

Optimization of adsorption process for acetylene removal with design of experiments

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Carbon nanotubes, carbon nanofibers and carbon powders were used for the acetylene adsorption experiments. The experiment designed by 3-factor, 3-level of Box-Behnken Design (BBD) was carried out with Pd concentration of 0 to 5%, adsorption temperature of 30 to 80 °C and C₂H₂/CO₂ of 3 to 10. Based on those data, a second order polynomial regression analysis was used to derive the adsorption amount prediction equation according to operating conditions. The adsorption temperature showed the greatest influence index and the C₂H₂/CO₂ ratio showed the smallest influence index according to the F-value measurement of the ANOVA analysis. However, there was little interaction between major factors. In the adsorption optimization analysis, 22.0 mmol/g was adsorbed under the conditions of Pd concentration of 3.0%, adsorption temperature of 47 °C and C₂H₂ / CO₂ of 10, and 95.9% accuracy was obtained in the experimental data.