For several months now, two containers have been on the playground of the school Leiepoort Deinze: one with toilets and one with a technical installation. The containers contain an innovative system from HYDROHM that ensures that urine is processed into disinfectant flushwater and into fertilizers for agriculture. The technology was developed in collaboration with the European Space Agency (ESA), where such techniques are extremely important given the limited amount of water in a space station.

In November, Korneel Rabaey, professor and employee of HYDROHM, gave several lectures for our students. He always started from the water problem: bringing five liters of water to space costs as much as a sports car. The professor explained both the social and the technical aspects of the 'astronaut toilet' and how urine is reused. The professor also likes to inform the parents via the HZ.

It will not surprise you: going to space is not easy. A rocket reaches an altitude of one hundred kilometers after about two and a half minutes and after a good eight minutes the altitude at which the International Space Station (ISS) orbits the earth. The ISS should orbit the Earth at around 28,000 kilometres per hour. This costs a lot of energy and, of course, money. Until recently, it cost around EUR 10 000 per kilogram to bring a load to the station. Meanwhile, due to the rise of SpaceX and others, this amount is rapidly declining, but it remains extremely expensive to keep a handful of astronauts alive on the ISS.

An important raw material is water. An astronaut consumes about 20 liters per day. That is why water is recovered in the ISS as much as possible. The urine, for example, is chemically treated and evaporated, after which the condensate again serves as drinking water. This may sound a bit dirty, but in itself it is perfect drinking water.

ISS is only flying about 450 kilometers above us. Soon we will go to the moon, which is a few 100 000 kilometers away. After that, we want to reach Mars – that's about 60 million kilometers away and requires a mission of at least 650 days. We will therefore have to use our raw materials very efficiently. That is why the European Space Agency (ESA) has for 30

years been developing systems to reuse water, carbon, oxygen and the like in space in an energy- and resource-efficient way.

Ghent University has been involved from the very beginning of this development and in the context of a PhD (by Dr Jolien De Paepe) a new technology was created to make toilets safer and more efficient. In the so-called URIDIS process, a source-separating toilet is used, in which urine is collected separately from the feces. The user does not notice this. The urine is then treated so that we eventually recover the water and nutrients from the urine. In addition, the URIDIS system also ensures that the toilet is properly disinfected, making it safer for multiple users. For those interested: the core of the system is an electrochemical cell, in which a base is produced at the cathode, and a small amount of disinfectants at the anode.

You may be thinking, so what? Reusing a little water in space for a handful of astronauts... Well, when we get our feet back on the ground, we see that safe and clean water has also become increasingly scarce on earth. This is because in Flanders we have to extract a lot of water to make our large population density, agriculture and (industrial) activity possible. Saving water is therefore becoming increasingly important, and in office buildings, for example, it appears that about 85% of the water is used to ... flushing toilets, indeed.

There is a clear need to deal better with this. Therefore, space technology for toilets was transformed into terrestrial technology, URIDIS. For this purpose, we recently founded the company Hydrohm as a spin-off from Ghent University. Last year, a very first test was done at the Blaarmeersen in Ghent with the support of the City of Ghent and Farys. With the support of BELSPO, there is now a separate toilet container at this school, the urine of which is collected and treated in the system. We investigate how efficiently we can treat the urine, how many nutrients we can recover and whether the toilets are indeed disinfected with the system. We also want to know what the students think about it and that turned out to be very interesting: many students thought that we purified urine and put the water on their drinking taps ...

Finally, let's talk a little bit about nutrients. Urine is the great product of our human body. We push almost all the nitrogen, phosphorus and potassium from our diet into that little stream. Indeed, those are the nutrients we use for agriculture. In a single “urine donation” there is enough nitrogen to fertilize a kilogram of potatoes. But what do we do with it today? We throw it at all the rest of the wastewater and then have to remove it later. If we separate the urine at the toilet, we get on earth – and in space – the opportunity to recover those fertilizers. So that's a double profit, we get raw materials back and we don't have to do any purification later.

For more information I would like to refer to Hydrohm and ESA.

Korneel Rabaey