BIOENERGY PRODUCTION FROM OLIVE TREE PRUNING USING GASIFICATION TECHNOLOGY

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Introduction

Thermochemical conversion process using biomass gasification for converting the agriculture residues to gaseous fuel using the biomass partial oxidization theory has a very potential to a simple, clean, and sustainable method. This approach producing heat and energy at rural and remote regions with less contamination compared to fossil fuel. The biomass gasification process produced a mixture of gases called the syngas, which contains hydrogen (H2), carbon monoxide (CO), methane (CH4), carbon dioxide (CO2), and nitrogen (N2).

Gasification of the olive tree pruning (OTP) can produce clean and affordable energy. This can help in achieving universal access to energy and reducing reliance on fossil fuels.

Objective

The current study aims to assess the suitability of olive tree pruning residues as a feedstock for gasification process using a laboratory-scale gasifier. The performance of the developed gasifier was analyzed and evaluated under three different levels of heating temperature and four types of catalyst. The evaluation bases included syngas production composition and energy efficiency

Materials and Methods

Examined olive tree pruning (OTP) materials were prepared for the experimental work (Figure 1).

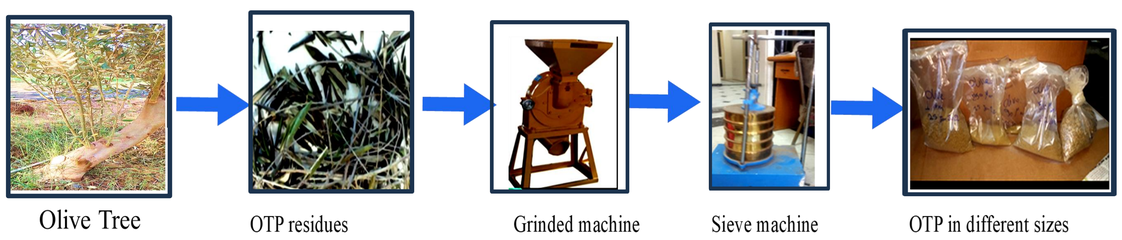

Figure 1: Diagram for preparation of olive tree pruning residues

A laboratory scale downdraft gasifier (Figure 2) was developed and evaluated for production of syngas from olive tree pruning (OTP) under different levels of gasification temperatures and different types of catalyst (Figure 3).

Figure 2 : Downdraft reactor for gasification of olive tree pruning

Figure 3 : Types of catalyst in the experimental work

Results & Discussion

The Preliminary Experiments:

As shown in figure 4 The moisture level of the studied OTP was lower enough for proper gasification. While the tested sample showed zero sulfur, which means a major advantage for the gasification process using the olive tree pruning from the environmental point of view.

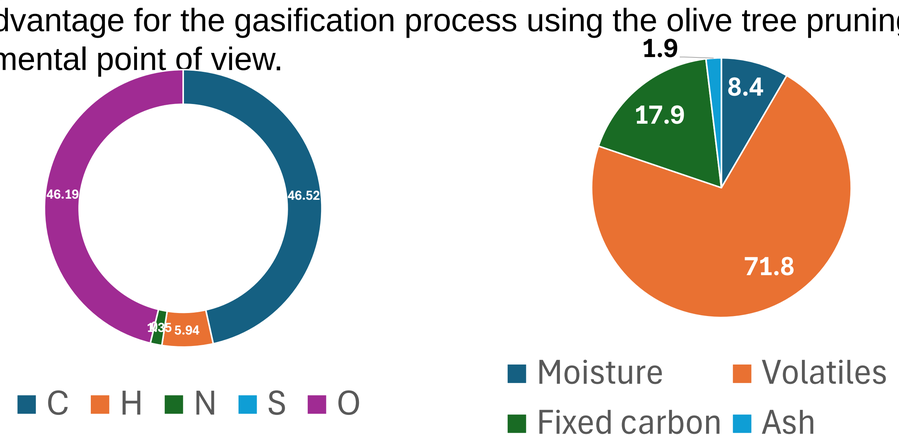

Figure 4 : Elemental and proximate analysis of olive tree pruning

Experimental work

As shown in figure 5, the heating temperature of 800°C recorded the highest level of gas production and hydrogen yield without adding catalyst

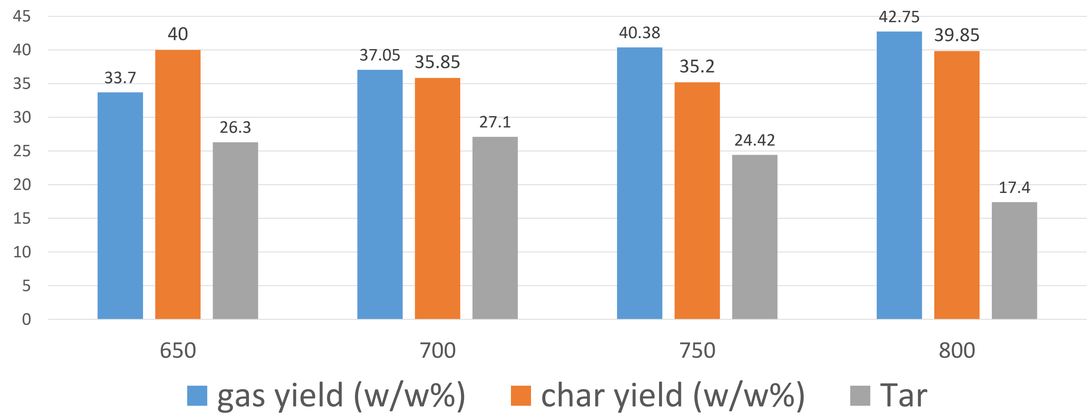

Figure 5 :The effect of temperature on the yield of gasification process.

The effect of different types of catalyst on gas production and gas composition is shown in figures 6,and 7

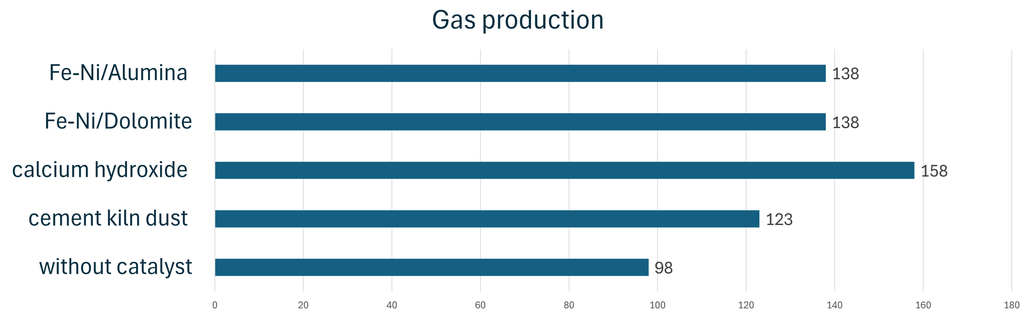

Figure 6: Effect of Different Types of Catalyst Material on The Gas production

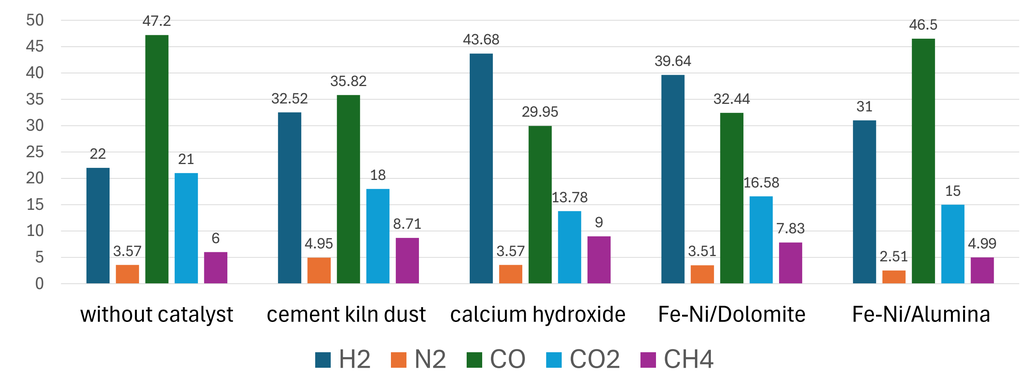

Figure 7: Effect of Different Types of Catalyst Material on The Gas composition

Conclusions

The most proper working condition for the developed gasifier was **800 °C** heating temperature and **calcium hydroxide catalyst**. Meanwhile utilizing olive tree pruning waste in the gasification process offers a promising solution for addressing the waste management and energy needs of the olive industry. Further research and development efforts are needed to optimize the process and overcome existing challenges for its widespread adoption and commercialization.

Acknowledgment

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