Summary

THE DOCTOR'S DISSERTATION

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"EDDHA and EDDHSA micronutrient chelate technology for fertilizing purposes"

The doctoral dissertation presents the results of modified syntheses of EDDHA and EDDHSA chelators and the preparation of their micronutrient chelates for agricultural purposes. In the selection of the synthesis path, the possibility of their application on an industrial scale was primarily considered. The synthesis was carried out using the Mannich reaction and the modified Strecker method of both examined chelators.

The paper presents the results of the degree of complexation of four microelement ions used for the production of fertilizers by EDDHA and EDDHSA. The effectiveness of micronutrient chelation was studied for four cations at different pH values in the base electrolyte environment and in fertilizer environments (N, NP, NPK). In order to compare the obtained results, tests were carried out under the same conditions for three other chelators: EDTA, IDHA and HBED. The reaction of chelation of micronutrient ions by EDDHA and EDDHSA occurs in fertilizer environments, but it is most effective in the base electrolyte environment at a pH of 7.

The study examined changes in the content of iron chelates and ions over time in aqueous solution and fertilizer systems (N, NP and NPK) at various pH values. The obtained results confirm that Fe-EDDHA and Fe-EDDHSA chelates can be used as components of compound fertilizers.

The level of biodegradation of both chelates was assessed by static and kinetic tests. In order to compare the results obtained, the biodegradation process was carried out for three other chelators under the same conditions: EDTA, IDHA and HBED. EDDHA and EDDHSA under the kinetic and static test conditions are classified as substances that are not readily biodegradable in the environment and biological sewage treatment plants.

The work presents the schematic diagram and mass balance of the Fe-EDDHA and Fe-EDDHSA chelates obtained. In both cases, for economic reasons, a process was planned based on Mannich's one-step reaction. A modification of the method proposed by Petree was introduced, which allowed to reduce the amount of substrate and organic solvents used. This will reduce the negative impact on the environment and production costs. Composition, production method and mass balance of foliar liquid fertilizer 12-4-6 from Fe-EDDHA or Fe-EDDHSA were also proposed. The composition of this fertilizer allows its use for all types of crops. It can be used preventively, especially on soils poor in absorbable iron compounds.