The personal and professional benefits of BRISK Transnational Access

Carlos Luna of Cordoba University in Spain visits BIOENERGY 2020+ on the site of TU Graz in Austria in order to further his research into biofuels.

In Andalucía (Spain), there is great potential for the exploitation of several types of biomass sources for creating clean energy. There are a number of small companies in Andalucía already involved in the use of biomass resources to create fuel through combustion processes and it is in this area that I have developed my doctoral research into biofuels.

My supervising professor suggested the possibility of undertaking a BRISK project on the basis of the programme's corresponding fields of interest. This seemed a good opportunity to develop both professionally and personally and I therefore decided to apply to visit BIOENERGY 2020+ (BE2020)/TU Graz (Austria). These institutions were not only working with biomass but also offered the opportunity to use interesting devices and research approaches, alongside the chance to improve my German language skills. I approached the institutions and we developed a project plan regarding the study of NOx reduction by means of Selective Non Catalytic Reduction (SNCR) in a biomass furnace. The objective of this project was to find means to improve the possibilities for reduction of NOx during biomass combustion in small scale (communal) biomass boilers by means of SNCR

Figure 1: TU Graz campus.

Figure 2: Drop tube furnace at BIOENERGY 2020+ on the TU Graz campus.

methods, with consideration also of the basics of optimising the layout for small scale SNCR systems. To this end, urea was injected in the hot secondary reaction zone of the biomass furnace.

When beginning the work I was initially surprised at the size of the devices available to carry out the experimental work, as this was my first experience of pilot plant scale equipment as opposed to the usual lab scale equipment at my own institution. During the first week of the project we tested the setup, the main part of which was a Drop-Tube-Furnace to which the measurement devices (Fourier transform infrared spectrometer (FTIR) and Flue Gas Analyser) and the injection system for urea had been connected. The urea injection was conducted with a HPLC pump (see Figure 3). Once this had been done, the first NOx reduction tests with the system were performed before the end of the first week.

In the following weeks a comprehensive testing campaign on NOx reduction was performed. In order to investigate the applicability of the SNCR system in biomass furnaces we performed several tests of the NOx reduction behaviour at different flue gas temperatures (825-1150°C) in several urea flow rates (0.8, 1 and 1.5 ml/min), in order to determine the optimal NOx reduction conditions. Therefore our last week was spent conducting analysis of our main results and conclusions. These are summarised in Figure 5, where the diagram shows the NOx reduction efficiency curve. This shows that the NOx concentration can be reduced significantly while injecting different urea flows between the temperature windows. Optimum results occur at 1.5 ml/min urea flow but this leads to a high ammonia slip as a side effect.

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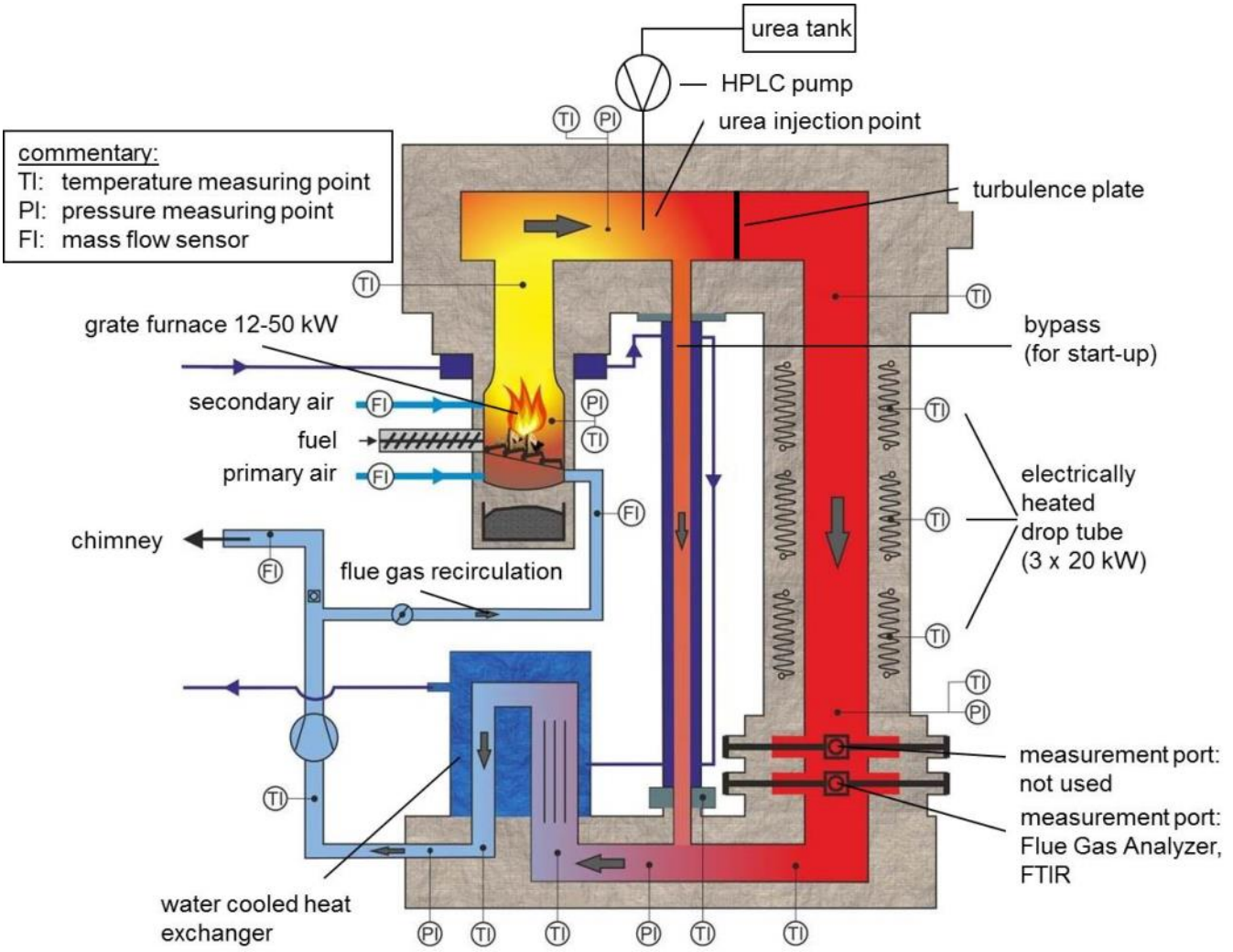

Figure 3: Schematic of the drop tube furnace with urea injection point and measurement devices (FTIR, Flue Gas Analyzer).

Measurement Day	1			2			3			4			5		
Injection temperatures (°C)	890-910			110-1140			930-1000			830-930			830-1100		
Urea flow (ml/min)	0.8	1	1.5	0.8	1	1.5	0.8	1	1.5	0.8	1	1.5	0.8	1	1.5
Injection periods	0	0	1	1	1	1	1	0	3	2	2	2	3	3	3
Period Injection time (min)	0	0	15	30	15	15	30	0	30	15	15	15	15	15	15
Measurement Equipment	FTIR/FGA/CLD			FTIR/FGA			FTIR/FGA			FTIR/FGA			FTIR/FGA		

Figure 4: Measurement data.

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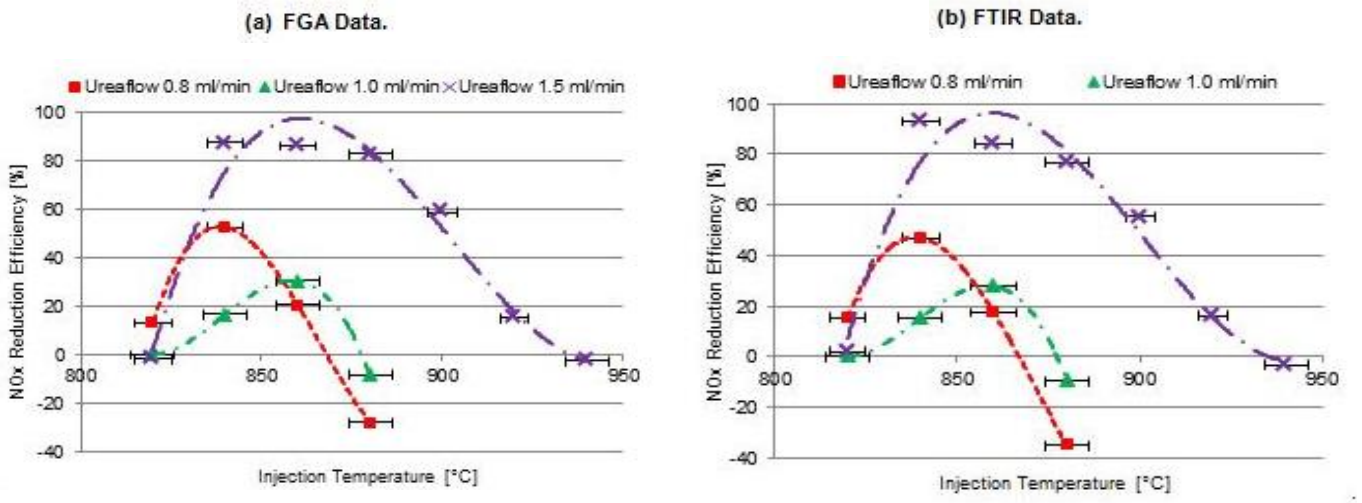

Figure 5: NOx reduction efficiency temperature window.

I would like to thank my hosts, Stefan Retschitzegger, Peter Sommersacher and Dietmar Klonner (Figure 6) who were kind and helpful throughout my visit, both in assisting me in the experiments and showing me around the city. They made me feel welcome and at home, and as well as the scientific and academic experience, my visit allowed me to make some good friends.

Figure 6: With some of the staff at BIOENERGY 2020+/TU Graz.

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