EuroSciCon

9th Edition of International Conference on

Biofuels and Bioenergy

March 29-30, 2018
Edinburgh, Scotland

Arch Chem Res 2018, Volume 2
DOI: 10.21767/2572-4657-C1-003

EXPERIENCES IN MODELING OF GAS EMISSIONS AND HYDROGEN PRODUCTION FROM BIOMASS COMBUSTION AND GASIFICATION

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As the experiments are the basic cognitive methods which allow specify empirical dependencies during solid fuels combustion, most of discussed in literature results are usually obtained via measurements on real objects. However a big challenge, as well as the costs, time-consuming and limitations make the experiments often an insufficient method of data mining.

An alternative can be mathematical modeling. As the nature of the industrial processes is often non-linear, sometimes extremely complex and therefore not sufficiently recognized the development of simple models of such cases is of practical significance. Two main modeling approaches can be distinguished in literature: the programmed computing approach and the methods based on the artificial intelligence (AI) methods. The first one is based on writing algorithms. In AI methods the empirical problem can be reproduced from training samples or can be formalized using the experience rather than the strict knowledge of the process.

Many aspects should be considered when discussing modeling, e.g. what approach should be used, what kind of validation data can be used, what is the accuracy accepted for the model research, how to consider the natural resources in the model, etc.

The present work shows mathematical modeling of gas emissions and hydrogen production from biomass combustion and gasification, respectively. The programmed and AI methods are presented allowing to predict pollutants emissions from biomass co-combustion in a large-scale circulating fluidized bed (CFB) boiler, chemical looping combustion (CLC) of biomass in a pilot-scale fluidized bed (FB) system as well as the H2 concentration in syngas during the hydrogen production via CaO sorption enhanced anaerobic gasification of sawdust in a laboratory-scale FB reactor.

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