers to improve the design of the heat transfer equipment and further reduce capital costs, while Aspen Plus Dynamics enabled researchers to study process performance and design the control strategy for the pilot plant.

## Reducing CAPEX, OPEX and Energy Requirements

Researchers discovered that their CAPEX requirements had lowered considerably after conducting technical, economic and environmental analyses with Performance Engineering. Column cost requirements were reduced by 3.1%, while optimal reboiler and condenser designs reduced equipment costs by 7.3% and 16.8% respectively.

Performance Engineering also resulted in lower energy requirements for the fractionation process: cooling duty was reduced by 16.9%, heating duty reduced by 10.2% and CO<sub>2</sub> emissions was reduced by 10%. The design and configuration of the control loops also helped ensure the pilot plant's operability.



## Extending the Research, Applying the Models, Scaling the Process

For UMP and other organizations, AspenTech Performance Engineering pushes the boundaries of what is possible. It enables teams to take a fully integrated, big picture approach for greater collaboration and efficiency. Examples of possible outcomes are reduced CAPEX and OPEX, greater safety, reduced emissions, higher profits, and more.

While UMP is primarily focused on research, it will also be able to use the models in its operations. Researchers determined that liquid split ratio and reboiler duty were the key variables impacting product purity, leading to more efficient process optimization. The dynamic model could also be extended to provide setpoints for the advanced process control system or to train operators via operator training systems once the process is at full-scale. Integrating Performance Engineering helped

researchers address design and knowledge gaps in the process. As a result of the research, the process can now be scaled up for widespread commercial use. Through mutual collaboration, AspenTech and UMP are looking to develop opportunities in academia, research, industry and the community in Southeast Asia.



### **About Aspen Technology**

Aspen Technology, Inc. (NASDAQ: AZPN) is a global software leader helping industries at the forefront of the world's dual challenge meet the increasing demand for resources from a rapidly growing population in a profitable and sustainable manner. AspenTech solutions address complex environments where it is critical to optimize the asset design, operation and maintenance lifecycle. Through our unique combination of deep domain expertise and innovation, customers in capital-intensive industries can run their assets safer, greener, longer and faster to improve their operational excellence.

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