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Influence of Oxygen Concentration on Ethylene Removal Efficiency

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Ethylene (C2H4) gas promotes the aging of some kinds of fruits and vegetables. Decomposition of C2H4 using non-thermal plasma is effective for keeping freshness of fruits and vegetables. In this paper, the influence of O2 concentration to C2H4 decomposition using a dielectric barrier discharge (DBD) was evaluated. The dual polarities pulsed voltage was generated using a pulse transformer driven by a full-bridge type pulse modulator using MOS-FETs. The bipolar pulse width are set as about 50 μs and the pulse repetition rate is fixed at 1 kHz. C2H4 gas was diluted by 200 ppm with N2 and O2 gas mixture and was fed into the DBD reactor at a gas flow rate of 3 L/min. The C2H4 and O3 concentrations are determined using a FT-IR spectrometer. C2H4 concentration decreased with increasing input energy density for all the O2 concentrations. C2H4 removal was improved by decreasing the O2 content from 20% to 2%. O3 concentration linearly increased with input energy density. Since the reaction rate of C2H4 with O is much higher than that with O3, O primarily decomposes C2H4 in the DBD reactor. Therefore, the O3 concentration with C2H4 is lower than that without C2H4. O3 concentration in the case of O2 concentration of 2% is approximately 2 times lower than that of 20% at same input energy density, which indicates that production of O decreases in the same proportion. However, the reaction between O and O2 is suppressed by the decrease of O2 concentration, which promotes the reaction between O and C2H4. Therefore, C2H4 removal was improved by the decrease of the O2 content from 20% to 2%.

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