CHAPTER VI

CONCLUSIONS AND RECOMMENDATION

6.1 Conclusions

The main purpose of the present research is to investigate the effect of elevated temperature and coexisting gases on the individual and simultaneous removal efficiency of acetaldehyde (CH_3CHO), ammonia (NH_3) and trimethyl amine [$(CH_3)_3N$] from N_2 using electron attachment reaction. The coexisting gases investigated are carbon dioxide gas, oxygen gas, and water vapor. From the results, it may be concluded as follows:

6.1.1 Effect of CO_2 coexisting gas on separate and simultaneous CH_3CHO, (NH_3) and $(CH_3)_3N$ removal

The presence of CO_2 substantially enhances the separate and simultaneous removal efficiency of CH_3CHO, (NH_3) and $(CH_3)_3N$ because of the effect of CO_3^- and O^- anions at low temperatures and various radicles at high temperature.

6.1.2 Effect of O_2 coexisting gas on separate and simultaneous CH_3CHO, (NH_3) and $(CH_3)_3N$ removal

The presence of O_2 drastically enhances the separate and simultaneous removal efficiency of CH_3CHO, (NH_3) and $(CH_3)_3N$ because of the effect of O_3 and O^- anion at low temperatures and N, O radicals at high temperatures. The co - presence of CO_2 has significant enhancement effect on the removal efficiency of CH_3CHO, (NH_3) and $(CH_3)_3N$ from N_2 - O_2.

6.1.2 Effect of H_2O on the removal of separate and simultaneous CH_3CHO, (NH_3) and $(CH_3)_3N$ removal

The presence of H_2O in N_2 slightly enhances the separate and simultaneous removal efficiency of CH_3CHO, (NH_3) and $(CH_3)_3N$ at low to moderate temperatures because of the effect of H^-, OH^- and O^- anions but slightly retards the removal efficiency at high temperatures because at a low discharge current, the relatively much smaller number of electrons tend to attach mostly to H_2O. The presence of water vapor in N_2 - O_2 - CO_2 mixed gas generally has favorable effect on the removal efficiency of CH_3CHO, NH_3 and $(CH_3)_3N$.

6.1.3 Two corona-discharge reactors in series for minimizing generation of byproducts and/or enhancing removal efficiency

Two independently operated corona discharge reactors in series have shown a good promise for minimizing the generation of byproducts and enhancing the removal efficiency. The first reactor should aim at the complete removal of $(CH_3)_3N$ at 300°C, whereas the second should aim at the complete removal of CH_3CHO and NH_3 at 200°C while minimizing the generation of byproduct CO, O_3 and NO_x down to 100 ppm, 0 ppm and 0 ppm, respectively. As the discharge current increases, the byproduct CO increases.

6.1.4 Suitable Conditions for the removal of target gases from N_2 - CO_2

Single component

Target Gas	Acetaldehyde	Ammonia	Trimethyl amine
CO_2 (%)	20	20	20
T (^oC)	100	100	100
ψ' (-)	1.0	0.21	0.97

Binary components

Target Gas	Acetaldehyde+Ammonia		Acetaldehyde+Trimethyl amine		Ammonia+Trimethyl amine	
	Acetaldehyde	Ammonia	Acetaldehyde	Trimethyl amine	Ammonia	Trimethyl amine
T (^oC)	100	100	100	100	100	100
ψ' (-)	0.91	0.64	0.93	0.95	-0.23	1.00

Tertiary components

Target Gas	Acetaldehyde + Ammonia + Trimethyl amine		
	Acetaldehyde	Ammonia	Trimethyl amine
T (^oC)	100	100	100
ψ' (-)	0.91	1.00	1.00

6.2 Recommendation for future work

From the experimental results, CO is still detected, and its concentration generally increases as the discharge current increases. As in the case of the exhaust gas from a combustion process, it may be impossible to completely get rid of the byproduct CO in the presence of CO_2 because of the chemical equilibrium between CO and CO_2. Nevertheless, more investigation of the applications of two independently operated corona discharge reactors in series for minimizing generation of byproducts should be carried out. To minimize the operating costs, the operating temperature and current discharge, which affect the energy - based efficiency, ψ_{ener} should be optimized.