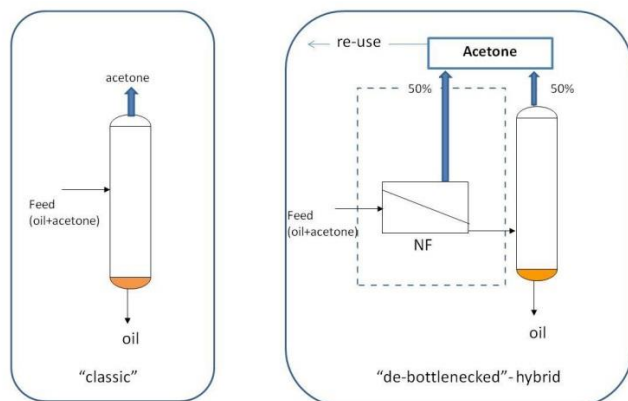


## EEMBAR: Raising the bar in sustainable process technology in the food industry

One of the projects supported by TKI Energy & Industry that is currently in full swing focuses on innovative ways to recover acetone from edible oils using membranes. A pilot is currently taking place at IOI Loders Croklaan, which specializes in oils and fats for the food industry. The company uses acetone to purify shea oil, a substance that is similar to cacao butter. Traditionally, the acetone is subsequently recovered using distillation, a highly energy-intensive process. The new technology could reduce CO<sub>2</sub> emissions by up to 650 tons per year, similar to the energy consumption of some 100 households.

### Hybrid technology

EEMBAR stands for Energy Efficient Membrane Based Acetone Recovery. In fact, it involves a hybrid technology, in which a membrane is added to the traditional distillation process. Lab tests have shown that the membrane, which is basically a sophisticated sieve, can filter out some 50% of the acetone before the oil enters the distillation stage. This "simple" addition to the process makes a huge difference in terms of energy consumption.



### Not as simple as it sounds

Of course, the new technology is anything but simple. 'Some four years ago, we were already considering the possibility of using membrane technology,' says Erik Schweitzer, Group Manager Process Engineering at IOI Loders Croklaan. "We take our corporate social responsibility very seriously, and we were actively looking for a more sustainable way of recovering acetone from our oils. However, at the time, the

research was still in its infancy. Making this promising technology actually viable in the factory would require much more investment and development. The fact that we're now part of the EEMBAR consortium has given our efforts a great boost. We wouldn't have been able to manage this on our own, both financially and in terms of manpower. ISPT's coordinating role has given us access to inspiring and innovative partners. SolSep and Vito are both fantastic membrane specialists. The students from Rotterdam University of Applied Sciences also add great value, as they put in most of the man hours in the factory. Together, we're all working towards a common goal: to reduce the ecological footprint of our factory."

### Ceramic versus polymer

In the pilot, which is still underway, two types of membranes are being tested simultaneously: a polymer version, made by SolSep, and a ceramic version, made by Vito. "Not long ago, the idea of using a polymer membrane to remove a solvent such as



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acetone was unheard of," says Petrus Cuperus of SolSep. "As their name suggests, solvents tend to dissolve things, and that includes most polymers. Our membrane is made of a special kind of polymer, which can resist the solvents' aggressive properties. Two major advantages of polymer over the more traditional ceramic membrane are that it is cheaper to produce and the membrane can be made larger. This makes it particularly suitable for high-volume applications, such as the acetone recovery process in Lodders Croklaan's factory."

### **Testing expertise**

Vito's modified ceramic membrane is also still in the running as a suitable candidate for the eventual technology to be adopted by IOI Lodders Croklaan. But Vito's contribution to the project goes much further. "We specialise in pilot setups, and have a lot of membrane testing and application expertise, especially for separations in organic solvent environments," says Pieter Vandezande, researcher at Vito. "We also test SolSep's solvent-resistant polymer membranes for other applications at other companies. Their technology is pretty unique, which also makes testing their membranes quite a complex undertaking. Things we focus on include durability and the extent to which the membrane suffers from fouling. If the 'sieve' clogs up, it won't work properly any more. So it's one thing to build a properly functioning membrane, but quite another to make sure it keeps working for a long time."

### **Link with education**

The involvement of Rotterdam University of Applied Sciences and its HBO students also adds unique value to the project as a whole. "At our university, we aim to provide our students with the best possible knowledge and skills for a successful career," says Marit van Lieshout, Research Lead for Process Optimisation & Intensification at the University. "That's why we want to be at the forefront of new technological developments. This particular research project requires close collaboration between our own Knowledge Centre, the Chemical Technology educational programme and the ISPT consortium. We believe it's important that our students learn that they shouldn't take things for granted, but keep looking for ways to improve processes. The innovative membrane technology that students get to work with here is ideal for developing this mindset."

### **Turning the knobs**

In total, four students are involved in the project. "Their main task is to operate the test units and register the results," explains Urjan Jacobs, Lecturer of Biochemical Engineering at Rotterdam Mainport University of Applied Sciences. "They measure how well the membranes function given certain settings. There are basically three variables you can influence in this process: flow rate, temperature and pressure. Simply speaking, it's a question of turning the knobs until you've found the best combination. By taking part in projects like this, students not only learn about innovative process technology, but also how to deal with all kinds of practical aspects, such as safety in the workplace. They're working with acetone, which is highly inflammable and toxic. There's no better way than learning in practice. Of course, they're closely supervised, both by IOI Lodders Croklaan and by the University, and they receive all the support they need. It's great to see how these young people develop in the course of a project. IOI Lodders Croklaan is already sad to see the first student leave after his graduation in February."



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### **Making the world a better place**

What this project clearly shows is that more sustainable process technology can contribute significantly to making the world a better place. It is also this belief that drives project coordinator ISPT to accelerate innovation and ultimately transform process technology into a green, clean and efficient endeavour, by uniting industry, universities, research organizations and SMEs.

“It’s a win-win-win situation all around,” concludes Erik Schweitzer. “We’re confident that membrane technology will eventually make our acetone recovery process much more sustainable, and also cheaper. Everyone wins. We save money and energy, graduates have a bright future ahead of them and can share their skills with others, the University can use the knowledge gained in its educational programme, the membrane manufacturers SolSep and Vito will have better products to sell, and the ultimate beneficiary is, of course, our planet – and generations to come.”

### **About TKI Energy and Industry**

*As a large user of energy, the industry plays a multiple role in the transition towards the use of renewable energy. This requires an increase in the efficiency of energy consumption in this sector. The energy used will have to transition from fossil to sustainably generated energy. The latter often translates to the transition from heat-driven processes to electrically driven processes. Also the more efficient use of resources leads to (secondary) energy efficiency.*

*TKI Energy & Industry is the collaboration between industry, universities and knowledge institutes that aims to accelerate the process of energy reduction in industry and make the process more efficient.*