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Note

KINETICS OF NON-ISOTHERMAL DECOMPOSITION OF ACID MALEATO COMPLEXES OF SOME BIVALENT METALS

S.S. SAWHNEY, R.M. SATI and V.S. NEGI
Chemistry Department, DAV (P.G.) College, Dehra Dun 248001 (India)

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McGinn et al. [1] and Misra and Naik [2] studied the complexing capacity of maleic acid with metals. Edge [3] reported his findings on the pyrolysis of normal nickel maleato. This note is concerned with the estimation of kinetic parameters of the non-isothermal decomposition of acid maleato complexes of Co(II), Cu(II), Ni(II) and Cd(II).

EXPERIMENTAL

All the chemicals used were of A.R. grade. Naik's procedure [4] was adopted to isolate the metal complexes. Air-dried samples were pyrolysed on a manually operated assembly equipped with a Toshniwal balance at a rate of $8°\ min^{-1}$.

RESULTS AND DISCUSSION

On pyrolysing each sample, two sigmoids were observed, providing clues to the initial cleavage of water molecules and the loss of organic matter of the anhydrous complex at temperatures ranging from 200 to 300°C (Table 1). Each sigmoid was individually analysed for the kinetics of non-isothermal decomposition of the metal complexes, resembling the reaction: $A_{(s)} - B_{(s)} + C_{(g)}$, tested for such a study by Freeman and Carroll [5], applying the methods of Dave and Chopra [6] detailed earlier, and Freeman and Carroll.

Table 1 incorporates the values of the kinetic parameters. Z values are abnormally low, proving that the non-isothermal decomposition of the metal complexes under study is a slow process. The difference in E values may be due to the non-adherence to the conditions necessary for the Freeman and Carroll method and the difficulty of maintaining them with the manually operated assembly; the slight errors in temperature, heating rate, etc., have

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TABLE 1

Kinetic parameters for the non-isothermal decomposition of acid maleato complexes of some divalent metals

Reaction	Temp. (°C)	Method A			Method B	
		n	E	Z	n	E
$CuR \cdot 4H_2O \rightarrow$						
$CuR + 4H_2O$	80–190	1	9.92	3.16	0.86	23.03
$CuR \rightarrow CuO + DP$	240–350	1	7.62	4.47	–	–
$NiR \cdot 4H_2O \rightarrow$						
$NiR + 4H_2O$	70–120	1	19.22	199	–	–
$NiR \rightarrow NiO + DP$	200–390	1	7.82	2.95	0.75	7.82
$CoR \cdot 4H_2O \rightarrow$						
$CoR + 4H_2O$	70–200	1	7.32	0.19	0.54	5.21
$CoR \rightarrow Co_3O_4 + DP$	220–560	1	5.03	0.15	0.61	5.21
$CdR \cdot 2H_2O \rightarrow$						
$CdR + 2H_2O$	60–200	1	9.60	1.99	0.70	7.81
$CdR \rightarrow CdO + DP$	300–590	1	7.78	0.23	0.77	18.42

Method A = Dave and Chopra. Method B = Freeman and Carroll. DP = Dissociation products. R = Mal·H_2. n = reaction order. E = activation energy of the reaction. Z = collision number.

no serious influence on the data calculated from the DTG curves of the complexes by the Dave and Chopra method.

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