CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A gaseous pollutant remover utilizing the electron attachment reaction was designed and constructed in this work. Low-energy electrons generated in the corona-discharge reactor are captured by electronegative gaseous pollutants, producing negative ions. The ions migrate in the electric field to the anode (reactor wall) and are removed at the wall.

The main purpose of the present research is to study the effect of changes in the structure of the corona-discharge reactor on the gaseous removal efficiency based on electron attachment reaction. A change in the reactor structure can affect simultaneously several important factors such as discharge current, electron energy, electric field strength, migratory distance and residence time in the reactor. The present research describes the effects of the reactor structure, namely, the cathode diameter, the anode (reactor) dimensions, and the number of cathodes in the reactor on the resulting removal efficiency with respect to three dilute gaseous pollutants, methyl iodide (CH_3I), 1,1,2-trichloro-1,2,2-trifluoroethane ($C_2Cl_3F_3$) and acetaldehyde (CH_3CHO). The experimental data of the study regarding reactor structure will be useful as guideline for optimizing or scaling up the device in the future.

From the experimental results, it can be concluded that the most suitable structure of a corona-discharge reactor for removal of dilute gases both from N_2

and air is the structure whose reactor diameter is the smallest and its single cathode wire is the thickest, as technically possible. In conclusion, it has been found that the gaseous pollutant remover constructed in this work has exhibited great potential for commercial application in gas purification.

6.2 Recommendations for future study

It is noteworthy that the method of gas purification based on electron attachment is innovative compared to conventional methods. Therefore, the data concerning removal results of many important kinds of gaseous pollutants are rarely available nowadays. It is recommended to use the prototype or scaled-up gaseous pollutant removers to further gather data on additional kinds of gases.

It has recently been found that some coexisting gaseous components in a gas mixture such as O_2 and H_2O vapor play important role in the enhancement or retardation of removal efficiency. Nevertheless, not many experimental data regarding removal results of individual targeted gases in a gas mixture are available. A further study of the role of several common coexisting gases on the removal of the individual targeted gases should be carried out.

Since there can be large differences in the individual removal efficiency of several pollutants in a gas mixture, simultaneous gaseous removal should be investigated in order to find how to improve their removal efficiencies.

Other types of corona-discharge reactors described in Section 3.2 should be also considered for the removal studies mentioned above.