

# Innovative emulsifying

The Innovation Award of chemicals federation Essenscia was granted to Emulco in 2012 for their technology to turn solid Polyisobutenes (PIB) into a milky liquid emulsion. This technology was acclaimed as a highly valuable innovation as it considerably expands the application of PIB. According to Founder and CEO Jean Vanhoebost, a lot has happened since this recognition.



All photos courtesy of Emulco, unless stated otherwise.

EMULCO (CENTRE LEFT) IS LOCATED ON THE SEA TANK TERMINAL PREMISES IN GHENT.

“The story of Emulco (short for The Emulsion Company) dates back to 1997,” Mr Vanhoebost tells, “when we founded our company in Malaysia. Throughout the years we became the market leader in the Asia-Pacific region for paraffin wax-based emulsions. This type of emulsion is often used in the rubber and wood industry.” In 2004, it was decided to establish a laboratory in Ghent. “The aim of our Ghent laboratory was to provide the technical and scientific support for core business emulsions, as well as a search for new types of emulsions. This turned into a long quest of structured and unstructured research that at a certain moment found its way to PIB polymers, an important product produced by, among others, BASF”, Mr Vanhoebost explains. “This PIB is a widely-used polymer, as it has the features of being UV stable, water, gas, and airtight, and it has an extraordinary cold flow behaviour as it only congeals at  $-60^{\circ}\text{C}$ ! Anything above this temperature makes the molecule self-healing if carved or scratched. It is a crystal-clear molecule that remains unchanged for decades. The product is also food-proof. It is, for instance, a common ingredient of chewing gum and lipstick. However, one of the disadvantages of PIB is that it is extremely viscous when molecular weight increases (similar to rubber), which makes it hard to dose and very difficult to apply. With my emulsion background, I have always been attracted by emulsion challenges and I was much triggered by BASF telling me that emulsifying PIB would be quite impossible.”

### High potential

After months of research, trying, and testing, Emulco countered the statement as it succeeded in finding the right solution. “The challenge was basically to overcome the PIB’s extreme viscosity and sticky behaviour to make a water-immiscible product water-miscible”, comments Mr Vanhoebost. “An emulsion consists of a water-immiscible substance, water, and a stabiliser system. When you shake these, they will barely mix and will after a while separate once again if no mechanical/physical process is added to keep the emulsion stable for longer periods. You can see this happen in vinaigrettes. For keeping the substances properly mixed, an emulsifier is needed and the challenge for this project

A FULL-SCALE RESEARCH, TESTING AND PRODUCTION FACILITY ON AN 8,000M<sup>2</sup> TERRAIN, ENABLES THE COMPANY TO PRODUCE THOUSANDS OF TONNES PER YEAR.



Photo courtesy of North Sea Port.



was to find the proper one, in combination with the suitable process technology. Once we managed to do so, Emulco patented the formulations and production process and built a pilot plant to move onwards in an effort to find new markets.” This pilot plant was important to be able to upscale the production volumes from a laboratory phase to larger quantities. Emulco entered the next phase of this upscaling in 2015 by opening a full-scale production facility on an 8,000m<sup>2</sup> terrain on which the company can produce thousands of tonnes per year. The factory is located on the Sea Tank Terminal premises in Ghent. Unfortunately, the original plans to develop the market did not work out as scheduled and Emulco was constricted to move around freely while sales were rendered impossible. “It is obvious that our programme went in dire straits”, voices Mr Vanhoebost. “Nevertheless, we persevered and to make a long story short, by the end of 2019 Emulco was able to resolve all legal issues to regain control of its technology and marketing possibilities.”

### Lab to pilot to production

With the new PIB emulsion, Emulco has opened a new market for PIB. “PIB has traditionally been used for more than 75 years now for, among other things, sealing double glazing, roofings, cosmetics, construction compounds, and a lot of adhesive applications”, Mr Vanhoebost explains. “With our new PIB emulsion, many more applications are possible, ranging from cosmetics, adhesives, sealants, and construction compounds to crack repairing paint. It can even be applied as a barrier for nuclear radiation or Radon gas. In fact, our biggest challenge now is to market our product, as most companies are unaware of the tremendous possibilities that this emulsion has to offer.” The unique PIB emulsion has undoubtedly put Emulco in the spotlights, yet this does not mean that it is the company’s only activity. “Emulco is today built on three pillars”, Mr Vanhoebost elaborates. “We provide lab to pilot to production all in one location, making us flexible enough to respond to specific needs and requirements, whilst being able to manufacture orders ranging from kilos to tonnes. There are three 15m<sup>3</sup> stainless steel reactors and one 10m<sup>3</sup> heavy duty reactor available. Our laboratory is used for own research, but we also conduct R&D projects for other companies.” A relatively new



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R&D activity is for the vegetable oil & wax industry. Companies like Cargill produce vegetable-based oils and waxes and are aiming at finding sustainable alternatives for mineral oil-based products. “Our focus here lies on the development of vegetable emulsions. These vegetable emulsions, often based on palm, soy, coconut, and rapeseed, have ample potential”, says Mr Vanhoebost. “A vegetable emulsion is food-proof, which means that it can be used for applications in the entire food industry such as for the production of food contact paper,



hereby replacing its plastic siblings responsible for the infamous plastic soup in our oceans.” Second pillar of the company is the pilot plant. Just like the laboratory, our pilot plant is available for our own use, but also for other parties,” states Mr Vanhoebost. “We help companies with upscaling testing new products, as ample products that proved to be working on a laboratory scale require further testing in higher volumes.” Emulco’s final pillar is the production facility in which own and third-party emulsions are produced.

### Blending without a blender

Research and technology will always be the core of the company’s business, Mr Vanhoebost admits. “In our research we often work together with universities such as KU Leuven and recently with ETH in Zurich, which is often referred to as the ‘MIT of Europe’. Together we have been investigating the possibility of producing emulsions by means of static mixing. Emulco acquired the intellectual property rights from ETH and subsequently filed for new patents in that field, but I cannot talk too much about this for now. Simply said, we have managed to find a way to emulsify a lot of different products, even high molecular materials, without using classic mechanical equipment (aimed at using brute forces on the molecules in an effort to force them together). Here, emulsions are made with a device that has no moving parts except for the pumps upstream feeding the device. It is like blending without a blender, one could say. Producing without moving parts is very interesting when looking at saving energy. Moreover, as all our tests with the new process have been successfully conducted at room temperature and just like the PIB emulsion, this invention also has plenty offer for the industry, and for Emulco, too. “This invention is a next step for our company, as apart from the three pillars research, pilot plant, and production facility for emulsions, we have now also turned into a emulsification equipment developer,” adds Mr Vanhoebost. “As a next step in this project, we are now seeking parties interested in using this innovative type of emulsifying. I know that a lot of products in the food industry are made by means of classic emulsification technology. Wouldn’t it be great to just add eggs on one side of the device and vinegar and oil on the other side and just wait for the mayonnaise to come out with a huge energy saving and a continuous process on top of it? As long as you keep the infeed of raw materials properly set, mayonnaise will keep flowing out. Same for cosmetics, sunscreens, dairy products, and the likes”, says Mr Vanhoebost enthusiastically.

### A rough ride

Since the start of the PIB emulsion project, it has been a rough ride for Emulco, but things are improving step by step with rising production volumes. “Indeed,” Mr Vanhoebost admits, “the past years can be characterised as a lot of research and development with only small production and sales volumes, but now things are gradually improving with new customers and new markets. To enable this, we also issue licences to produce some specific emulsions to companies all over of the world. We are simply too small to be everywhere. Nevertheless, the more companies that buy our products and concepts, the better. Making use of licensees enables us to fully use the potential of our research efforts and become a background world player.”



JEAN VANHOEBOST, FOUNDER AND CEO OF EMULCO AT THE COMPANY'S LABORATORY.

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