



DOSSIER: THE CHEMICAL SECTOR AT A CROSSROADS

“Sustainable chemistry: It's now or never”

Sustainable development, green economy: these are keywords in the new Flemish Coalition Agreement, Flanders in Action and Pact 2020. The chemical sector is contributing by doing all it can to make the transition to sustainable chemistry. A sustainable chemical industry demands a change in thinking, but also requires the development of new and improved technologies. To realise the required breakthroughs, VITO and essencia (the sector organisation for the chemical industry and life sciences) are pushing for collaboration that transcends the walls of companies and research centres.

Toward a sustainable chemical industry

With annual turnover of 55 billion euro and employment for 94 000, the chemical sector and biotechnology play a prominent role in the economy of Flanders. This importance can continue to grow in the future: The sector after all has great potential to counter the social problems of today and tomorrow. In other words, chemistry can make a significant contribution in the transition to a sustainable society. At the same time, the chemical sector is faced with huge challenges: the shortage of raw materials, rising costs, globalisation of the economy, the societal demand for a sustainable economy, the ever-growing expectations of the consumer... To strengthen its leadership position in this changing context, the chemical sector is required to embrace radical innovations. These are needed to anchor cleaner and more efficient technologies, and thus to keep pace with the trend toward sustainable development, an absolute precondition for a chemical sector with a future.

A new research programme

The transition to sustainable chemistry must be supported by adapted scientific research. “As a prominent research centre, VITO intends to fine-tune its activities to the developments in the chemical sector. The chemical sector is resolutely placing its bets on sustainable chemistry, and is actively searching for innovative and sustainable process techniques. Therefore, a form of transition is also needed in our research into chemical processes, a domain in which VITO has been accumulating expertise for years. The new sustainable chemistry research programme is intended to scientifically facilitate the chemical sector in flux”, explains **Rik Ampe**, director of Industrial Innovation at VITO. “Focusing research on sustainable chemistry is also in line with our responsibility to society. Making chemical processes sustainable is a precondition for the sustainable development of our society. Consequently, a programme targeting sustainable chemistry is a logical step in light of the task that VITO performs for the Flemish government.”

Setting milestones

“The transition to a sustainable chemical industry is a process that will take years. Hence, VITO’s research programme looks sufficiently into the future: what innovations will be needed to sustainably anchor the chemical sector in Flanders for the long-term, what technologies are promising in the long-term? This is the strategic, visionary component of our research programme. However, we also need milestones now: concrete steps to be taken that make use of innovations that are already in the pipeline today.” To understand the paths it should follow in its research into sustainable chemistry, VITO listened carefully to the sector. A survey in the framework of the FISCH project (see below) exposed three major research needs that correspond to the huge challenges faced in developing a green chemical sector:

- 1) raw materials based on biomass as alternative to fossil raw materials;
- 2) process intensification or the evolution to more intensive processes;
- 3) sustainable chemical products.

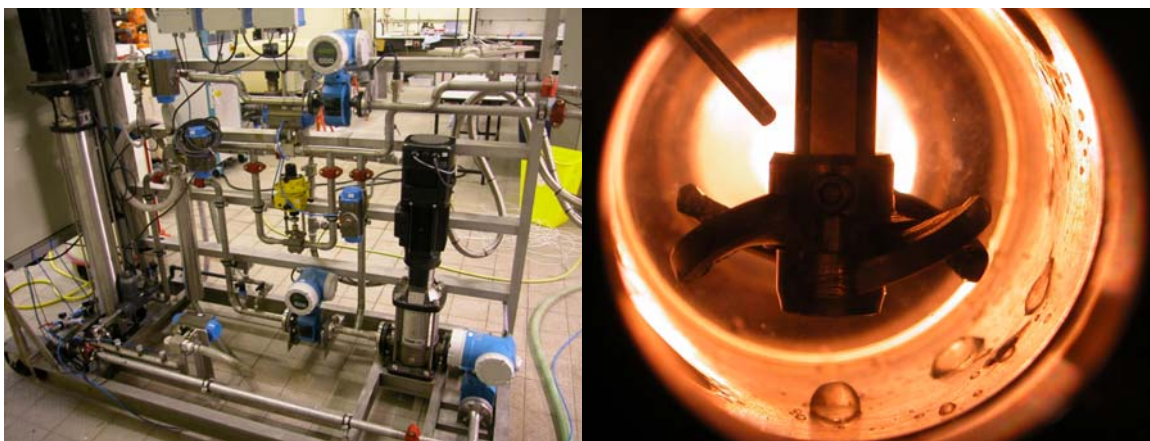


“It is no accident that the first two constitute the spearheads of our research programme around sustainable chemistry: they after all are two domains in which VITO has accumulated considerable experience in recent years. In order to concretely tackle innovation, we have selected a number of breakthrough technologies in both domains. These technologies are intended to bring about a breakthrough in the chemical sector in the short to medium term – within one to six years.”

In situ product recovery

In the area of process intensification, for example, much is expected of membrane technology, an area of research in which VITO has long built up a reputation and made considerable investments. **Ludo Diels**, research manager of Sustainable Chemistry at VITO: “Membranes are already intensively used in the production of drinking and process water, and in water treatment plants. But they are also gradually finding application in chemical processes that often take place in organic solvents. The development of solvent resistant membranes makes solvent recuperation possible. Membranes with specific functionalities and affinities are capable of extremely efficient separation processes. Pervaporation membranes make possible the separation of solvents from water and vice versa, and offer a sustainable alternative to energy-intensive distillation. These developments in process intensification also allow linking reaction and separation to each other in a single reactor; hence, we also speak of *in situ product recovery*. An example of this is the integration of fermentation and pervaporation to remove alcohols.”

“VITO is also developing advanced technologies to convert biomass into raw materials for the chemical industry. One of the promising directions is the production of biomass using CO₂ as raw material: numerous algae and microorganisms are able to convert CO₂ into a biomass containing valuable substances. Thus, algae are a new and interesting raw material that can be used as a basis for chemicals and high-grade products. Another promising technology for the chemical sector is the application of microbial electrochemistry in the production of electricity, hydrogen gas or other chemicals”, says **Ludo Diels**.



Knowledge centre being planned

Sustainable chemistry is also being pursued at other research centres and universities in Flanders. And companies themselves are also investing in R&D in this area. This, however, is not enough, believes **Frans Dieryck**, Managing Director of *essenscia*, the sector organisation for the chemical industry and life sciences: “Many companies in our sectors have already incorporated sustainable development into their business vision. These companies are also often engaged in reorienting their research strategy to sustainable chemistry. However, to also position Flanders as a top region internationally in the area of chemistry, we need an open innovation platform. An umbrella knowledge centre dedicated to sustainable chemistry that transcends the frontiers of chemical sectors, research centres and universities. There are examples of such knowledge centres in other sectors: think of the world-leading independent research center in nanoelectronics and nanotechnology IMEC and the Flanders Institute for Biotechnology (VIB).” To bring clarity to the economic and technical feasibility of a centre for sustainable chemistry, in the past year, *essenscia* – in collaboration with VITO – conducted the feasibility study FISCH (Flanders strategic Initiative for Sustainable CHEmistry). “The goal of this study was to engage in fundamental discussion with all parties concerned about the needs and preconditions in the area of knowledge, innovation and research, in order to prepare the chemical industry for the coming fifty years”, explains **Frans Dieryck**. “Dozens of companies, research centres and universities contributed to the study. FISCH has three strategic pillars: to draw up a strategic research agenda, bring about an open research structure and establish a knowledge centre for sustainable chemistry. The first objective is a business plan for the knowledge centre, which we will soon propose.”

Sharing knowledge is crucial

VITO and *essenscia* agree that an open playing field is needed to give sustainable chemistry a real chance. “Collaboration is needed between the sectors and companies, as well as across universities and research centres”, believes **Rik Ampe**. “The aim must be to give momentum to sustainable chemistry in Flanders such that a critical mass in the direction of change is achieved.” “The power of FISCH lies precisely in networking and collaboration”, confirms **Frans Dieryck**. “The challenge consists in finding what it is that binds the partners. And despite the different positions and interests of companies, to still take steps together in these areas of common interest. Sustainable chemistry only has a chance in Flanders if companies and research organisations share knowledge and put aside their defensive attitude.” Both VITO and *essenscia* are committed to placing sustainable chemistry on the agenda of the political, business and research world, thus ensuring the required dynamism. Hence, it appears certain that there will be a follow-up to FISCH.