Ethylene Removal from Post-harvest AgriculturalStorages Using Adsorption and Plasma-catalytic Oxidation

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Ethylene,which is produced during the respiration of agricultural products, is known tohave a negative impact related to after-ripening even at low concentrations(several ppb~ppm), and it must be removed when long-term storage is required. Plasma methods are relatively new technologies thatcan easily decompose hydrocarbons such as ethylene. While plasma processing hasseveral advantages over conventional ones, it is likely to generate harmfulby-products due to its poor selectivity to carbon dioxide. The combination ofplasma with catalysis is a way to overcome the disadvantages, maintaining theadvantages. However, it is economically undesirable to continuously supplyelectrical energy into the plasma-catalyzed process for the treatment of diluteethylene. In order to solve this problem, we investigated a two-stageprocess, namely, concentrating ethylene for a long time using adsorption,followed by decomposing the adsorbed ethylene by plasma for a short time. Sinceno electricity is used for the adsorption-concentration step, the operationcost can be greatly reduced. For the successful application of this process,the adsorption of ethylene is the most important. Since ethylene has a veryhigh vapor pressure, adsorption does not effectively take place on conventionaladsorbents. Upon investigation, among various zeolite adsorbents, ZSM-5 was themost excellent for the adsorption of ethylene. Especially, it was found thatthe ZSM-5 with Si/Al ratio of 23.8 was optimal. In addition, when Pd wassupported on ZSM-5, the ethylene adsorption performance was remarkablyimproved. The catalyst preparation method had also a great influence on theadsorption performance. It was confirmed that palladium catalyst having a highdegree of dispersion could be obtained by ion exchange method rather thanimpregnation method.

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