

THERMAL AND ELEMENTAL ANALYSIS OF LIQUID CHELATE FERTILIZER OBTAINED FROM THE $\text{FeCl}_3 - \text{EDTA-Na}_4 - \text{H}_2\text{O}$ SYSTEM

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Abstract : *This in the article Based on FeCl_3 and EDTA-Na_4 ($\text{C}_{10}\text{H}_{12}\text{N}_2\text{O}_8\text{Na}_4$). taken liquid chelate "Iron chelate " fertilizer complex (Fe-EDTA)" thermogravimetric (TGA), differential thermal (DTA) and scanner electronic microscopy energy-dispersive in spectroscopy (SEM-EDS) methods research TGA analysis was done . as a result sample up to 800°C when heated general mass loss of 24,140 % organization reached , main thermal effects at temperatures of 104.97°C , 162.84°C , 237.28°C , 276.65°C and 367.75°C observed SEM- EDS analysis sample contains the elements C (42.52%), O (38.49%), Na (6.68%), Cl (1.78%) and Fe (8.95%) existence showed . Obtained results chelate fertilizer thermal stability and element composition assessment opportunity gave .*

Key words: *chelate fertilizer, EDTA-Na_4 , FeCl_3 , thermogravimetry, DTA, SEM-EDS, iron, thermal stability.*

INTRUDUCTION

Microelements, especially iron, are essential for normal plant growth. and development for necessary was It is an essential element . Iron deficiency as a result to the surface coming chlorosis village on the farm big economic damage This brings. problem solution in doing from chelated iron fertilizers use effective method EDTA

(ethylenediaminetetraacetic acid) acid (based) chelates the most stable and wide applicable from complexes is one.

Liquid chelate of fertilizers quality in evaluation their thermal stability and element composition determination important importance Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) of fertilizer to heat in the process mass change and thermal effects study opportunity SEM -EDS method and the element composition high in accuracy in determining is applied .

This of the research purpose from the $\text{FeCl}_3 - \text{EDTA-Na}_4 - \text{H}_2\text{O}$ system taken liquid chelate fertilizer ("Iron chelate") complex (Fe-EDTA)) thermal features and element composition complex from learning consists of .

Materials and research methods

Research object as Based on FeCl_3 and EDTA-Na_4 ($\text{C}_{10}\text{H}_{12}\text{N}_2\text{O}_8\text{Na}_4$). taken liquid chelate "Iron chelate " fertilizer complex (Fe-EDTA) ” used . Sample in advance prepared and dried in case to analyzes submitted .

Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) in the file "2024-11-20.FeCl3Tb-4Na-12obr.TGA.DTA.DSC.pdf" cited results based on done Analysis up to 800 °C temperature between take Mass loss and thermal effects automatic accordingly record was done .

Results and discussion

Thermogravimetric analysis results

The results of TGA and DTA analysis of "iron-chelate complex (Fe-EDTA)" revealed the following main indicators (Table 1).

Table 1

"Iron chelate TGA analysis of the complex (Fe-EDTA) results

Indicator	Value
Elementary mass	4,365 mg
Final mass (800°C)	3,312 mg
General mass loss	1,053 mg
General mass loss , %	24,140%
Elementary temperature	41.74°C
Final temperature	801.71°C

TGA curve on the line one how many step by step mass loss observed . The first stage around 104.97°C is, this sample in the content humidity and adsorbed of water evaporation with depends on . At this stage mass loss of 0.616 mg (14.122%) organization reached .

Second stage around 162.84°C observed, this is EDTA -Na₄ crystallization water loss and partially degradation with is explained. At this stage mass loss of 1,901 mg (43,581%) organization reached .

Third stage at temperatures of 237.28°C and 276.65°C At these temperatures, EDTA organic part of decomposition happened will be. Fourth stage around 367.75°C is, this is iron chelate of the complex complete decomposition and iron oxides harvest to be with depends.

DTA curve on the line one how many endothermic and exothermic effects record was endothermic at 104.97°C. effect (water evaporation), endothermic at 162.84°C effect (crystallization) water loss), exothermic at 237.28°C and 276.65°C effects (organic part of combustion), and at 367.75°C endothermic effect (of iron oxides) harvest (to be) was observed.

SEM-EDS analysis results

"Iron chelate" SEM-EDS analysis of the complex (Fe-EDTA). The results are presented in Table 2.

Table 2

**“Iron chelate Elemental composition of complex (Fe-EDTA)
(Spc_009)**

Element	Line	Mass %	Atomic %
C	K	42.52 ± 0.08	54.79 ± 0.10
Oh	K	38.49 ± 0.12	37.23 ± 0.12
No	K	6.68 ± 0.04	4.50 ± 0.02
Hand	K	0.19 ± 0.01	0.11 ± 0.00
Cl	K	1.78 ± 0.01	0.78 ± 0.01
Fe	K	8.95 ± 0.05	2.48 ± 0.01
Pt	M	1.38 ± 0.02	0.11 ± 0.00
Total		100.00	100.00

Spc_009 fitting ratio: 0.0154, non-standardized ZAF method

Comparison The elemental composition of sample Spc_008 was also studied (Table 3).

Table 3

Elemental composition of sample Spc_008

Element	Line	Mass %	Atomic %
C	K	37.46 ± 0.07	49.78 ± 0.10
Oh	K	41.32 ± 0.12	41.23 ± 0.12

Element	Line	Mass %	Atomic %
No	K	7.49 ± 0.04	5.20 ± 0.03
Hand	K	0.17 ± 0.01	0.10 ± 0.00
Cl	K	0.45 ± 0.01	0.20 ± 0.00
Fe	K	11.83 ± 0.06	3.38 ± 0.02
Pt	M	1.27 ± 0.02	0.10 ± 0.00
Total		100.00	100.00

Spc_008 fitting ratio: 0.0161

SEM-EDS analysis results this showed that "Iron- chelate complex (Fe-EDTA)" in the composition carbon (42.52% by mass) and oxygen (38.49% mass) high in quantity This is EDTA- Na₄ organic structure and carboxyl groups existence with Sodium (6.68% mass) is present in EDTA -Na₄ 8.95 % of iron by mass in the amount of to be of fertilizer main microelement with iron as enriched confirms .

Sample Spc_008 with In comparison, "Iron- chelate" complex (Fe-EDTA)" (8.95 %) compared to Spc_008 (11.83%) less , but carbon The amount (42.52%) is higher. These differences of samples structural in proportion changes with depends.

Chlorine's "Iron Chelate" complex (Fe-EDTA)" in 1.78% by mass in the amount of to be FeCl₃ content chloride ion residue as the rest shows. Aluminum (0.19%) and platinum (1.38%) to be determined , perhaps , sample preparation or tool materials with related. In SEM-EDS analysis, platinum is often metallization in the process is used.

Discussion

Received results this shows that "Iron- chelate complex (Fe-EDTA)" thermal in terms of one how many in stages decomposes. At 104.97°C, water evaporation , crystallization at 162.84°C of water loss , organic at 237.28-276.65°C part of decomposition and iron oxides at 367.75°C harvest to be is observed .

General mass loss of 24,140 % organization example in the composition pilot components (water, organic part) relative less that This chelate fertilizer high thermal stability confirms .

SEM-EDS analysis sample in the composition of iron chelate in the form of existence and those plants by easy adaptable in case that shows . 8.95% of iron by mass amount to chlorosis against effective tool as use for enough .

TGA and DTA analysis of fertilizer storage and application conditions in marking important importance Fertilizer is above 100°C . at temperatures non-preservability recommendation is done , because this at temperature humidity evaporation and of the content change begins .

Conclusion

Transferred research as a result following to conclusions bride :

1. "Iron chelate" TGA analysis of the complex (Fe-EDTA) up to 800°C when heated general mass loss of 24,140 % organization what has happened showed . Home mass loss at temperatures of 104.97°C, 162.84°C, 237.28°C, 276.65°C and 367.75°C observed .

2. DTA analysis one how many endothermic and exothermic effects record was: 104.97°C (water evaporation), 162.84°C (crystallization water loss), 237.28-276.65°C (organic part of combustion) and 367.75°C (combustion of iron oxides) harvest to be).

3. SEM-EDS analysis sample contains the elements C (42.52%), O (38.49%), Na (6.68%), Cl (1.78%) and Fe (8.95%) existence Iron high amount of fertilizer to chlorosis against effective that confirms .

4. Received results based on liquid chelate Fertilizer at temperatures below 100°C storage and application recommendation is being done.

5. In the future taken of fertilizer different village farm to crops in use agronomic efficiency in the field study to the goal is appropriate.

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