CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The gliding arc discharge is one of promising technologies for converting biogas to useful products. The biogas reforming was investigated in the present study. A four-stage gliding arc system in series was use to investigate the effects of stage number, feed flow rate, frequency, applied voltage, gap distance and oxygen concentration on biogas reforming to produce hydrogen. The CH_4 and CO_2 conversions decreased with increasing feed flow rate becomes of decreasing residence time. With a higher frequency, the CH_4 and CO_2 conversions decreased since current decreased resulting to having less electrons generated to initiate the reactions. The CH_4 and CO_2 conversions increased with increasing voltage since the current is increased leading to increasing the probability of collision between CH_4 and CO_2 molecules with electrons. The selectivities of C_2H_6 decreased with increasing voltage. C_2H_6 was found as primary products from the oxidative coupling reaction of CH_4. At a higher voltage or a lower frequency, C_2H_6 is further dehydrogenated to form C_2H_4 and then C_2H_2. With increasing gap distance corresponding to increasing residence time, both CH_4 and CO_2 conversions as well as C_2H_6 selectivities increased. For any given residence time, both CH_4 and CO_2 conversions increased significantly with increasing stage number while the power consumption decreased. With O_2/CH_4 molar ratio of 0.3/1, both CH_4 and CO_2 conversions as well as increased and the power consumption decreased. The optimum conditions of the gliding arc system were found at a feed flow rate of 150 mL/min, a frequency of 300 Hz, an applied voltage of 17,000 V, a gap distance of 0.6 cm and a O_2/CH_4 molar ratio of 0.3/1 for the maximum CH_4 and CO_2 conversions and high hydrogen gas production with very low power consumption.

5.2 Recommendations

The biogas reforming should be studied by using the gliding arc plasma system with catalyst to produce more hydrogen. Other reaction including steam reforming of biogas and combined steam reforming and partial oxidation of biogas should be investigated both with and without catalyst.