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Numerical modelling biogas combustion in the novel burner

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INTRODUCTION

Currently, the most effective way to analyze structures is experimental, however, conducting a large number of experimental studies is quite a difficult task. Currently, numerical modeling methods are widely used, which allow saving time and labor costs for the creation of experimental studies. This poster presents the results of numerical simulation of a burner device using biogas as the main fuel.

METHODOLOGY

In order to simulate combustion in a burner device, the laws of conservation of mass, momentum and energy were used. Additionally, it is important to take into account the processes of turbulent flow, as well as the chemical reaction during turbulent combustion, as well as the processes of thermal energy release.

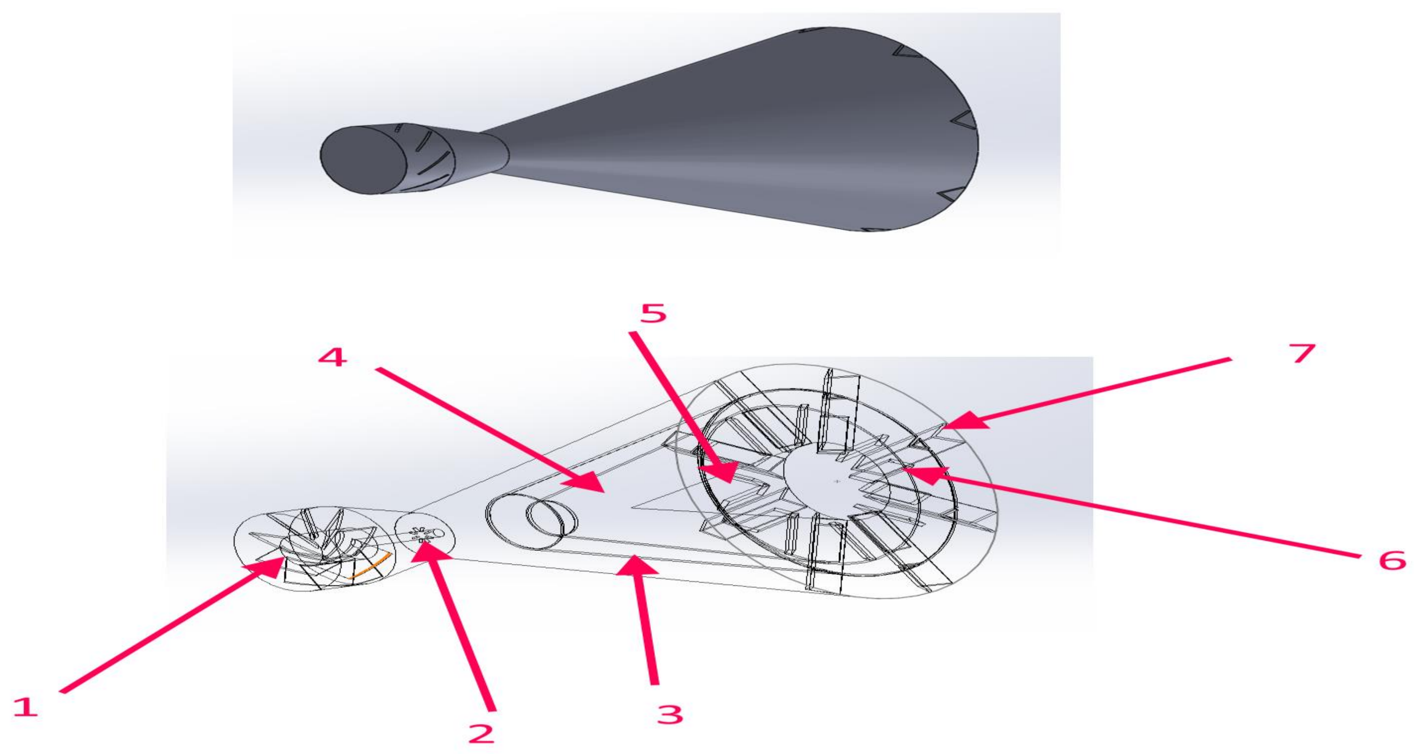

Fig. 1. General view of the burner device.

Figure 1 shows a model of a burner device for burning gaseous fuels, in particular biogas. In Figure 1: 1 – Input register; 2 – fuel tubes; 3 – first cone; 4 – second cone; 5 – stabilization cone; 6 – secondary air supply; 7 – corner stabilizers.

3 biogas compositions presented in Table 1 were selected for this study.

Table 1. Composition of biogas

No.	Composition of biogas			A source CH_4, %
	CH_4, %	CO_2, %	Impurities of other gases, %	
1	70	29	1	70
2	60	38	2	60
3	74	26	-	74

In this study, concentration number 2 was used: CH_4 – 60%, CO_2-40%.

RESULTS

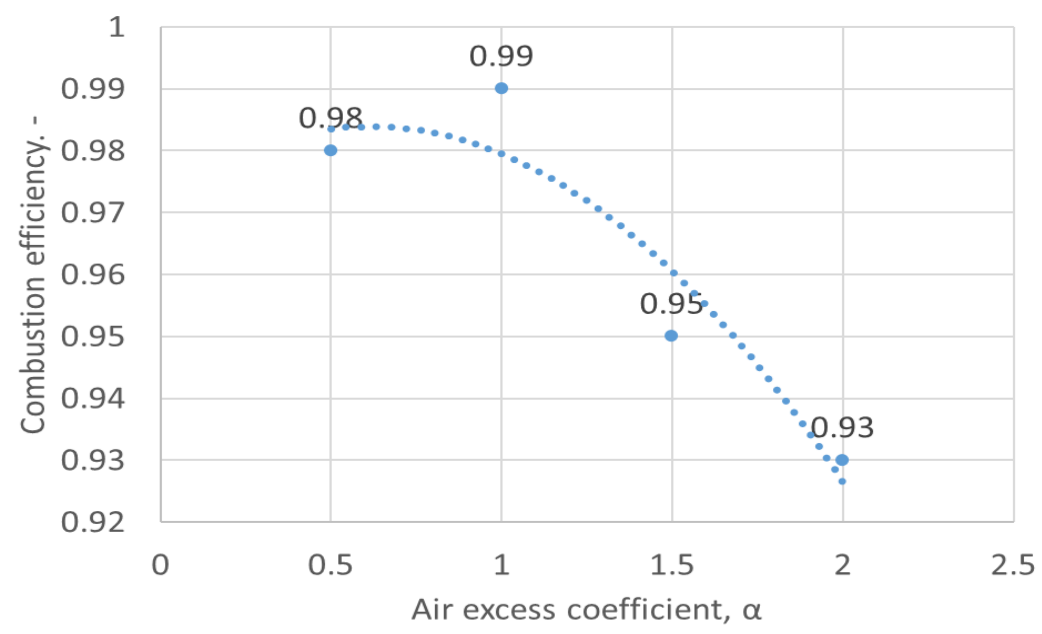

Fig. 2. The dependence of the completeness of combustion on α

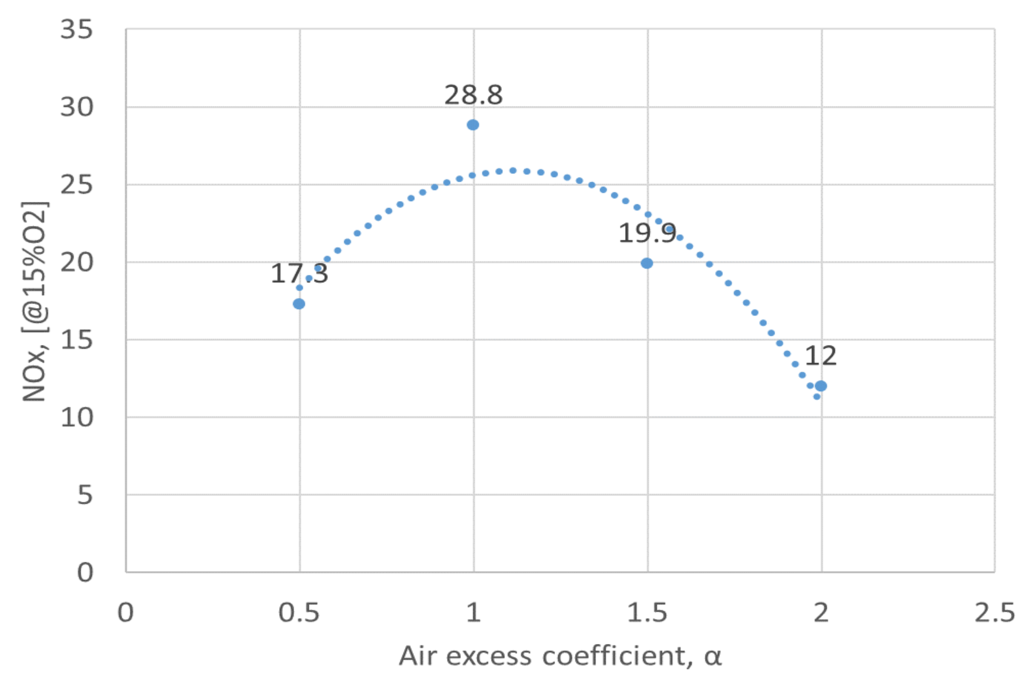

Fig. 3. Dependence of NOx on α

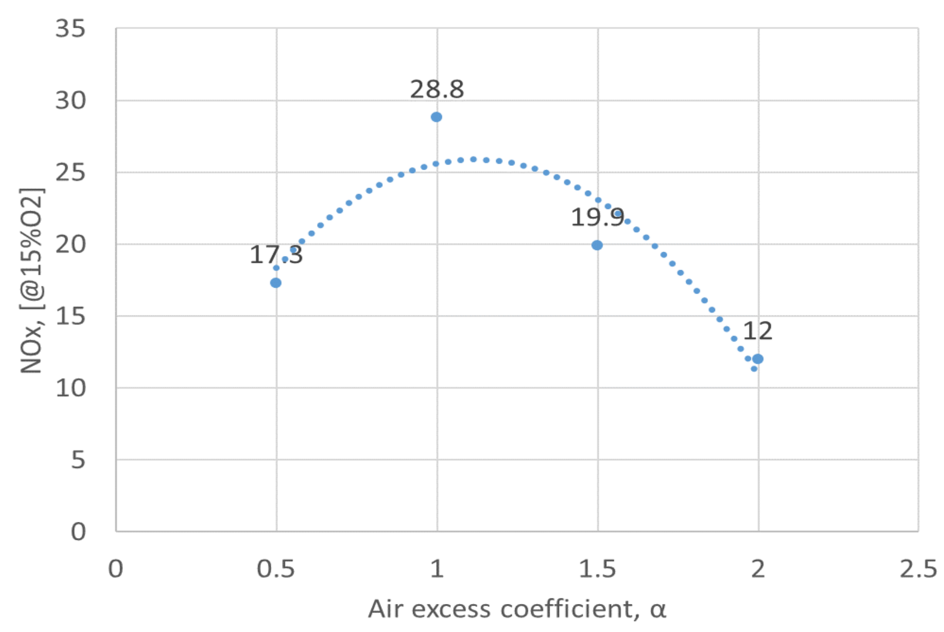

Fig. 4. Dependence of the temperature of the exhaust gases on the excess air coefficient

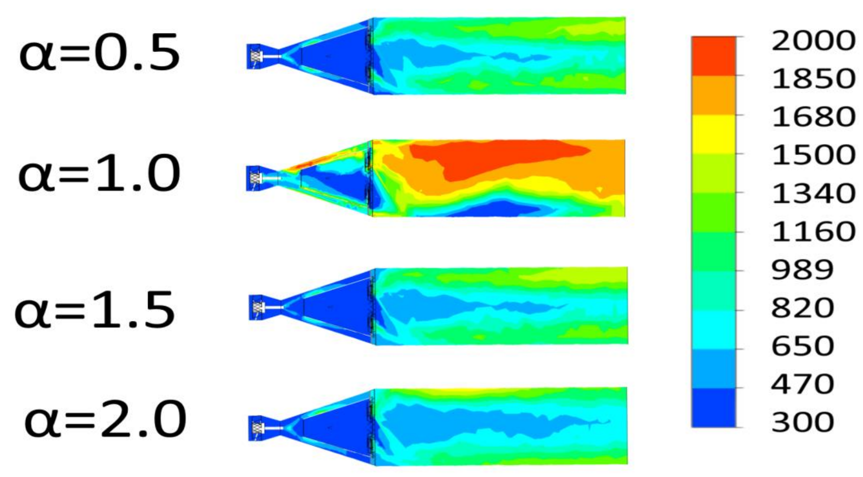

Fig. 5. Shows the temperature contours at different fuel excess coefficients

CONCLUSIONS

The analysis performed shows that there is a possibility of a significant decrease in NOx concentrations with an excess of air equal to 1.5-2.0. This mode allows you to burn fuel quite efficiently. Further research needs to be carried out in the field of increasing the efficiency of combustion and other compositions of biogas fuels.

The temperature contours showed that the flame has a symmetrical shape and the swirl allows for more efficient mixing of the fuel-air mixture.