PhD researcher develops inexpensive, sustainable production method

December 6 2006

Delft University of Technology (Netherlands) PhD candidate Maaike Kroon has developed a sustainable and inexpensive production method for the chemical industry. This method combines reactions and separation processes, does not produce chemical waste and uses much less energy. After just two years of PhD research, she will receive her doctorate degree based on this research subject on December 11.

Maaike Kroon has developed a sustainable production method for the chemical industry that combines reaction and separation processes. She used this new method in trial experiments to reproduce a (already existing) medicine for Parkinson's disease. In doing so, no chemical waste was produced nor harmful solvents used, and the process required 75 percent less energy than is normally used. Moreover, not only is the end product extremely pure, but Kroon's method is also faster and less expensive. If used for this specific medicine, her production method would result in possible savings of 11 million euro per year.

The method combines so-called ionic liquids and separation with supercritical carbon dioxide. Using this combination was Kroon's idea, which Delft University of Technology has since patented.

The raw materials for the medicine are dissolved in ionic liquid. Ionic liquids are fluid salts that serve as clean solvents. Carbon dioxide is added to this liquid under high pressure. The high pressure propels the CO_2 gas to the so-called supercritical phase, during which it assumes the properties of both a gas and a liquid. This causes everything present to

fully mix in a homogenous phase. The resulting reactions occur much more quickly than during the reaction processes currently used. A further advantage of Kroon's method is that all the raw materials are transposed into the end product without containing any by-products. The separation process occurs after the reaction.

For this to occur, the pressure in the kettle is reduced, causing the CO_2 and material produced to evaporate and float in a gas bubble on top of the liquid. It is easy to remove this gaseous mixture. The ionic liquid's fluid mixture and the catalyst remain behind in the kettle for reuse. The pressure is lowered further for the gaseous mixture, causing the end product to separate into a solid or liquid form.

Kroon says that there are no technical obstacles preventing the industry from using this method. Kroon: "Unfortunately, we must however consider the investments that companies have already made in existing production plants. Many companies will therefore only use this new method if a new factory is built." The combination of ionic liquids with supercritical carbon dioxide can in principle be used for the production of many other materials. Three new PhD candidates will conduct further research in this area at Delft University of Technology.

Source: Delft University of Technology