INVESTIGATION OF CARBON DIOXIDE TRAPPING CAPABILITY OF N,N-ETHYLENEBIS(ACETYLACETONEIMINATO)COPPER(II) COMPLEX

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Introduction

Carbon dioxide (CO_2) is a greenhouse gas that traps the earth's heat and contributes to the global warming. The concentration of CO_2 has risen by about 25 % after the industrial revolution and it has become a severe threat at present. Therefore, many attempts are tried at present for the mitigation of the pollution caused by CO_2. One such attempt is to synthesize systems capable of trapping CO_2. Recent studies regarding this issue have shown some transition metal macrocyclic complexes are capable of trapping and utilizing small molecules like carbon dioxide (Yin and Moss, 1999). This paper describes the capability of trapping CO_2 by N,N-ethylenebis (acetylac etoneiminato) copper(II) Complex.

Materials and Methods

All the chemicals used for the synthesis were of analytical grade. N,N-ethylenebis(acetylacetoneimina to) copper(II) complex was synthesized by template synthesis method (Udugala-Ganehenege and Adhikari, 2008). CO_2 was produced from the reaction between $CaCO_3$ and HCl. CO_2 produced was passed through a series of methanolic solutions of the complex having different concentrations (Table 1) at known temperatures. CO_2 was detected by using CO_2 sensor (Vernier LabPro interface) as the amount (in *ppm*) transmitted with time (in *s*).The total amount of CO_2 trapped was then calculated by taking the area under then curve of transmittance Vs. time. The IR spectra were recorded from NICOLET 6700 FT/IR spectrometer for dry KBr pellets of the complex before and after passing CO_2. Control experiments were carried out for each sample by using Cu $(CH_3COO)_2$.

Results

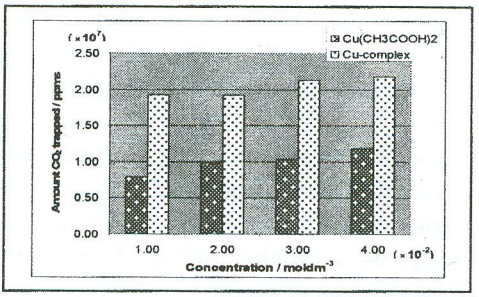

Figure 1. Amount of CO_2 trapped with time

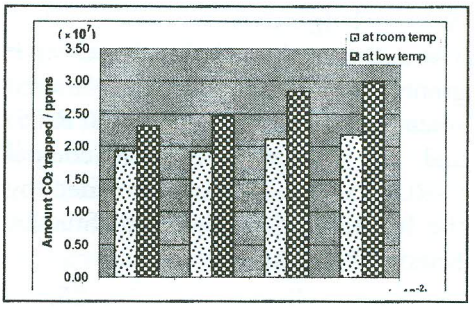

Figure 2. Amount of CO_2 trapped at RT and 3 ^{0}C

Discussion

The amount of CO_2 trapped by N,N-ethylenebis (acetylacetoneimia to)

copper(II) complex at a particular time period is about two times higher than that of $Cu(CH_3COO)_2$(Figure 1). This observation indicates comparatively higher affinity of CO_2 towards N,N-ethylenebis(acetylacetoneiminato)copper(II) complex . This association may be due to the significant axial coordination or trapping of CO_2 into N,N-ethylenebis-(acetylicetoneiminato) copper(II) complex. The affinity of binding CO_2 increases with decreasing the temperature (Figure 2). The presence of a small new band at 2095 cm^{-1} of the IR spectra (Figure 3) after passing CO_2 may be due to the stretching of coordinated/associated CO_2 to the complex.

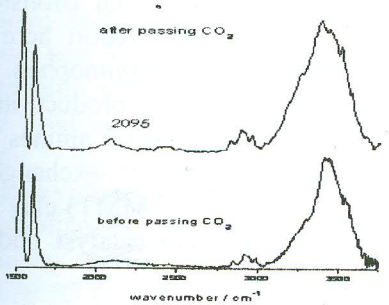

Figure 3. IR spectra of the complex before and after passing CO_2 through a solid sample of the complex

Conclusion

Ethylenebis(acetylacetoneiminato)copper(II) complex (0.04 M in methanol) shows the capability of trapping ~34 % of CO_2 passed at room temperature. The trapping capacity increases up to ~54 % at 3 ^{0}C. Therefore ethylenebis(acetylacetoneiminato)copper(II) complex may be used for the utilization of CO_2. Further studies to detect the fate of the trapped CO_2 are underway.

Table 1. The CO_2 amount trapped by the Cu-complex and $Cu(CH_3COO)_2$ (Total amount of CO_2 Passed × time = 5.518 × 10^7 ppm s): a. Concentration /M (in methanol); b. Amount CO_2 trapped at RT by $Cu(CH_3COO)_2$

a	B	[Amount CO_2 trapped by N, N-ethylenebis(acetylacetoneiminato) copper(II) Complex] × [time] in ppms/10^7	
		at RT	at 3 ^{0}C
0.01	0.791	1.924	2.313
0.02	0.978	1.917	2.472
0.03	1.034	2.121	2.850
0.04	1.177	2.181	2.991

Acknowledgement

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References

Udugala-Ganehenege M.Y and Adhikari A.M.K.S.P. (2008). Spectroscopic Evidence for the pH Sensitivity and Anion Trapping Capability of N,N-ethylenebis(acetylacetoneiminato) copper(II) Complex, Proceedings of the 64th Annual Sessions, SLAAS. 156.

Yin, X. and Moss, J.R. (1999). Recent development in the activation of carbondioxide by metal complexes. Coord.Chem.Reviews, 181:27-59.