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METHOD FOR PRODUCING SAPROPEL EXTRACT FOR USE AS FERTILIZER FOR GRAIN CROPS

Abstract. The leading industry in the regional economy is agriculture, especially the crop sector. In a competitive market economy and growing environmental problems associated with agricultural activities, the use of environmentally friendly fertilizers with low cost is required to increase crop yields. The aim of the study is to develop a concentrated extract based on the organomineral resources of lakes and to use grain crops in presowing treatment to increase yield. Why it is necessary to develop a method for obtaining the Saprolin extract of various concentrations. Object of study: Organomineral accumulations of lakes. Today, scientific research on the use of organic resources of lakes in agriculture, to improve the qualitative and quantitative indicators of agricultural products, is moving to a new stage. It is proposed to use concentrated sapropel extract obtained on the basis of the resources of local lakes in pre-sowing seed treatment as fertilizer.
Key words: methodology, sapropel extract, fertilizer, crops, crop sector.

Introduction. The new proposed technology can give a significant environmental effect - it is assumed that pre-sowing treatment with sapropel extract will contribute to the direct supply of seeds with biologically active substances, as well as macro- and microelements. The economic effect can really be expressed by an increase in the yield of environmentally friendly products at low cost, and the environmental effect can have a long-term effect in the form of a contribution to the conservation of natural soil fertility. Due to the fact that the North Kazakhstan region is a grain region, it is proposed to use this extract when sowing grain crops.

Sapropel as an environmentally friendly and high-quality organomineral fertilizer is used for all types of soils and all types of plants to increase productivity, which is an important condition, including for soils degraded and degumified [1, 2]. The concentrated extract prepared on the basis of sapropel will become an organomineral saturated structure that feeds the seeds of agricultural plants with resources.

Main part. The main research results are to create a technology for the production of sapropel extract of optimal concentration; in determining its properties, in developing methods for presowing treatment of seeds of agricultural crops with extract. As a result of the study, recommendations will be developed on the rational use of local resources for the optimization and ecologization of agricultural nature management, which will find practical application by nature users for the development of organic farming in order to improve the quality and safety of food. This, in turn, contributes to an increase in the export of organic products and the development of competitive, highly efficient entrepreneurial activities, which in general will contribute to the socio-economic development of the region.

Necessary equipment: 700 ml beaker, 96 % ethanol, sapropel, methanol, distilled water, glass rod, glass beakers, filter, scales, 3mm cuvettes, centrifuge, photometer, water bath, viscometer, conductivity meter, pH meter, refractometer.

We take a glass glass of 700 ml, mix in it sapropel and ethyl alcohol 96 % in a ratio of 1: 1 (200 ml of dirt and 200 ml of alcohol). Weigh sapropel (table 1):

Table 1 - The mass of sapropel during the experiment

Показатель	Масса со стаканом, грамм	Масса без стакана, грамм
Масса сапропели	394	222
Масса сапропели со спиртом	550	378

Mix the solution for 15 minutes at 110 rpm. 15 minutes after mixing, remove the optical density. For this, part of the suspension must be centrifuged. Centrifugation takes place for 5 minutes at 2000 rpm in glass cups, over 2000 rpm in plastic cups (figure 1). Then drain the liquid, pour into the cuvette and directly determine the optical density. As a blank sample, use ethanol 96 %. Then repeat the steps again.

Figure 1 – Centrifugation

Thus, the solution was mixed for 1 hour (figure 2).

Figure 2 – Mixing the solution

Every 15 minutes, the optical density was determined. The following indicators were obtained (table 2):

Table 2 – Indicators of the coefficient of optical density of the solution

Wavelength	% (1 time) Coefficient of optical density	% (2 times) Coefficient of optical density	% (3 times) Coefficient of optical density	% (4 times) Coefficient of optical density
364	24,5	22,3	28,7	38,1
400	29,6	25,2	16,1	23,3
440	35,6	32,2	21,8	30,7
490	48,6	46	33,2	45,3
540	61,2	58	43,2	56,4
590	67	64,7	51	58,6

After that, the resulting liquid is evaporated in a water bath at 40 ° (Figure 3). Weigh the dry residue. The mass of dry residue was 0.131 grams.

Figure 3 – Evaporation in a water bath

The remaining precipitate in a beaker is dissolved with distilled water in the same beaker to the mark of 500 ml, mix well and leave to dissolve for a day, then remove the top layer, pass through a filter and evaporate the purified solution in a water bath to a viscous consistency. Then we weigh the sapropel (200 grams) again, pour distilled water to the mark of 500 ml, leave to insist. We merge supernatants and repeat the steps until the required amount of solution is obtained.

After receiving the required amount of solution, evaporate it in a water bath 3 times. Then you need to find out the mass of the substance that is contained in this solution. We take a conical flask, weigh it on an analytical balance to the fourth decimal place, then we collect a 10 mm solution into it (this amount of solution is taken with a precision Mora pipette to avoid errors) and weighed again. The data obtained are shown in table 3.

Table 3 – The mass of the flask, the initial solution during the experiment

Indicator	Weight, gram
Conical flask	42,0324
Conical flask after drying the solution	42,0393
Stock solution in a volume of 10 ml	10,005

From the data of the table it turns out that in 10 ml of the initial solution contains 0.0069 grams of the substance, respectively, in 1 liter of 0.69 grams. Thus, the concentration of the initial solution is 0.69 g / L.

After measuring the concentration, we prepare another 3 solutions of different concentrations with a volume of 100 ml and measure the following characteristics:

1) Determination of viscosity on a VPZh-4 viscometer. It is necessary to fix the time of fluid flow through the capillary of a certain diameter. The diameter of the VPZh-4 viscometer is 0.73 mm. Before measuring, it is necessary to fix the temperature of the room and measure the viscosity of distilled water. The fixed flow time of the obtained solutions are presented in table 4.

Table 4 – the fixed time of the flow of solutions to determine their viscosity

Solution Measurement No.	Dist. water	Stock solution (0.69 g / l)	Solution (0.5175 g / l)	Solution (0.345 g / l)	Solution (0.175 g / l)
1	49,2 сек	48,78 сек	48,65 сек	48,25 сек	48,44 сек
2	48,88 сек	49,16 сек	48,65 сек	48,47 сек	48,37 сек
3	48,88 сек	49,16 сек	48,78 сек	48,48 сек	48,29 сек
4	48,58 сек	48,94 сек	48,75 сек	48,54 сек	48,35 сек
среднее	48,78 сек	49,09 сек	48,7 сек	48,5 сек	48,3 сек

We discard the time of the first measurement, and add up the results of the remaining measurements and calculate the arithmetic mean. The room temperature at the time of measurement was 18.5 ° C.

Viscosity is determined by the following formula [3]:

$$V = \frac{g}{9.807} \times T \times K\,, \tag{1}$$

where K is the constant of the viscometer (0.02743 mm^2 / s^2); T is the fluid flow time (in seconds); V is the kinematic viscosity of the liquid (in mm^2 / s); g – acceleration of gravity at the measurement site (in m / s^2)

Thus, the kinematic viscosity of distilled water is equal to:

$$V = \frac{9{,}815}{9.807} \times 48{,}78 \text{ сек } \times 0{,}02743 \text{ мм}^2/\text{с}^2 = 1{,}3391 \text{ мм}^2/\text{с} \tag{2}$$

Kinematic viscosity of the initial solution (0.69 g / l):

$$V = \frac{9{,}815}{9.807} \times 49{,}09 \text{ сек } \times 0{,}02743 \text{ мм}^2/\text{с}^2 = 1{,}3476 \text{ мм}^2/\text{с} \tag{3}$$

Kinematic viscosity of the solution (0.5175 g / l):

$$V = \frac{9{,}815}{9.807} \times 48{,}7 \text{ сек } \times 0{,}02743 \text{ мм}^2/\text{с}^2 = 1{,}3369 \text{ мм}^2/\text{с} \tag{4}$$

Kinematic viscosity of the solution (0,345 g / l):

$$V = \frac{9{,}815}{9.807} \times 48{,}5 \text{ сек } \times 0{,}02743 \text{ мм}^2/\text{с}^2 = 1{,}3314 \text{ мм}^2/\text{с} \tag{5}$$

Kinematic viscosity of the solution (0,1725 g / l):

$$V = \frac{9{,}815}{9.807} \times 48{,}3 \text{ сек } \times 0{,}02743 \text{ мм}^2/\text{с}^2 = 1{,}3259 \text{ мм}^2/\text{с} \tag{6}$$

The viscosity of these solutions is presented in table 5.

Table 5 – the viscosity of the solutions

Solution	Kinematic viscosity, mm² / s
Distilled water	1,3391
Stock solution (0.69 g / l)	1,3476
Solution (0.5175 g / l)	1,3369
Solution (0.345 g / l)	1,3314
Solution (0.175 g / l)	1,3259

1) Determine the optical density of solutions at different wavelengths and cuvettes of different sizes: 10 mm, 20 mm and 30 mm (Figure 4)

Figure 4 – Photometer KFK-3-01 "30MZ"

The measurement results of the optical density of the initial solution (0.69 g / l) are presented in table 6:

Table 6 – Indicators of optical density of the solution (0.69 g / l)

wavelength	Cuvette 10 mm %	Cuvette 20 mm %	Cuvette 30 mm %
400	37,4	12,8	4,77
440	53,3	25,9	13,3
490	68	42,4	27,6
540	77,8	55,6	41,3
590	84,2	65,4	52,7

The measurement results of the optical density of the solution (0.5175 g / l) are presented in table 7:

Table 7 – Indicators of optical density of the solution (0.5175 g / l)

wavelength	Cuvette 10 mm %	Cuvette 20 mm %	Cuvette 30 mm %
400	42,2	17,9	7,56
440	57	32,4	18,4
490	69,4	48	33,4
540	78,4	60,6	47
590	83,9	69,3	57,7

The measurement results of the optical density of the solution (0.345 g / l) are presented in table 8:

Table 8 – Indicators of optical density of the solution (0.345 g / l)

wavelength	Cuvette 10 mm %	Cuvette 20 mm %	Cuvette 30 mm %
400	62	36,6	21,9
440	72,8	52,1	36,9
490	82,2	65,9	52,8
540	88,1	75,3	64,2
590	91,6	81,5	71,9

The measurement results of the optical density of the solution (0.1725 g / l) are presented in table 9:

Table 9 – Indicators of optical density of the solution (0.1725 g / l)

wavelength	Cuvette 10 mm %	Cuvette 20 mm %	Cuvette 30 mm %
400	78,7	60,8	47,9
440	86,9	72	62,6
490	91,9	80,9	74,2
540	95	86,6	81,8
590	97	90	86,9

1) The refractive index at the boundary of 3 phases. The refractive index is determined on a refractometer. The measurement results of these solutions are presented in table 10.

Table 10 - The refractive index of solutions

Solution	Refractive index
Stock solution (0.69 g / l)	1,330
Solution (0.5175 g / l)	1,333
Solution (0.345 g / l)	1,334
Solution (0.175 g / l)	1,330

1) Electrical conductivity. This indicator is measured on a conductivity meter. The measurement results of the solutions are presented in table 11:

Table 11 – the conductivity of the solutions

Solution	Conductivity, μS / cm
Stock solution (0.69 g / l)	290,9
Solution (0.5175 g / l)	235
Solution (0.345 g / l)	168,4
Solution (0.175 g / l)	102,3

1) the pH of the solution. The measurement results are presented in table 12:

Table 12 – pH of solutions

Solution	pH
Stock solution (0.69 g / l)	6,74
Solution (0.5175 g / l)	6,58
Solution (0.345 g / l)	6,37
Solution (0.175 g / l)	5,25

According to the table, it can be seen that the pH is <7. Thus, the environment of the resulting solutions is acidic.

The obtained results of the characteristics of the obtained Saprolin extract of various concentrations can be summarized in a single table 13:

Table 13 – Characteristics of the extract “Saprolin” of various concentrations

concentration	% A (refractive index) T (transmittance) Electrical conductivity	µS / cm pH density viscosity	concentration	% A (refractive index) T (transmittance) Electrical conductivity	µS / cm pH density viscosity	concentration
0,01875	1,33	80,9	102,3	5,25	0,997	1,3259
0,0375	1,334	65,9	168,4	6,37	0,995	1,3314
0,056	1,333	48	235	6,58	0,996	1,3369
0,075	1,33	42,4	290,9	6,74	0,995	1,3476

Based on the data obtained during the measurement of the characteristics of the sapropel extract of different concentrations, it can be noted that the performance of the solutions are different. This can also be seen in the graphs of the dependence of the concentration of the solution on all characteristics.

In increasing crop yields, a special role belongs to local organic fertilizers. Their significance is not only that they are a rich source of the most valuable nutrients for plants - nitrogen, phosphorus, potassium, calcium, magnesium, sulfur and others, but also that they activate microbiological processes in the soil, increase the concentration of carbon dioxide in the ground and soil air, enrich the soil with humus. As a result of this, the buffering of the soil increases, its physical and chemical properties, structure, water and air conditions improve, the acidity and content of mobile aluminum decrease. All this creates the basis for the effective use of organic and mineral fertilizers.

The concentrated extract “Saprolin” prepared on the basis of sapropel is an organ mineral saturated structure that feeds the seeds of agricultural plants with resources, which allows increasing the yield of grain crops.

Conclusion. The conducted research work allowed confirming the following conclusions:

1. Laboratory studies prove the effectiveness of the method of obtaining the extract “Saprolin” for the treatment of seeds of grain crops, which can be obtained from organ mineral accumulations of lakes using an organic harmless extracting.

2. "Saprolin" is a stimulator of seed growth of grain crops, ie to a greater extent affects the germination energy. Sapropel extract refers to stimulants of natural origin, which contains water-soluble natural minerals. Improving plant nutrition through local natural resources of organic origin is environmentally friendly at its core. This is a step towards the so-called organic farming, which is admittedly progressive in terms of environmental protection.

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ДӘНДІ ДАҚЫЛДАРҒА АРНАЛҒАН ТЫҢАЙТҚЫШ РЕТІНДЕ ПАЙДАЛАНУ ҮШІН САПРОПЕЛЬ СЫҒЫНДЫСЫН АЛУ ӘДІСТЕМЕСІ

Аннотация. Өңір экономикасының жетекші саласы – ауыл шаруашылығы, әсіресе, өсімдік шаруашылығы. Бәсекелес нарықтық экономика жағдайында және ауылшаруашылық қызметімен байланысты өсіп келе жатқан экологиялық проблемалар кезінде дақылдардың өнімділігін арттыру үшін экологиялық таза тыцайтқыштарды пайдалану қажет. Зерттеудің мақсаты – көлдердің орғаноминералды ресурстарына негізделген концентрацияланған сығынды алу және шығымдылығын жоғарылату үшін дәнді дақылдарды өңдеу кезінде пайдалану. Неліктен әртүрлі концентрациядағы сапролин сығындысын алу әдісін жасау қажет? Зерттеу нысаны: Көлдердің орғаноминералды жинақталуы.

Ұсынылған жаңа технология қоршаған ортаға айтарлықтай әсер етуі мүмкін сапропельді сығындымен егу алдындағы өңдеу тұқымдарды биологиялық белсенді заттармен, сонымен қатар макро- және микроэлементтермен тікелей қамтамасыз етуге ықпал етеді деген болжам бар. Экономикалық тиімділік шынымен экологиялық таза өнімнің төмен бағамен шығымдылығының артуынан көрінеді, ал экологиялық эффект топырақтың табиғи құнарлылығын сақтауға үлес түрінде ұзақ мерзім бойы әсер етуі мүмкін. Солтүстік Қазақстан облысы – астық алқабы болғандықтан, бұл сығындыны дәнді дақылдар себу кезінде пайдалану ұсынылады.

Сапропель экологиялық таза және жоғары сапалы органоминералды тыңайтқыш ретінде өнімділікті арттыру үшін топырақтың барлық түрлеріне және өсімдіктердің барлық түрлеріне, оның ішінде тозған және майсыздандырылған топырақтар үшін қолданылады, бұл – маңызды шарт. Сапропель негізінде дайындалған концентратталған сығынды ауылшаруашылық өсімдіктерінің тұқымын ресурстармен қоректендіретін органоминералды қаныққан құрылымға айналады.

Зерттеудің негізгі нәтижелері: оңтайлы концентрациядағы сапропель сығындысын алу технологиясын құру; оның қасиеттерін анықтауда, ауылшаруашылық дақылдарының тұқымдарын сығындымен өңдеудің әдістерін жасауда.

Зерттеу нәтижесінде ауылшаруашылық табиғатты пайдалануды оңтайландыру және экологияландыру үшін жергілікті ресурстарды тиімді пайдалану бойынша ұсыныстар жасалады, олар табиғат пайдаланушыларға сапа мен қауіпсіздікті жақсарту мақсатында органикалық егіншілікті дамыту үшін практикалық қолданысын табады. Бұл, өз кезегінде, органикалық өнімдердің экспортын ұлғайтуға және бәсекеге қабілетті, жоғары тиімді кәсіпкерлік қызметті дамытуға ықпал етеді, бұл тұтасымен аймақтың әлеуметтік-экономикалық дамуына ықпал етеді.

Түйін сөздер: әдістеме, сапропель сығындысы, тыңайтқыш, дақылдар, өсімдік шаруашылығы.

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МЕТОДИКА ПОЛУЧЕНИЯ ЭКСТРАКТА САПРОПЕЛЯ ДЛЯ ИСПОЛЬЗОВАНИЯ В КАЧЕСТВЕ УДОБРЕНИЯ ДЛЯ ЗЕРНОВЫХ КУЛЬТУР

Аннотация. Ведущей отраслью в экономике области является сельское хозяйство, в особенности растениеводческий сектор. В условиях конкурентной рыночной экономики и растущих экологических проблем, связанных с сельскохозяйственной деятельностью, для повышения урожайности сельскохозяйственных культур требуется использование экологически чистых удобрений с низкой себестоимостью. Целью исследования является разработка концентрированного экстракта на основе органоминеральных ресурсов озер и применение в предпосевной обработке зерновых культур для повышения урожайности, для чего необходимо разработать методику получения экстракта «Сапролин» разной концентрации. Объект исследования: органоминеральные накопления озер.

Новая предложенная технология может дать значительный экологический эффект: предполагается, что предпосевная обработка экстрактом сапропеля будет способствовать прямой поставке семян биологически активных веществ, а также макро- и микроэлементов. Экономический эффект действительно может быть выражен в увеличении урожая экологически чистых продуктов при низких затратах, а воздействие на окружающую среду может иметь долгосрочный эффект в виде вклада в сохранение естественного плодородия почвы. В связи с тем, что Северо-Казахстанская область является зерновой, предлагается использовать этот экстракт при посеве зерновых культур.

Сапропель как экологически чистое и высококачественное органоминеральное удобрение используется для всех типов почв и всех типов растений для повышения продуктивности, что является важным условием, в том числе для деградированных и дегуммированных почв. Концентрированный экстракт, приготовленный на основе сапропеля, станет органоминерально насыщенной структурой, которая питает семена сельскохозяйственных растений ресурсами.

Основными результатами исследований являются создание технологии получения экстракта сапропеля оптимальной концентрации; при определении его свойств, при разработке методов предпосевной обработки семян сельскохозяйственных культур экстрактом.

В результате исследования будут разработаны рекомендации по рациональному использованию местных ресурсов для оптимизации и экологизации сельскохозяйственного природопользования, которые найдут практическое применение у природопользователей для развития органического земледелия с целью повышения качества и безопасности еды. Это, в свою очередь, способствует увеличению экспорта органических продуктов и развитию конкурентоспособной, высокоэффективной предпринимательской деятельности, которая в целом будет способствовать социально-экономическому развитию региона.

Ключевые слова: методика, экстракт сапропеля, удобрение, зерновые культуры, растениеводческий сектор.

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