Effect of microwave on the simultaneous removal of NOx and SO_2 under electron beam irradiation and derivation of NOx removal rate

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The removals of NO and SO_2 from air mixture were carried out in a flow process combined the irradiation of electron beam(EB) with microwave(MW) for improvement of the removal efficiencies of NOx. The additional irradiation of MW could considerably decrease EB doses compared to a single irradiation of EB: for 80% of removal efficiency it could increase the removal rate by 21.1% to above 117.4% at initial concentrations of NOx ranged by 250ppm to 1000ppm. In this study, it was estimated that the increase of NO removal efficiency by addition of MW was arisen from an intrinsic kinetic rather than a thermal effect. The removal process of SO_2 and NOx with stoichiometric ratio(M) addition of NH_3 showed high removal efficiencies, converting them into main final products of NH_4NO_3 and $(NH_4)_2SO_4$. The rate form of NOx removal ($-r_{NO}=k[NO][NH_3][R\bullet]$) in simultaneous removal of SO_2 and NOx could be converted to a second order rate on the irradiation dose instead of reaction time, and linearly testing of this rate form with experimental data showed a good correlation, depending on M value.