CHAPTER 4

CONCLUSIONS

Although many metal oxides are sensitive toward ethanol and acetone. In this work commercially available TGS 822 sensor head from Figaro Company Limited is selected for the detection of ethanol and acetone because it has low cost, long-life and wide dynamic range. The TGS 822 is a SnO_2 thick film on the surface of an alumina ceramic tube which contains an internal heater. TGS 822 by itself cannot be used for the detection of the mixture of acetone and ethanol. Therefore in the present work an analytical column is added into the detection system to separate ethanol and acetone before reaching the sensor head. The data of the response can be collected by a software program in the PC system.

The optimum conditions of the system for the detection of acetone and ethanol are achieved by varying the flow rate of the carrier gas, V_H, V_C, R_L and the injection port temperature. It is found that the flow of the carrier gas is 15 mL/min, the circuit condition with $V_H = 5.5$ V, $V_C = 20$ V, $R_L = 68$ kΩ and the injection port temperature is 150 ^{o}C. In pure air R_S is high. In the presence of detectable gas, R_S changes with the variation of gas concentration, the load resistance on the resister (R_L) is measured by a multimeter. If the output voltage (V_{RL}) increases while the R_S decreases, the change in the R_S depends on the concentration of ethanol and acetone.

The detection principle of oxide semiconductor sensor is based on the chemical adsorption and desorption of gas on the sensor surface. At atmospheric condition, types of chemisorbed oxygen ion on the surface of the oxide semiconductor are O_2^-, O^-, and O^{2-}, type of chemisorbed oxygen ion on the SnO_2 surface is O^-.

Therefore the changing in density of the oxygen negative ion on the SnO_2 surface is used to determine the amount of ethanol and acetone quantitatively while the retention time (t_R) is used to determine the presence of ethanol and acetone qualitatively as 1.95 and 0.57 min respectively.

The standard solution of acetone and ethanol are prepared in the ranges from 5-40 ppm and 10-60 ppm respectively. One μL of each concentration is injected into the sensor system under the optimum conditions. In this work the TGS 822 response values as peak areas are plotted against concentration of standard solution for construction of the calibration graphs. The limit of detections are 9.27 mg/L and 4.41 mg/L for ethanol and acetone respectively.

Suggested future work

1. The sensor head made from metal oxides nanoparticles synthesized from Nanoscience Research Laboratory will be replaced TGS 822, in which the response and the limit of detections will be investigated in the new system.
2. Other volatile organic compounds such as ether with low molecular weight and alcohol will be tested using the device.