Ethylene Treatment Using Nanosecond Pulsed Streamer Discharge

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Ethylene (C_2H_4) isone of volatile organic compounds (VOCs) having properties of low-molecularweight, sweet odor, flammable and colorless, and has the effect of promotingthe growth of fruits and vegetables. However, ethylene influences differentlydepending on the type of fruit, and its excessive amount can cause the fruit toripen rapidly. Recently, fruits and vegetable may frequently undergo longtransportation by container ship, during which it often loses freshness due toC_2H_4 release. In recent study, a nanosecond pulsegenerator which has a 5 ns pulsed duration in output pulsed voltage wasdeveloped and showed higher energy efficiency for exhaust gas treatment [1]. Inpresent study, C_2H_4 decomposition using nanosecond pulseddischarge was implemented.

The C_2H_4 andbyproducts concentrations of discharge treated gas was analyzed by Fouriertransform infrared spectrometer (FT-IR). The results show that $C_2H_4$was completely decomposed at 40 J/L in input energy density under the differentconditions of applied voltage and pulse repetition rate (initial C_2H_4concentration = 100 ppm; gas flow rate = 5 L/min). The results also indicatedthat the nanosecond pulsed discharge has a significant advantage in energyefficiency for ethylene decomposition. In addition, C_2H_4,decomposition efficiency slightly decreased in case of moisturecondition. Also, CO_2, N_2O, O_3, CO, HNO_3,and HCOOH were generated as byproducts after discharge treatment of C_2H_4.

Reference

[1] T. Matsumoto, D. Wang, T. Namihira,H. Akiyama, “Energy efficiency improvement of nitric oxide treatment usingnano-seconds pulsed discharge”, IEEE Transactions on Plasma Science, Vol.38,No.10, pp.2639-2643, 2010.