Environmental Engineering and Management Journal

April 2024, Vol. 23, No. 4, 807-814
http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu
http://doi.org/10.30638/eemj.2024.063

"Gheorghe Asachi" Technical University of Iasi, Romania

MICROWAVE-MATRIX CAVITY REFORMER FOR BIOGAS APPLICATIONS

June An, Young Nam Chun*

Department of Environmental Engineering, Chosun University, #309 Pilmun-daero, Dong-gu, Gwangju, 61452, Republic of Korea

Abstract

The active use of organic waste gases (like biogas and landfill gas, etc.) as alternatives to fossil fuels reduces the net increase in CO_2 emissions. This study focused on the conversion of biogas into hydrogen-rich gas, which is a high-quality fuel energy source. To achieve this, a new type of microwave-matrix cavity reformer (MMCR) was suggested, and parametric studies were performed to demonstrate the possibility of solid oxide fuel cell (SOFC) stack applications. Based on the performance of the reforming characteristics for each variable, the optimal operating conditions of the MMCR were obtained as follows: when the air ratio was 0.4, the reformed gas recirculation rate was 100%, the water feed rate was 20 mL/min, and the CH_4 conversion, CO_2 conversion, and H_2 selectivity were 64.0%, 54.7%, and 62.5%, respectively. Particularly, the CO/H_2 ratio was 0.67, which is a good condition without incurring carbon deposition. This novel MMCR is expected to be a biogas reformer for application in SOFC stacks as a residential power generator.

Key words: biogas, climate technology, hydrogen production, partial oxidation reforming, solid oxide fuel cell stack

Received: July, 2022; Revised final: January, 2024; Accepted: February, 2024; Published in final edited form: April, 2024

* Author to whom all correspondence should be addressed: e-mail: ynchun@chosun.ac.kr