CFD SIMULATION OF THE BIOMASS SYNGAS COMBUSTION

Kamil Kwiatkowski*, **Konrad Bajer**†

* † Institute of Geophysics, Faculty of Physics, University of Warsaw
Pasteura 7, 02-093 Warsaw, Poland
* e-mail: kamil@igf.fuw.edu.pl, † e-mail: kbajer@fuw.edu.pl

ABSTRACT

Since the process of biomass gasification became popular, its product, the biomass syngas, is considered as an attractive source of energy. After thorough purification this gas may fuel internal combustion engines to produce electricity or, without any purification process, the biomass syngas may be burnt directly in the combustion chamber to produce heat. Combustion of biomass syngas is common, e.g. in furniture factories, where wood waste is gasified, produced syngas is burnt and obtained heat is used to dry fresh wood.

Due to stringent norms on pollutant emissions in the combustion process (especially nitric oxides) the parameters of the process should be carefully adjusted and well-controlled all the time. Computational Fluid Dynamics (CFD) simulations of the combustion of biomass syngas seem to be a relatively cheap tool to describe, investigate, and optimise the process.

We designed and performed a series of 2D and 3D simulations of nonpremixed turbulent combustion (Steady Flamelet model [1]) in an operational industrial burner (fig. 1) for various, experimentally determined compositions of syngas, and different flow rates of syngas and air. The results were compared qualitatively with the data from the working installation. More precise experiments are planned in the near future.

While verifying the resullts of the simulations, we are now also modelling the chemistry of the NO_x generation using Conditional Moment Closure [2] approach (Steady Flamelet method is adequate for flow field reconstruction, but insufficient for the prediction of pollutant emissions). The results of the CMC modelling of the NO_x production in this industrial installation will be presented.

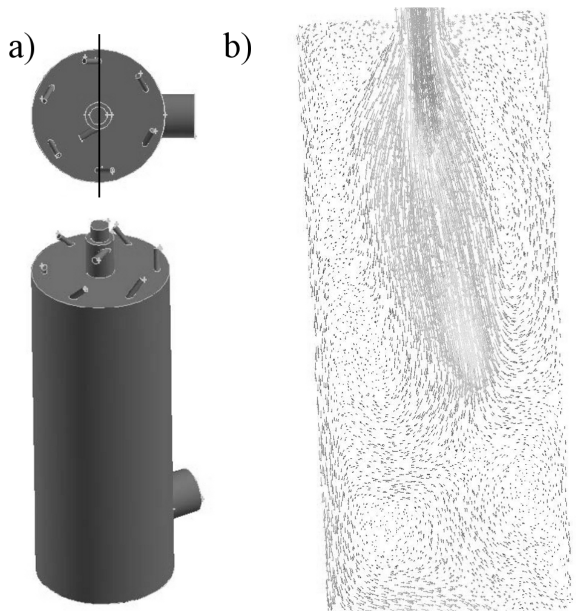

Figure 1: a) The 3D model of the syngas burner. Six additional inclined inlet pipes are mounted in the top wall induce swirl.
b) Example of simalutions result: velocity field.

REFERENCES

[1] N. Peters, Turbulent Combustion, *Cambridge University Press* (2000)

[2] A.Y. Klimenko and R.W. Bilger, Conditional Moment Closure for Turbulent Combustion, *Prog. Energy Combust. Sci.* **25**, pp. 595-687 (1999)