OSDD Slovenia from the Dutch viewpoint

External experts Willlemien Veele and Cláudia Sousa

Willemien Veele, Senior Researcher Circular Design at the Research Group of Circular Plastics within the NHL Stenden University of Applied Sciences, located in Leeuwarden and Emmen. Within the Research Group we have tree main research lines which are new (bio) polymers, recycling technologies (mechanically and chemically) and circular design (integral and systemic design approach to circular plastics). I'm currently developing the research program for circular design the research group and working on the Wad gaat Om program which is an interdisciplinary approach to prevent and reduce plastic waste and pollution in the UNESCO World Heritage site of the Waddensea area.

Visiting this OSDD of the PLASTIX project in the Velenje region of Slovenia was very valuable. You really step out of your own bubble and see how the same circular plastic issues and bottlenecks are being worked on from other areas and regions. This provides further inspiration and confirmation that we are working on the right topics. The visit was a confirmation for me that NHL Stenden's Circular Plastics and Water Technology departments are working on the right research topics. The specialized knowledge available within one university of applied sciences is also unique. Certainly, also the Circular Design aspect and the integral approach to the issues. Furthermore, it is inspiring to see how other regions have set up and developed their ecosystems. It was confirmed that the overview we have within the Northern Dutch Ecosystem for Circular Plastics of stakeholders involved is also unique and was also desired from other regions including Slovenia and Sweden.

I gained very valuable contacts. Among others, with the Faculty of Polymer Technology in Slovenia. A follow-up meeting is definitely being planned with them, because there is a need for knowledge exchange in the same fields and expertise (polymer chemical, recycling technologies and new biopolymers). We will explore where we can complement and strengthen each other. In addition, with the other stakeholders brought along, including

Tampere University of Applied Sciences from Finland, where they are definitely interested in researching recycling technologies chemical and mechanical for both thermoplastics and thermosets. The Spanish, Slovenian and Italian regions have interesting manufacturing industries for household electronics, among others, which incorporate a lot of plastics and where they are looking to reduce microplastics in washing machines, among others. But also, to the deployment of circular business models and use of recycled raw materials. The Paper Province in Sweden is keen to seek cooperation around biopolymers (PHAs) in which we are also active.

We visited two production sites that were very large in terms of contrast. Not only in terms of content but also in terms of modernity and quality. The visit to the VEPLAS Group, a producer of thermoset composite products for use in aircraft, helicopters, campers and (medical) bathtubs, showed the daily reality of a company that is not yet challenged by its customers (and regulations) to innovate and become more sustainable, or to think about circularity. Recycling and introduction of biocomposites was experienced as difficult (which it is) based on a number of EU projects (MIMOSA and DEREMCO). It seemed as if the management lacked the drive to really work on sustainability/circularity. This was also visible in the way they worked and showed us around (lack of personal protective equipment).

The visit to Skaza, an injection moulding company of furniture for IKEA, among others, and an in-house production line of bokashi and home composting bins, was totally the opposite. IKEA as a customer has been a real driver for them to start innovating. This has inspired the company to now develop independent products (including bokashi bins) from recycled materials. The production site itself is hyper modern and uses various automatic and robot-controlled machines. They recycle their own waste streams back into the products. Even for the last 1.5% of waste that is difficult to recycle, they have researched how to reuse it. They expect to start this process of printing with the material in two months. The company is also one of the investors in the Faculty of Polymer Engineering (FTPO). They have some experience with biobased materials, but are still exploring what they can do and would like to explore more possibilities in cooperation with the FTPO. In terms of education, they see an increasing need for personnel with electronic engineering and programming skills linked to the automation of their processes.

A multi-day visit that included other activities, such as a beautiful dinner at 175m depth in an old coal mine or a hike to a waterfall, allows you to make contacts in a relaxed manner. There was plenty of room in the program to get to know each other better, formally and informally, and to network. A visit I will not soon forget, also thanks to the good organization from the Slovenian partners, the Province of Fryslân and the other partners of the PLASTIX project.

Cláudia Sousa, Project Manager Water technology at the Research group Water Technology within the NHL Stenden University of Applied Sciences, located in Leeuwarden. Water is a primary necessity of life. Without water, life would be impossible. How do we make sure that we do not unnecessarily waste water? And how can we employ advanced techniques to give the growing world population access to good quality water? The NHL Stenden Water Technology research group aims to find answers to these questions by using scientific and education activities in the area of physical-chemical processes. More specifically, the group has large experience with particle production and characterization using techniques as electrohydrodynamic atomization (EHDA), flow filed fractionation (FFF), laser obscuration, high speed imaging and imaging analysis. Furthermore, nano and microplastics production and characterization, oxidation processes, aeration and other physical-chemical techniques are among the group's expertise. Additionally, the link "water and plastics" and topics covering water treatment and recirculation in plastics recycling processes is among our main interests, due to the close cooperation with the NHL Stenden Circular Plastics research group. Internationally the group has a strong network in Brazil and has been closely working with Brazilian utilities, technology providers and public organizations from that country. The NHL Stenden Water Technology research group is also an active member of the Water Campus Leeuwarden, and, therefore, it cooperates with organizations like Wetsus, Center of Expertise Water Technology (CEW), the Water Application Centre and with Van Hall Larenstein University of Applied Sciences.

The visit to the OSDD of the PLASTIX project in Slovenia's Velenje region proved to be an enriching experience. Making clear the shared challenges and innovations surrounding the plastics problematics and the initiatives in diverse regions. But also creating opportunities for collaborations and bridging the demand and supply between different organizations.

I gained very valuable contacts. Among others, with the Faculty of Environmental Protection in Slovenia. We intend to have a follow-up meeting, because there is a need for knowledge exchange in the same fields and expertise (detection and quantification of micro and nanoplastics, sampling protocols standardization, etc.). We will explore where we can complement and strengthen each other. The Spanish and Italian stakeholders are very interested in the techniques and methodologies applied by our research group. Understanding the recycling water cycle and close the water balance in this problematics looks to be a demand where joining forces would be an added value.

During the OSSD, site visits to production sites were planned. We have visited VEPLAS Group and Skaza. It was interesting to see the processes the 2 companies were using but also the different impact that a sustainable and green organizational culture (and way of thinking) has on the overall way of working. Innovation and sustainable thinking impacts the choice of raw materials, recyclability, health and working conditions of

employees. Important to mention that the reality of the day by day working policies is challenged everyday by the market demand, where the cost/price is still one of the main drivers for the success of the companies. During these days a well-organized agenda, gave us the opportunity to get acquainted with the area. We have visited a coal mine, had lunch at the Farm Bukovje (and get to know the challenges and the impact from the floods that happened had on a family business), a hike to RINKA WATERFALL. These activities promoted the interaction between the stakeholders on a more relaxed way and increased the networking opportunities and exchange. From water technology (and me in particular) we want to thank the opportunity to the partners from Plastix project and the province of Friesland.