Biogas upgrading using ionic liquid [Bmi][PF_6] followed by thermal-plasma-assisted renewable hydrogen and solid carbon production

김광식[1], Nguyen Van Duc Long[2,3], Nam Nghiep Tran[3], 이동영[1], Laurent Fulcheri[4], Zhen Song[5,6], Kai Sundmacher[5,6], 이문용[1,†]

[1]영남대학교; [2]Univ.of Warwick; [3]Univ of Adelaide; [4]PSL Research University; [5]Otto-von-Guericke University; [6]Max Planck Institute for Dynamics of Complex Technical Systems

The use of hydrogen has attracted significant attention because conventional hydrogen production processes require intensive energy and are dependent on natural gas. The main objective of this study is to develop an innovative and eco-friendly hydrogen production process utilizing biogas as an alternative to natural gas. Ionic liquid [Bmim][PF_6] shows high potential for the replacement of aqueous amine solutions for CO_2 absorption and are employed for biogas upgrading, while thermal plasma(TP) is employed for the production of "turquoise" hydrogen. In addition, an intercooler is used to improve CO_2 removal in the absorber. Heat and power integration is employed to enhance the performance of the upgrading process and TP hydrogen production. All simulations were conducted using Aspen Plus V10.0 software. The simulated results show that the solid carbon production increases compared to that in the base case. The savings in both the heater and the third flash drum are 100%, while the saving in power consumption in the compression section is 62.0%. Furthermore, sensitivity is investigated to determine the effect of biomethane composition on the proposed configuration.