EXAMINATION OF ELIMINATIONS OF VOC AND MOISTURE WITH ZEOLITES QUICKLY REACTIVATED BY MICROWAVE HEATING

TATSUO OHGUSHI*, TOORU UEMIZU, MASANOBU HORIE

Toyohashi University of Technology, Toyohashi, 441-8580, Japan/Aichi
ohgushi@las.tut.ac.jp

It was examined whether VOC (volatile organic compounds) and moisture were effectively eliminated with zeolite quickly reactivated by microwave heating (MWH, f=2.45GHz). Ethyl alcohol and toluene were used as VOC, and pelletized Na-X, Na-LSX and Na-Y zeolites and AC (active carbon) were examined as adsorbent for VOC. Adsorption properties were measured in a bag containing adsorbent of 5g and VOC of 1000-4000 ppm in air, and an efficiency of adsorption was an order of AC>Na-Y>Na-LSXNa-X. Both Na-LSX and Na-X could adsorb VOC but caused desorption of VOC in an intermediate stage due to moisture. A mixture of Na-X+AC=2.5g+2.5g caused no desorption. In MWH, temperature rise was an order of Na-LSXNa-X>Na-Y. AC caused sparks during MW irradiation. A pelletized mixture of Na-X:AC=1:1 caused no sparks but the pellet was too fragile to handle. Since each adsorbent showed a reverse aptitude for the adsorption of VOC and MWH, a simultaneous use of Na-X and AC was examined. A breakthrough curve of adsorption bed with Na-X+AC=200g+200g was measured for methyl alcohol in air. After the breakthrough, Na-X was heated to ca. 570K by MWH (500W×15 min). Such a cycle was repeated twice, and the breakthrough curves were compared with each other. A beginning of breakthrough slightly became earlier after the second MWH than the first MWH. For toluene, a similar tendency was observed in the breakthrough curves. It was considered that a reactivation temperature by MWH was high, VOC partly decomposed and pores in zeolite were partially blocked by carbon generated from VOC. To eliminate moisture at low cost, natural zeolite (and Na-X for reference) was examined. Both natural zeolite (NZ) and Na-X of 1.5kg were fully hydrated in a container and reactivated by MWH (1000W×30min). This cycle was repeated 30 times, and changes of adsorption capacity C with the number of treatment n were investigated. NZ was heated up to ca. 530K by MWH and Na-X up to ca. 570K. C for both zeolites linearly decreased with increasing n, and its dependence of NZ on n was expressed by Cn/C0=1-2.27×10-3n and that of Na-X Cn/C0=1-3.27×10-3n, where Cn denotes C after nth treatment. When a life of adsorbent is defined as nl at Cnl/C0=0.5, the life of NZ is nl=220 and that of Na-X is nl =152. Dried NZ of 1kg can eliminate moisture of 19.3kg by its life in the present conditions. The result indicates that the use of NZ together with MWH is promise for the elimination of moisture.

Keywords: VOC, moisture, zeolite