DEVELOPMENT OF EMISSIONS REDUCING METHOD AND APPARATUS FOR VOLATILE ORGANIC HALIDES

Taneaki Yahata*, Yuji Tsuchiya and Masahiko Toba
Morikawa Industries Corporation
150 Imojiya Koshoku-city Nagano Prefecture, Japan
mail: dect@cd.mbn.or.jp

The environmental pollution by hazardous chemicals has become a real problem. Various volatile organic halides (VOHs) such as CH_3Br, CH_2Cl_2, C_2HCl_3, C_2Cl_4, etc have been especially strong impacts on the ozone layer destruction, soil and water pollution and global warming. These volatile organic chlorides have excellent characteristics as cleaning solvents, large amount of these organic chlorides are spent at many metal parts and semiconductor manufacturing plants to remove oil and fats. Also, they are used as adhesive agents, cooling media and dry cleaning solvents in various industries. With its advantageous characteristics, CH_3Br is used for pesticide. Due to the lack of effective disposal methods for VOHs, they have been stored or emitted for long time. This paper describes about method and apparatus for dehalogenation of VOHs by Calcium Oxide (CaO) to remove halogen from organic halides in the form of $CaCl_2$ or $CaBr_2$.

Basic principle of dehalogenation of VOHs

Formula of chemical reaction of VOHs and CaO is as follows;
VOHs + CaO = CaHs + CO_2 + H_2O (Hs; F_2, Cl_2 and Br_2)
Reaction temperatures are about 900^0C for fluorides, 650^0C for chlorides and 500^0C for bromides.

Apparatus

Figure shows a bench scale moving bed apparatus. The apparatus is consisted of reaction column, CaO tank, CaO transport pipe, VOHs feedstock with liquid pump. 2-4 mm of CaO particles are put into the top of the reaction column, while VOHs are led into the bottom side of the column. The characteristic of this moving bed is provided a rotary agitator. It can be easily discharged the reaction products from the reaction column to the receptacle pot. In the reaction column, the counter current reaction is occurred between

CaO and VOHs. C_2HCl_3 was changed into $CaCl_2$, CO_2 and H_2O at 650^0C. Before the reaction, the concentration of C_2HCl_3 is 8.3 X 10^3 ppm and after the reaction, that is 0.3 – 3 ppm. About 4kg per hour of C_2HCl_3 is treated. CH_3Br was changed into $CaBr_2$, CO_2 and H_2O at 500^0C. Inlet of the concentration is 8.2 X 10^4 ppm and outlet is ca 7 ppm. Off gas was analyzed by gas chromatography mass spectrometry.

Conclusions

From the dechlorination reaction using moving bed, some important results can be obtained; CaO is very effective for dechlorinating material to VOHs. Another toxic compounds could not be detected during the reaction. Moving bed equipped with an agitating device is a very promising apparatus for dechlorinating of VOHs. Low running cost including lower electric power is available for the system because of using heat of reaction alone caused by reaction of VOHs and CaO.