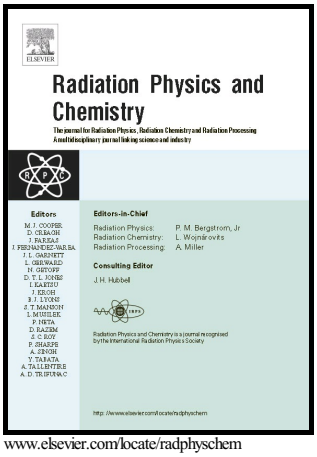
Author's Accepted Manuscript



www.elsevier.com/locate/radphyschem

A hybrid plasma-chemical system for high-NO_x flue gas treatment

Andrzej G. Chmielewski, Ewa Zwolińska, Janusz Licki, Yongxia Sun, Zbigniew Zimek, Sylwester Bułka

PII: S0969-806X(17)31130-1
DOI: https://doi.org/10.1016/j.radphyschem.2017.11.005
Reference: RPC7688

To appear in: *Radiation Physics and Chemistry*

Received date: 26 October 2017
Accepted date: 11 November 2017

Cite this article as: Andrzej G. Chmielewski, Ewa Zwolińska, Janusz Licki, Yongxia Sun, Zbigniew Zimek and Sylwester Bułka, A hybrid plasma-chemical system for high-NO_x flue gas treatment, *Radiation Physics and Chemistry,* https://doi.org/10.1016/j.radphyschem.2017.11.005

A hybrid plasma-chemical system for high-NO_x flue gas treatment

Andrzej G. Chmielewski[a], Ewa Zwolińska[a], Janusz Licki[b], Yongxia Sun[a,*], Zbigniew Zimek[a] , Sylwester Bułka[a]

[a] Institute of Nuclear Chemistry and Technology, Warsaw, Poland

[b] National Centre for Nuclear Research, Otwock - Świerk, Poland

ABSTRACT

The reduction of high concentrations of NOx and SO_2 from simulated flue gas has been studied. Our aim was to optimise energy consumption for NOx and SO_2 removal from off-gases from a diesel generator using heavy fuel oil. A hybrid process: electron beam (EB) plasma and wet scrubber has been applied. A much higher efficiency of NO_x and SO_2 removal was achieved in comparison to dry, ammonia free, electron beam flue gas treatment (EBFGT). A recorded removal from a concentration of 1500 ppm NO_x reached 49% at a low dose of 6.5 kGy, while only 2% NO_x was removed at the same dose if EB only was applied. For SO_2, removal efficiency at a dose of 6.5 kGy increased from 15% (EB only) to 84% when sea water was used as a wet scrubber agent for 700 ppm SO_2. The results of this study indicate that EB combined with wet scrubber is a very promising technology to be applied for removal of high concentrations of NOx and SO_2 emitted from diesel engines operated e.g. on cargo ships, which are the main sources of SO_2 and NO_x pollution along their navigation routes.

Keywords: Electron beam irradiation; SO_2; NOx; Wet scrubber; Flue gas

Introduction

SO_2 (sulphur dioxide) and NOx (nitrogen oxides, mainly NO and NO_2) are harmful pollutants which affect human beings and the biota. Exposure to these compounds is dangerous to human life, causing respiratory diseases such as emphysema and bronchitis [Kampa & Castanas, 2008]. Moreover, emissions containing SO_2 and NO_x, when released into the atmosphere, result in acid rain, which destroys historic monuments, sculptures and