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DEVELOPMENT OF A PHOTOREACTING FABRIC FILTER FOR SIMULTANEOUS REMOVAL OF VOC VAPOR AND FINE PARTICLES

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This study was conducted to develop an integrated technology for removing dusts and VOCs simultaneously from contaminated air streams by employing a photoreacting filter with TiO2-coated felted fabric. Pressure drop across a sample fabric and toluene vapor removal efficiency were measured using a fabric filter sampling system on a lab scale under varying conditions of toluene vapor concentration, photocatalyst particle size, photocatalyst load per unit fabric area, and injection duration of dust-laden gas. As the operating of a photoreacting filter with photocatalyst-coated fabric proceeds under a fixed pressure drop condition, the duration of dust filtration gradually shortens and the frequency of dust cleaning in pulse-jet fashion increases. This suggests that appropriate determinations of reverse-air pressure, blow-pipe nozzle size, photocatalyst film thickness, and a set pressure-drop point are necessary to maintain the proper cleaning effect. It was confirmed that the toluene vapor removal efficiency before pulse-jet operation and dust detachment is reduced rapidly due to dust cake build up, and that it then regains 60-70% of its initial level after the starting of the pulse-jets operation in a filter sampling system equipped with photocatalyst-coated fabric and UV light sources. Insufficiency in gas removal efficiency can be effectively compensated by employing a multichannel photoreactor using felted fabric as a supporter for photocatalyst.