PO1027

Regeneration of Mineral Adsorbent by Nonthermal Plasma Desorption of Formaldehyde

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Formaldehyde is a highly toxic byproduct in the biogas combustion process and as such an economic process is required in order to remove it from the exhaust gas. A new process was being developed where formaldehyde remediation was carried out in two steps. Firstly, gaseous formaldehyde was being adsorbed at the surface of a microporous natural mineral until the break-through point of the adsorption process was reached. The second process step involved the regeneration of the formaldehyde-loaded adsorbent in a dielectric barrier discharge (DBD) plasma reactor. As a result, formaldehyde was quantitatively desorbed from the mineral adsorbent during the plasma process. The adsorbent regeneration efficiency was found to depend critically on plasma process parameters such as discharge power and residence time of the process gas in the packed-bed reactor. The reproducibility of alternating adsorption and desorption processes was also successfully demonstrated as the adsorbent regeneration efficiency was found to be retained after several cycles. Additionally to the successful and reproducible desorption process of the pollutant from the mineral, formaldehyde was observed to degrade to carbon dioxide, carbon monoxide, methanol, methane and methyl formate during the plasma process. The ratio of carbon dioxide was obtained to be 62 % in the product mixture.

Keywords
air cleaning
formaldehyde removal
microporous minerals
plasma desorption