Environmental Engineering and Management Journal March/April 2009, Vol.8, No.2, 207-212
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

A NOVEL PLASMA REACTOR FOR TOLUENE DECOMPOSITION IN CONTAMINATED AIR FLOW

Zhihui Xie, Lingen Chen*, Fengrui Sun, Qizheng Ye

Naval University of Engineering, Postgraduate School, 717 Jiefang Road, Wuhan 430033, The People's Republic of China

Abstract

A new type of wire-cylinder plasma reactor, in which air flow shapes into gas torches is developed. The decomposition performance of toluene in contaminated air flow induced by pulsed corona discharge in the reactor is investigated experimentally under atmosphere pressure and room temperature. It is found that the decomposition efficiency is affected dramatically by air introduction way, and the ejection stimulates the decomposition of toluene compared with the conventional method. The decomposition efficiency difference reaches to 14.4% at voltage of 34kV. The direction of electric field effect on decomposition is proved experimentally. The decomposition efficiency is improved when the direction of electric field is consistent with the flow direction. The difference of decomposition rates reaches to 42.5% at voltage of 34kV. The experimental results utilizing the gas ejection mode show that the decomposition efficiency increases with the increase in voltage when the applied voltage is lower than the spark voltage. When the voltage is too high, spark discharge is created between two electrodes and the decomposition efficiency decreases. The decomposition efficiency by small capacitance discharge is higher in the range of low voltage, but the advantages of larger capacitance appear gradually with the increase in voltage. The decomposition efficiency decreases with the increase in initial concentration of toluene. When environment humidity is too high, not only the decomposition efficiency decreases but also the oxidation is not complete and CO is created.

Key words: air cleaning, air introduction way, direction of electric field, discharge plasma, VOCs

* Author to whom all correspondence should be addressed: e-mail address: lgchenna@yahoo.com, lingenchen@hotmail.com, Phone: 0086-27-83615046, Fax: 0086-27-83638709