Analysis on SO_2 Removal and $(NH_4)_2SO_4$ Particle Growth in Dielectric Barrier Discharge-Photocatalyst Hybrid Process

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We analyzed the effects of several process variables on the SO_2 removal and ammonium sulfate ($(NH_4)_2SO_4$) particle growth by the dielectric barrier discharge - photocatalyst hybrid process. The size and crystallinity of ammonium sulfate particles were examined by using TEM and XRD analysis. The dielectric barrier discharge reactor consisted of two zones: the first one is for plasma generation and the second one is for the formation and growth of ammonium sulfate particles. The first zone of reactor was filled with glass beads as a dielectric material. To enhance SO_2 removal efficiency, the TiO_2 photocatalysts were coated on glass beads by dip-coating method. SO_2 was converted into sulfuric acid in the first zone of the reactor. $(NH_4)_2SO_4$ was generated by the reaction between sulfuric acid and ammonia and grew continuously by particle coagulation and surface growth in the second zone of reactor. As the voltage applied to the plasma reactor or the pulse frequency of applied voltage increases, the SO_2 removal efficiency increases. $(NH_4)_2SO_4$ particles become bigger, moving inside the reactor. Larger particles are produced according to the increase of residence time or SO_2 concentrations.