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ОЛИЙ ВА ЎРТА МАХСУС ТАЪЛИМ ВАЗИРЛИГИ

ФАРҒОНА ДАВЛАТ УНИВЕРСИТЕТИ

FarDU. ILMIY XABARLAR-

1995 йилдан нашр этилади
Йилда 6 марта чиқади

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НАУЧНЫЙ ВЕСТНИК. ФерГУ

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ТАРКИБИДА ФЕРРОЦЕН САҚЛОВЧИ СУЮҚ АЗОТЛИ ЎҒИТЛАР ОЛИШ

ПОЛУЧЕНИЕ ЖИДКИХ АЗОТНЫХ УДОБРЕНИЙ С ФЕРРОЦЕНОМ В ИХ СОСТАВЕ

OBTAINING LIQUID NITROGEN FERTILIZERS WITH FEROCENE IN THEIR STRUCTURE

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Аннотация

Мақолада минерал ўғитлар ва уларнинг турлари, таркибида ферроцен сақловчи суюқ азотли ўғитларнинг олиниши айрим спектрал таҳлиллари келтириб ўтилган.

Аннотация

В статье представлен спектральный анализ минеральных удобрений и их видов, производства жидких азотных удобрений, содержащих ферроцен.

Annotation

The article presents some spectral analysis of mineral fertilizers and their types, the production of liquid nitrogen fertilizers containing ferrocene.

Таянч сўз ва иборалар: минерал ўғитлар, суюқ азотли ўғитлар, ферроцен, фосфорли, азотли, калийли, магнийли ўғитлар.

Ключевые слова и выражения: минеральные удобрения, жидкие азотные удобрения, ферроцен, фосфор, азот, калий, магниевые удобрения.

Keywords and expressions: mineral fertilizers, liquid nitrogen fertilizers, ferrocene, phosphorus, nitrogen, potassium, magnesium fertilizers.

Salts and other inorganic, industrial and mineral products used to obtain stable, high yields that retain elements necessary for plant growth, development and soil fertility are referred to as mineral fertilizers [1].

Fertilizers are divided into classes depending on the origin, field of application, composition, properties and methods of obtaining. All fertilizers are divided into two:

1) direct (the use for fertilizing plants)
2) indirect (the use for the correction of soil melioration and pH)

Depending on their origin, fertilizers are divided into mineral, organic-mineral and bacterial fertilizers. Mineral fertilizers are prepared on an industrial basis and retain the nutrients needed for plants, mainly in inorganic form. Organic fertilizers include manure, peat, green plants, compotes, and more. Bacterial fertilizers contain microorganisms that accumulate nutrients in the soil that the plant can assimilate.

Depending on the composition of mineral fertilizers are divided into phosphorus, nitrogen, potassium, magnesium, barium and other fertilizers. Fertilizers are divided into simple or one-component and complex fertilizers, depending on the number of nutrients they contain. Normal fertilizers contain only one nutrient. However, this is a conditional concept, because in many cases they also contain Mg, Ca, S and trace elements [1, 2,3].

About 2 million tons of ammonia are produced in the country at the Navoi Nitrogen Production Association, Almalyk ammophos and Fergana nitrogen fertilizer plants by contact method.

In modern botany, the dynamics of production of liquid nitrogen fertilizers and feeding plants with them is growing day by day. Liquid nitrogen fertilizers are industrially produced minerals that are applied to the soil in liquid form. Liquid fertilizers include anhydrous ammonia (82% nitrogen), aqueous ammonia (18-20% nitrogen), ammonia (30-50% nitrogen), solutions of potassium salts (14% K2O), phosphoric acid, liquid complex fertilizers. When liquid fertilizers are applied to the soil

before plowing or planting, they mix well with the soil, do not wash off under the influence of water, and increase the yield compared to when applied with ammonium nitrate. For example, 3.5 t / ha more grain was obtained from winter wheat at the expense of KAA (urea-ammonia mixture) than the equivalent dose of ammonium nitrate.

Today, the demand for liquid fertilizers is growing because they have a number of advantages over solid fertilizers. For example, they have good solubility in water and nitrate solutions, they have simple method of preparation, they require low capital and operating costs, they have no toxic waste, they are 2-3 times less labor-demanding in their loading, transportation and use in agriculture is easier, they can be evenly distributed in the soil and have a number of other advantages. One of the advantages of urea-ammonium nitrate (KAS) produced in our country is that it contains nitrate, ammonium and amide nitrogen. It is beneficial to all agricultural plants while giving effective results in basic nutrition and supplemental fertilization. KAS (contains 28-32% nitrogen) provides long-term nutrition of plants with nitrogen. Due to its lack of free nitrogen, it does not evaporate into the atmosphere when deposited in the soil, but the presence of the ammonium form requires wet soil compaction under high temperature conditions and in the absence of precipitation after application [4,5].

Urea-ammonium nitrate is a mixture of concentrated aqueous solutions, the mass fractions of which are 31-36 and 40-44%, respectively. The industry produces KAS or urea ammonia mixture (KAA) - in three forms of urea and ammonium nitrate: KAS-28, KAS-30 and KAS-32, in which the nitrogen content is 28%, 30% and 32%, respectively [6].

In order to fully meet the demand of the country for liquid mineral fertilizers, it is important to use industrial minerals, improve the quality of the production economy, create and implement world-class science and technology, best practices, innovative technologies.

Studies show that the use of fertilizers containing micronutrients (Mn, Zn, Fe, B, Cu, Co, etc.) improves the yield and quality of agricultural products. Lack of micronutrients disrupts the normal growth and metabolism of plants, reduces productivity and increases the susceptibility to various diseases. For example, chlorosis, which occurs in plants, is caused by iron deficiency. The use of iron-containing micronutrients is important in the prevention and elimination of this disease. At the same time, the application of mineral fertilizers in combination with basic fertilizers increases the uptake of nitrogen by 5-9% and phosphorus by 4-5%, which increases the yield of cotton from 2.5 to 7.0 centner / hectare [7].

Given the above, we set the goal of synthesizing liquid nitrogen fertilizers containing iron. It is known from the literature that a number of derivatives of iron-containing ferrocene have been recognized as biologically active substances. Therefore, it is important to synthesize its water-soluble products, to study their positive effect on the growth and development of plants, disease control and productivity in combination with liquid nitrogen fertilizers.

Ferrocene is a metalloorganic compound with aromatic properties. A.N.Nesmeyanov, N.S.Kochetkova, E.G.Perevalova, V.A.Sergeev, V.D.Vilchevskaya, S.A.Shlyogl, L.Asatiani, E.A.Kolennikov, foreign scholars such as Y.M. Paushkin, R.B. Woodward conducted research on ferrocene and its derivatives. They synthesized aliphatic and aromatic derivatives of ferrocene.

In our country, chemists, inventors and rationalizers, doctors of chemistry, professors A.G. Makhsumov, I.R. Askarov and other scientists have obtained ferrocene and biologically active substances based on it. The biostimulants created by them are widely used in various fields of agriculture [8,9,10].

We managed to synthesize a biologically active substance based on m-ferrocenylbenzoic acid in the Scientific Laboratory of Commodity Chemistry established at Andijan State University.

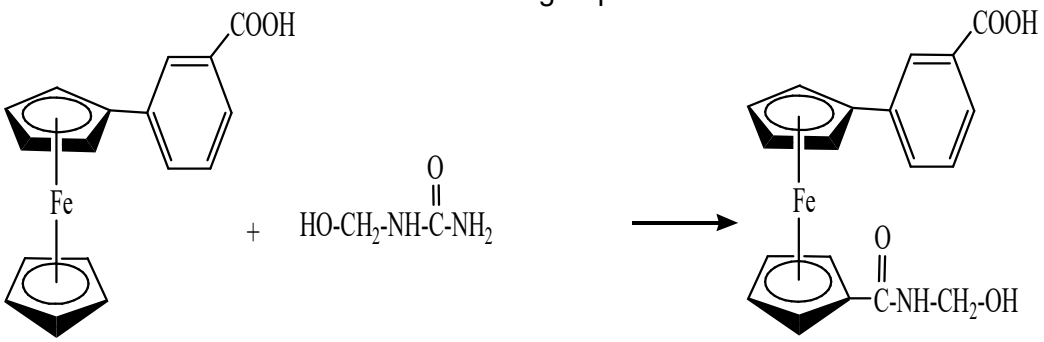
Experimental part

Reaction of m-ferrocenylbenzoic acid with monomethyl urea

Equipped with an agitator, a dropper funnel, and a thermometer, a 3-neck 500 ml volumetric flask was filled with 150 ml of water, 1.35 g of monomethyl urea with 100 g of ice cubes, and 11.5 ml of concentrated hydrochloric acid. The flask is stirred vigorously at -2 °C. A solution of 15 g of sodium nitrite in 40 ml of water was added dropwise through an infusion funnel for one hour. At the end of the

drip, 1 g of urea dissolved in 5 ml of water and 2 g of sodium acetate solution dissolved in 10 ml of water were added to the reaction mixture to decompose the excess HNO_3. The ice bath was then replaced with a water bath. 0.75 g of m-ferrocenylbenzoy dissolved in 100 ml of diethyl ether was added to the reaction mixture. The drip funnel was replaced with a return cooler. The mixture is heated at 34-36 °C for 3.5 hours while stirring. At the end of the reaction, the mixture was taken to a separating funnel and the aqueous and etheric layers were separated. The aqueous layer was extracted 3 times with diethyl ether. The ethereal layers were added and washed 2 times with water. Ether layers were added and extracted several times with 2% sodium hydroxide solution. The resulting aqueous extract was neutralized with a 5% hydrochloric acid solution.

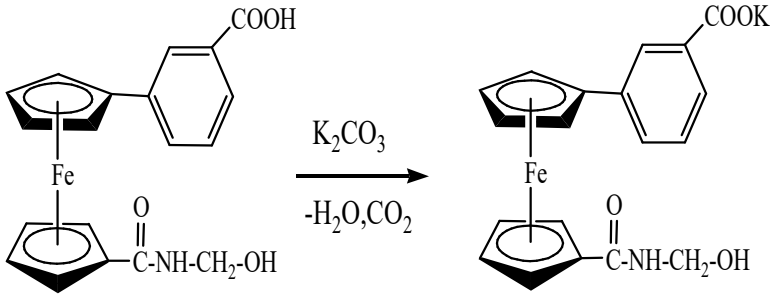
The yield is 0.5 g (52% m-ferrocenylbenzoic acid) T.s = 153-154 oS
The mixture formed as a result of reactions of m-ferrocenylbenzoic acid with monomethylolochemina was separated from each other by column chromatography. The yield of synthesized 1 '- (3-carboxyphenyl) -1-N-methyloxyperrocenylamide was 52%. When the substance was analyzed using IR spectroscopy, the absorption of light at 1102 cm-1 indicated the presence of an exchanged cyclopentadienyl ring in the ferrocene residue. The absorption line at 1403 cm-1 indicates the presence of deformable oscillating OH- groups, and at 3581 cm-1 davalent oscillating -NH- groups. The reaction scheme is as follows:



1 '- (3-carboxyphenyl) -1-N-methyloxyperrocenylamide potassium synthesis

To carry out the synthesis, 365 mg (0.001 mol) of 1 '- (3-carboxyphenyl) -1-N-methyloxyperrocenylamide is obtained and dissolved in 20 ml of diethyl ether. The solution is poured into a separating funnel and a solution of 69 mg of K_2CO_3 in 10 ml of water is added to it. The aqueous layer is separated and the water evaporates. This resulted in the formation of the potassium salt of 1- (3-carboxyphenyl) -1-N-methyloxyferrocenylamide.

1 '- (3-carboxyphenyl) -1-N-methyloxyperrocenylamide was obtained by its action in an aqueous solution of K_2CO_3 to obtain its potassium salt. The reaction scheme is as follows:



Ferben-Kaliy

The resulting salt was separated into a reddish powder. Product yield is 92%.

The synthesized biologically active compound together with urea-ammonium nitrate (KAS) produced in our country was tested in laboratory and field practice for its effect on the growth and development and yield of wheat and cotton plants.

We applied the fertilizer as a stimulant in suspension form when feeding the leaves

during the cotton application. The results are presented in Table 1.

Table 1

Influence of liquid nitrogen fertilizers containing ferrocene on cotton yield, (ts / ha).

№	Experiment options	Processing time and standards		Cotton yield (ts / ha)	Additional to control	In addition to the standard
		During mating	At the beginning of the flowering period			
1	Control	Unprocessed		34,6	-	-4,4
2	KAS	1,2 l/300 L	1,0 l/300 L	39,0	4,4	-
3	Ferfenol	1,2 l/300 L	1,0 l/300 L	39,7	5,1	0,7
4	Ferben-Kaliy	1,2 l/300 L	1,0 l/300 L	40,8	6,2	1,8
5	Ferben-Natriy	1,2 l/300 L	1,0 l/300 L	40,3	5,7	1,3
6	SAKO (standard)	1,2 l/300 L	1,0 l/300 L	39,0	4,4	-

During the cotton operation, 34.6 c / h of cotton was harvested in the water-controlled control variant. During the mowing and flowering period of cotton, treated in the norms of 1.2 and 1.0 l / h, in variant (2) it was 39.0 c / h, which is 4.4 ts / ha higher than in the control. In the variant treated with Ferphenol (3) the yield was 39.7 c / h, which is 5.1 c/ h higher than the control and 0.7 ts / ha higher than the standard. The highest yield was 40.8 c / h in the Ferben-Kaliy (4) variant, which was 6.2 c / h higher than the control and 1.8 c / h higher than the standard. During the mating and flowering period of cotton in the variant treated in the norms of 1.2 and 1.0 l / h (5) was 40.3 c / h, which is 5.7 c/ h higher than the control and 1.3 c / h higher than the standard. The standard was 39.0 c / h in variant (6) treated with SAKO, which was 4.4 c / h higher than the control.

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