ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

Microbiological Processing of Cattle Manure and Slude Phosphorite of Central Kyzylkum

Kanoatov Khayrullo Murodillaevich , Kutliyeva Guzal Djumaniyazovna , Temirov Uktam Shavkatovich, Namazov Shafoat Sattarovich , Usanbayev Najimuddin Halmurzaevich

Candidate of techniques sciences, Namangan institute of engineering and technology
Head of the laboratory "Microbiology and Biotechnology of Probiotics" of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan
Doctoral student, Department of Chemical Technology, Navoi State Mining Institute, Doctor of Philosophy (PhD)
Doctor of technical Sciences, academician, head of the laboratory of phosphorous fertilizers, Institute of General and inorganic chemistry of the Academy of Sciences of the Republic of Uzbekistan
Doctor of technical Sciences, Chief researcher of the laboratory of phosphorous fertilizers, Institute of General and inorganic chemistry of the Academy of Sciences of the Republic of Uzbekistan

ABSTRACT: The article presents the results of studying the processes of obtaining organomineral fertilizers by biological processing of composts prepared on the basis of cattle manure and sludge phosphorite of the Central KyzylKum. It has been shown that the treatment of composts with solutions of the association of microorganisms containing more than 10 strains of lactic acid bacteria with probiotic properties and 2 strains of yeast and a culture liquid of micromycetes from the cellulose-decomposable family of Trichoderma accelerates the process of compost maturation and reduces the release of nitrogen compounds and low molecular weight organic substances.

KEYWORDS: cattle manure, sludge phosphorite, nitrogen, microorganisms, phosphorus, humus, humic acid, fulvic acid.

I. INTRODUCTION

Improving land fertility and obtaining a high and high-quality harvest from agricultural crops in modern conditions is one of the most urgent tasks. An important role in the preservation of soil fertility belongs to organic matter and its main component - humus. The humus content is one of the main indicators of the level of soil fertility. Thanks to it, the main functions are maintained and soil fertility is ensured; during mineralization, humic substances provide plants with nitrogen and other necessary nutrients in an accessible form [1-3], while in the soil due to the mineralization of humic substances, their loss will be 0,6-0,7 tons/ha per year. With high yields of grain crops, the soil annually loses 0,5-1,0 t/ha of humus, while cultivating tilled crops, the loss of humus increases to 1,5-3,0 t/ha. It has been established that a decrease in the humus content in the soil by 1% leads to a decrease in the yield of agricultural crops by about 5 centners of grain units per hectare [3,4]. It should also be noted that one ton of raw cotton annually removes 45 kg of nitrogen, 15 kg of P_2O_5 and 45 kg of K_2O from the soil. One ton of wheat annually removes 35 kg of nitrogen, 10 kg of P_2O_5 and 24 kg of K_2O from the soil [5].

The problem of creating a positive balance of humus and other nutrients in the soil is one of the most pressing problems in agriculture. Only with the optimal amount of humus and other nutrients in the soil is it possible to obtain a high effect from the cultivation of agricultural crops. In the reproduction of humus and other nutrients, the role of organic and organomineral fertilizers is irreplaceable.

The source for obtaining organic and organomineral fertilizers are: litter manure, litterless manure, bird droppings, peat, brown coal, green fertilizer, straw, sapropel, household and industrial waste, as well as sewage sludge [6]. Of these, the cheapest source of organic matter for the reproduction of humus in agriculture is cattle manure (cattle) from livestock farms [7]. Manure, tested for centuries, is a practical soil "improver", one of the most valuable types of organic fertilizers [8].

It should be noted that animal waste is characterized by a high content of organic matter, mineral compounds of nitrogen, phosphorus, potassium, etc. When animals are kept in large quantities, waste odors become a problem. This problem is especially acute where manure spreading is practiced and most of the waste is not utilized. Much of the odor comes from manure. At the same time, ammonia and other harmful gases are found in the atmospheric air in concentrations exceeding the MPC by 5-6 times, microbial and general organic pollution is 8-10 times higher than the background, intensive bacterial contamination of the soil is also recorded. Most odors are a complex mixture of chemical compounds. In some odors, one specific component may prevail, its concentration can be determined by instruments. For example, ammonia or hydrogen sulfide, thioglycolic or butyric acids. Most agricultural waste is stored in heaps, piles or, at best, storage tanks, pits, before being used. During the storage of waste products of anaerobic decomposition are formed: ammonia, sulfides, mercaptans, amines, methane, organic acids, etc. Many of these unoxidized compounds have their own unique and unpleasant odor even at low concentrations [9].

In Uzbekistan, animal husbandry is one of the leading sectors of agriculture. Today in Uzbekistan the total number of cattle has reached 12,7 million heads, and poultry - 75 million. The mass of manure and poultry droppings per day reaches 6-8% of the weight of the animal. In total, 110 thousand tons of manure and dung are produced every day. Currently, cattle manure is partially composted with aging for several months and is used in agriculture. In many farms, manure and poultry droppings are stored, and the accumulated organic waste is used as organic fertilizer. In this case, the humification process is incomplete, and pathogenic microorganisms are practically preserved. Organic waste from livestock, poultry and other plant waste must be processed by composting or other methods, which create conditions for the destruction of pathogenic microorganisms and the conversion of organic substances into water-soluble, alkaline and acidic solutions with the formation of humic substances.

To obtain a better and more efficient organomineral fertilizer and to create a favorable environment for the composting process, various additives are used (phosphate rock, simple superphosphate, ammonium sulfate, ammonium nitrate, potassium chloride), industrial waste (phosphogypsum) and agricultural ores (bentonite, glauconite, lime, etc. etc.). Compost [10-12] based on animal waste containing inorganic fertilizers or the combined use of organic and inorganic fertilizers to improve soil fertility and productivity and reduce negative environmental impacts during intensive farming have been widely recognized in world agricultural practice.

Based on the above, a number of studies were carried out to obtain organic fertilizers by composting cattle manure with the addition of substandard phosphorites of the Central KyzylKum and various mineral fertilizers. As a result of research, it has been shown that the preparation of composts based on cattle manure with the addition of phosphate raw materials leads, on the one hand, to an increase in the assimilable form of P_2O_5 due to the interaction of humic acids, fulvic acids and water-soluble organic substances with phosphates, on the other hand, to a decrease in the loss of nitrogen and organic substances. At the same time, the assimilable form of P_2O_5 of phosphate raw materials increases 6,5-7,0 times, the loss of nitrogen and organic matter decreases by almost 2,5-3 times, and the degree of humification of organic substances increases 2 times [13-17]. The available information in the scientific and technical literature as well as the studies carried out show the promise of using phosphate raw materials and various mineral fertilizers as an additive in the preparation of composts based on waste from livestock farms and other organic farms. However, in order to obtain a complex organic-mineral fertilizer in this way, it is necessary at least 3-4 months to ripen the composts, which creates certain difficulties in providing farms.

In [18], the effectiveness of the use of the biological product "Baikal-EM 1" in the disposal of fresh chicken droppings is given, according to which chicken droppings on a transport belt in the poultry house are treated with the preparation "Baikal-EM 1" and kept for 3 days at an air temperature of at least +18 ^{o}C. After three days, EM compost with certain properties is obtained. Microbiological, parasitological and chemical analyzes of the EM compost, carried out after 3 days, showed: the beneficial microflora increased several times, sweat microorganisms. including salmonella, as well as cystitis of lablia, larvae of flies, pupae of flies, helminth eggs were not found. Microbiological and parasitological indicators of the quality of chicken manure met the requirements of clause 5.6.

SanPin 2.1.7.573-96. It is also shown that the pH in the control remained alkaline all the time, which contributed to the loss of nitrogen in the form of ammonia. The addition of Baikal-EM 1 resulted in the acidification of chicken manure due to lactic acid, which forms non-volatile compounds with ammonia - ammonium lactate. In [19], a method for biological processing of poultry droppings is presented, according to which poultry droppings with a moisture content of

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

96% are mixed with a moisture-absorbing material, peat is used as the latter. The resulting mixture is added to the consortium of strains Bacillus subtilis B-168, Bacillus mycoides B-691, Bacillus mycoides B-46, Streptococcus thermophilus B-907, Candida tropicalis Y-1520, Candida utilis Y-2441 in the amount of 1-108 cells in 1 ml per 1 ton of poultry droppings by spraying over the entire volume of the pile, and then aerobic fermentation of the mixture is carried out with stirring and in the absence of ultraviolet rays until the temperature of the fermentation mixture naturally drops to 25-35ºC. The resulting organic fertilizer is packed in plastic containers and stored. In industrial conditions, with pre-sowing treatment of fields with an area of 550 hectares in the amount of 3-4 t/ha of organic fertilizer obtained for the claimed object, the increase in barley yield was 27% compared to the control field.

The known method [20] microbiological processing of poultry droppings. According to which poultry droppings are placed on a solid flat platform or sump layer by layer to a height of 1-1,5 m with the addition of up to 20% moisture-absorbing material (straw or sawdust) and each layer is watered with an aqueous solution containing the mixture strains of microorganisms Candida krusei-96 and Trichoderma reesei RUT-C30, in a ratio of 1:2 at the rate of 4 ml per ton of poultry manure once and leave in air for 20-30 days. Treatment of litter manure, for floor keeping poultry, carried out by irrigation with a working solution of microorganisms in the same concentration in the room, followed by laying and forming heaps. Biological warming up to a temperature of 70°C is carried out and aerobic fermentation of the mixture until the temperature naturally drops to 20-30°C. Received organic fertilizer is packed in plastic containers and stored. The microorganisms in the mixture effectively decompose poultry droppings and turn it into a high-quality, environmentally friendly, organic fertilizer with high nutritional properties and no specific smell. There is an invention [21] representing four options for obtaining biocompost based on agricultural waste, mainly bedding poultry manure and manure from domestic animals, during aerobic-anaerobic fermentation. The first option, used in summer, is carried out as follows way. Litter poultry droppings are taken from poultry farms to a composting area (on a previously prepared site with a hard surface) and laid in bulk according to the plan for forming a pile with transverse dimensions corresponding to the dimensions of the beater, for example, 5,5 m wide and 2,0 m high. The length of the pile can reach 100 m or more. A previously prepared liquid microbiological complex (at the rate of 1-3 liters per 1 ton of compostable mass) is added to a pile of a known mass by spraying or watering, before moistening or by dissolving in moistening water, and the pile is mixed with a beater. The microbiological complex has the following composition in wt%:

Culture fluid (QL),	
Lactobacillus plantarum, 34, B 2118	15-20
KZh Lactobacillus fermentum, 27, V 2431	25-30
CL Lactococcus lactis, pcs AMC, V 3123	5-10
CL Bacillus cytaseus, 21/2/AS, B 4441	15-20
KZh Bacillus cereus, RKhTU * VT-5	15-20
QL Bacillus subtillis, GL, B 8130	10-15
Filtrate of an aqueous suspension containing 20-30% fresh cattle manure or horses	20-30
Microelement complex	0,05-0,1
Alkali solution (K^+, Na^+, NH^{4+}) to pH 5,5-6,0	rest

Poultry droppings are moistened to 55-65% when laying heaps or in the process of mixing them with a beater. Repeated and subsequent mixing of the composting mass of the piles is carried out after reaching the temperature of 60-70 °C in the composting mass at a depth of 0,5-1 m from the surface of the pile and holding in this state for at least 2 days. If the drop in temperature begins before the end of this period, then stirring begins earlier - immediately after detection temperature drop. The number of agitations is determined by the acceptable external kind of uniformity and looseness. The last mixing is carried out without humidification in order to achieve acceptable humidity (about 30%) by evaporation using biological heat. For the possibility of further use of the obtained biocompost, it is stored in storages, which can be large piles of compact composition, where the processes of anaerobic ripening of the product take place. The second variant of the method, used when laying the rubble in winter, is carried out similarly to the first, but at the same time it is added to the compostable mass microbiological complex, the components of which are preliminary immobilized on dispersed solid-phase carriers in a free-flowing form at the following ratio of ingredients, in wt%:

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

SF Lactobacillus plantarum, 34, B 2118	15-20	
SF Lactobacillus fermentum, 27, B 2431	25-30	
SF Lactococcus lactis, AMC, V 3123	5-10	
SF Bacillus cytaseus, 21/2 / AS, B 4441	15-20	
SF Bacillus cereus, RCTU VT-5	15-20	
SF Bacillus subtillis, GL, B 8130	10-15	
Fine fraction of cattle manure or horses (any shelf life)	10-20	
Microelement complex		0.05-0.1
Water up to humidity 30-40%		rest

When preparing a microbiological complex as dispersed solid-phase carriers use highly dispersed organic and inorganic substances or mixtures thereof with high moisture content: dry ground compost, beet pulp, chaff, peat, expanded perlite, bentonite, etc. Waste piles are formed on a site with a solid surface, the microbiological complex is introduced by spraying or scattering over the surface of the collar, and the mixing of the collars is carried out after the completion of their formation. Two more variants of the method are proposed - the third and the fourth, in each of which the use of sowing compost is proposed. To obtain it, a pile of seed composting is laid as follows. From 10 to 50% of the planned mass of bedding manure of cattle or horses is brought to a prepared site and evenly distributed over the site. On the surface of the formed layer, the calculated amount of liquid (according to the composition and ratio ingredients according to the first option) or solid-phase immobilized (according to composition and ratio of ingredients according to the second option) microbiological complex at the rate of 2-3 kg per ton of mass of the pile. Then lay the main compostable mass and mix the whole mass with a beater with simultaneous and subsequent moistening with water to a humidity of 50-60% using autonomous or built-in irrigation device. For ensuring uniform distribution of components over the volume of the pile, produce two or three times mixing of its mass. In some cases (low air temperature and poor quality of the main compost mass) for any from the stages of the formation of the sowing heap, 1-3% of the compostable masses of a mixture of molasses with corn extract (9:1) and nitrogen-phosphorus salts, for example, ammonium phosphates in the amount of 0,01-1,05%. After that they wait warming up the mass of the collar to a temperature of 40-70°C at a depth of 0,5 m from its surfaces and carry out repeated and subsequent mixing, avoiding overheating of the mass of the collar above a temperature of 70 °C. Holding period at temperature of 40-70°C should not exceed 0,5 days (12 hours) to preserve viability of spore mesophilic microflora. Due to this it is undesirable for the moisture content of the composting mass of the seed pile to drop below 45% (at a maximum humidity of 65%), i.e. constant monitoring of the process is required sowing composting. Storage (use) of seed compost permissible for 10 months after laying the pile at periodic (one or two once a month) stirring and maintaining humidity at 45 + 5%. Period from laying the seed compost before using it as an additive for industrial composting is at least 4 weeks (full time maturation of the seed compost). In contrast to the first and second variants of the method, the third and fourth variants of the method use inoculation of the main compostable mass with an increased dose of a complex of microorganisms multiplied and adapted under the conditions of the adopted composting technology. The microbiological community of the seed compost was formed in the process of seed composting on the basis of microorganisms of the seed substrate and is not only adapted in composition to the conditions of the composting technology, but also provided with readily available substrates for feeding microorganisms, which intensifies microbiological processes at the initial stage of composting. And this, in particular, provides the possibility of composting the bulk in the cold season, if only the pile has time to form before the compostable substrate freezes. In the summer period of composting, the method according to the last two of its options causes some acceleration of the process and the possibility storage of finished compost in the form of large-sized heaps. For industrial composting, piles of the main compostable mass are formed using a beater, their masses are estimated and the seed compost is evenly distributed on the surface of each pile along the perimeter of its base (at the rate of 10-30 kg per 1 ton of pile weight), after which the mass of the pile is mixed and moistened using a beater and irrigation devices. Further, the composting process is carried out in the mode of each of the above options. Comparative tests of the proposed method and the prototype were carried out for obtaining biocompost from poultry manure and cattle manure, as well as for their application, tests were carried out both as a model type (in containers with a volume of 2 m3) and in experimental industrial conditions. The results of the tests showed that acidification of the compostable mass was observed in both methods, but in the experiments on the prototype this acidification was much more intense, which is due to the formation of the dominant microorganisms of acidic fermentation, enhanced by the lactic acid yeast complex of the preparation "Baikal EM". However, at the same time there was also a decrease in the concentration of total and ammonium nitrogen, which is associated with the activity of the nitrifying complex microorganisms converting organic and mineral ammonium nitrogen to nitrites and nitrates through the stage of atomic-molecular nitrogen. This leads to losses of nitrogen in the compostable mass due to its volatilization. In the proposed the way the process of acidification of the compost mass is much less intense due to the balancing of acidic fermentation by deamination processes and binding of ammonia to organic acid salts. At the same time, nitrification processes little expressed, as a result of which the total concentration of nitrogen in the compost mass increases due to a general decrease in the compostable mass due to the evaporation of moisture and the release of CO_2 and other gaseous substances. The biological activity of the bio-composts obtained by the proposed method and according to the prototype was evaluated after their introduction into the soil at the rate of 10 t / ha according to the relative (in%) increase in the biomass of plants grown on these soils in comparison with plants grown on control soils. For this, three soils were prepared - a control one and two with the introduction of biocompost, obtained by the proposed method and prototype (complex "Baikal EM") with consumption of 2 liters per 1 ton of the initial mass of poultry manure, and on periodically sampled (with with an interval of 10 days for 4 months) soil samples were sown with 50 seeds test cultures (barley variety "Gonar"). Average biomass of plants for each sowing was determined by the average mass of roots and stems from among normally emerged ten day old plants in each experiment. Relative biomass growth plants were determined by the ratio of the difference between the average weights of the experimental and control to average plant weights in control crops. Biological results soil activity after the introduction of biocompost showed that the biological activity of the biocompost obtained by the proposed method is about 30% higher than that of the prototype, and has no periods of negative biological activity in time inherent in the prototype.

In [22], a method for processing poultry droppings using microbiological cultures diluted in water (depending on the moisture content of the initial substrate from 10 to 1000 or more times) and introduced into poultry droppings is given; strains of the yeast Candida krusei-96 are used as microbial cultures and Saccharomyces cerevisiae with destructive properties in relation to organic raw materials. The method is carried out as follows. Poultry droppings are placed on a solid flat area or sump layer by layer to a height of 1-1,5 m with the addition of up to 20% moisture-absorbing material (straw or sawdust) and each layer is watered with an aqueous solution containing a mixture of microorganism strains in a ratio of 1:1 at a rate of 2 ml per ton of poultry droppings once and left in the air for 20 days. Processing is carried out in the summer from May to October. The microorganisms that make up the mixture effectively decompose poultry droppings and turn it into a high-quality, environmentally friendly, organic fertilizer with high nutritional properties. The use of these microorganisms made it possible to neutralize the substrate from pathogenic microflora, eimeria oocysts, significantly reduce the number of bacteria of the Escherichia coli group and enterococci. The introduction of the resulting fertilizer into the soil had a positive effect on its agrochemical properties. The content of mobile phosphorus (P_2O_5) and exchangeable potassium (K_2O) increases in the soil. In work [23], a method for obtaining organic fertilizers from poultry manure and animal manure is given, according to which poultry manure or manure is processed directly in the room with a pre-activated symbiotic microbiological complex "Baikal EM1" or its modifications. Pre-activation is carried out by preparing preparations in water subjected to cavitation treatment of ultrasonic frequency. In addition, the preliminary activation of the symbiotic microbiological complex "Baikal EM1" is carried out by adding the biostimulator "Biostim". According to the description of the method, the composition of the preparation includes lactic acid, photosynthetic nitrogen-fixing bacteria, yeast fungi, enzymes, etc., which quickly and efficiently process organic matter, while releasing amino acids, vitamins, natural antibiotics and other physiologically active substances that provide a positive influence on soil fertility, growth and development of plants. The organic fertilizer is obtained in the following way, the unloaded manure is sprayed with an aqueous solution of an activated drug at the rate of 1 liter of the drug per 1 ton of manure on a conveyor belt before being dumped onto an inclined conveyor that supplies manure to the body of a car. Averaged samples for analysis and testing were taken from the car body immediately after loading without holding. Untreated droppings from the same building served as a control. In the average processed sample, a sharp, specific odor disappeared. The smell of untreated droppings remained unchanged. The hazard class of the droppings after treatment decreased from 3rd to 4th (completely safe product). The phytotoxicity class decreased from 3-4 (dangerous) to 5-6 (safe). Indicators of physical, chemical and biological analysis are shown in table 1.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

Table 1.
Organic fertilizer indicators

Indicators	Norm	fact
Mass fraction of dry matter,%	No less 25	26,2
Mass fraction of total nitrogen,% of the initial moisture content	No less 0,7	1,5
Mass fraction of total phosphorus,% of the original moisture	No less 0,5	0,54
Mass fraction of total potassium,% of the original moisture	No less 0,3	0,3
Hazard class for OPS	No less 4	4
Phytotoxicity class	No less 5	5-6
Coliform index	1-9	3
Enterobacteriaceae index	1-9	5
Index of pathogenic and pathogenic microorganisms	Not allowed	Not detected
Eggs and larvae of helminths, ind./g	Not allowed	Not detected
Cysts of intestinal pathogens of protozoa, specimens / 100 g	Not allowed	Not detected
The presence of viable larvae and pupae of synanthropic flies, ind./kg	Not allowed	Not detected

In the average processed sample, a sharp, specific odor disappeared. The smell of untreated droppings remained unchanged. The hazard class of the droppings after treatment decreased from 3rd to 4th (completely safe product). Class phytotoxicity decreased from 3-4 (dangerous) to 5-6 (safe). This method provides for the processing of droppings and manure into organic fertilizers directly at the place of their formation. Fertilizers obtained using this technology in all respects meet the requirements of GOST R 53117-2008 "Organic fertilizers based on animal waste" The known method [24] according to which poultry droppings are mixed with a microbial culture of Pseudomonas sp. 114, after 5 days a microbial culture of Azotobacter chroococcum B 35 is introduced and again mixed. The titer of the introduced microbial cultures is for Pseudomonas sp. 114-108 cells/ml and for Azotobacter chroococcum B 35-108 cells / ml. The volumetric ratio of the introduced crops is 2:1, respectively, at the rate of 45 ml per 1 kg of poultry manure with no bedding of poultry. When poultry litter, Pseudomonas sp. 114 and Azotobacter chroococcum B 35, taken in a 2: 1 ratio, are applied in an amount of 15 ml per 1 kg of droppings. Before adding microbial cultures, each of them is diluted with water in a ratio of 1:2. Microbiological processing of poultry droppings is carried out within 15 days. The method allows to accelerate the bioconversion process and at the same time to increase the biological activity of the processed product, as well as to ensure its environmental safety. From the above, it can be seen that one of the methods for accelerating the humification of organic substances in manure and the maturation of compost is the use of solutions containing microorganisms involved in the destruction of organic substances in the preparation of composts. In this regard, in this work, the processes of obtaining organomineral fertilizers by biological processing of composts prepared on the basis of cattle manure and sludge phosphorite of the Central KyzylKum were studied using solutions of the association of microorganisms containing more than 10 strains of lactic acid bacteria with probiotic properties and 2 yeast strains and micromycete culture liquid from family of cellulose-degradable Trichoderma. Materials and methods. To study the processes of obtaining organic fertilizers, cattle manure was used as a feedstock, which has the following composition (wt.%): Moisture – 73,21; ash – 4,32; organic matter – 22,56; humic acids – 2,5; fulvic acids – 2,67; water-soluble organic matter – 2,52; insoluble organic matter – 14,79; P_2O_5 – 0,18; N 0,43; K_2O – 0,58; CaO – 0,4. Slurry phosphorite (FM) of Central KyzylKum (CC) was used as a phosphate raw material. Before use, WF was ground to a particle size of 0,25 mm. the composition of which is shown in table 2.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

Table 2
Chemical composition of slurry phosphorite

Content of components, weight. %									$P_2O_{5ass.}$ P_2O_{5total}. %	CaO / P_2O_5
P_2O_5	CaO	Al_2O_3	Fe_2O_3	MgO	F	CO_2	SO_3	H.O.		
11,57	41,08	1,84	1,42	0,61	1,52	20,91	0,46	14,9	11,50	3,55

For the processing of phosphate rock, information is required on the physicochemical and physicomechanical properties - dispersed composition, moisture content, bulk density, angle of repose, fluidity, pH, hygroscopicity, moisture capacity. These properties were determined by the methods described in [25, 26]. The composition and properties of SHF are shown in tables 1-3. The results show that the free bulk density of WB is 0,81 g/cm^3, and with compaction, 1,04 g/cm^3. The smaller the angle of the slope, the greater the mobility of the friability particles. For WB, the angle of repose is 39°, that is, WB has high mobility and dissipates without any difficulty. The hygroscopic point of phosphate rock is 46,7%. The limiting moisture capacity of the sample is 7,4%, and at higher humidity they lose their friability.

Table 3
Physical characteristics of slurry phosphorite

SHF properties	
Initial moisture,%	1,73
Free bulk density, g/cm3	0,81
Density with compaction, g/cm^3	1,04
Slope angle, deg	39^{o}18´
Scattering, sec.	Evenly, without any difficulty
Hygroscopic point,%	46,7
Moisture capacity,%	7,4
pH of 10% suspension	9,07

Table 4
Dispersed composition of slurry phosphorite

Size class, mm	**Fraction yield, wt. %**
- 0,315 + 0,2	0,4
- 0,2+0,16	43,8
- 0,16 + 0,1	41,6
- 0,1 + 0,05	9,4
- 0,05	4,8
Initial mass	100

The composts based on cattle manure with the addition of SHF were prepared at weight ratios of manure: SHF = 100:10. The resulting mixtures were treated with created solutions based on the existing association of probiotic bacteria in the collection of the laboratory "Probiotic Microbiology and Biotechnology" of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan. The Association of Microorganisms was treated with more than 10 strains of lactic acid bacteria with probiotic properties, 2 strains of yeast and a culture liquid of micromycetes from the Trichoderma family of cellulose-degradable. Microorganism strains were isolated by classical methods generally accepted in microbiology from dairy products and from the root rhizosphere of agricultural crops. Initially, the biological

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

product was diluted in water without chlorine and the mixture was processed. In order to ensure the quality of the fermentation process, the treated compost was covered with a polyethylene film. Under laboratory conditions, experiments were carried out in specially adapted vessels with the following ratios of cattle manure: association of microorganisms: water = 100:(5-21):(5-21). Samples were obtained from the prepared composts every five days and the influence of the association of microorganisms on the conversion of organic substances into humic substances, changes in pH, the amount of nitrogen and organic matter in the composts was determined. The determination of all forms of P_2O_5 was carried out by the gravimetric method by precipitation of a phosphate ion with a magnesian mixture in the form of magnesium ammonium phosphate, followed by calcining the precipitate at 1000-1050°C in accordance with GOST 20851.2-75. Humidity was determined according to GOST 26712-85, ash content according to GOST 26714-85 and organic matter according to GOST 27980-80. The total nitrogen content in the composts was determined by mineralization of the analyzed fertilizer upon heating with concentrated sulfuric acid in the presence of hydrogen peroxide, a mixed catalyst in sulfuric acid, followed by distillation of ammonia into a boric acid solution and titration with sulfuric acid GOST 26715-85. The amount of the water-soluble fraction of organic substances extracted from the products with water was determined by filtration and evaporation in a water bath, drying the solid residue to constant weight, followed by its combustion to determine the ash content and subtract it. Humic acids were isolated by treating the products with a 0,1 N alkali solution followed by acidification of the solution with mineral acid [27].

The solid phase after separation of alkali-soluble organic substances from it contains residual organic matter. It was thoroughly washed with disc water, dried to constant weight, and the content of organic matter was determined. The difference between the amounts of alkali-soluble organic substances and humic acids gives us the fulvic acid content. The analysis results are shown in Table 4. The preparation of compost by processing with an association of microorganisms has a positive effect on the acceleration and increase in the content of humic acids, fulvic acids and water-soluble organic substances in composts. For example, if in the composts prepared without adding an association of microorganisms, after 15 days the content of humic acid, fulvic acid and water-soluble organic substances was 4,63%, 4.81% and 4,51%, then in composts prepared with the addition of 21 ml of the association microorganisms per 1000 g of cattle manure and water to reach a moisture content of 70%, the content of the above substances was 4,80%, 4,95% and 4,63%. It was also determined that the influence of the association of microorganisms on the reduction of the content of nitrogenous and organic substances due to the release into the gas phase during the composting process. It has been established that the preparation of compost by treating cattle manure or poultry droppings with an association of microorganisms significantly reduces the loss of nitrogenous and organic substances. With a change in the ratio of cattle manure: association of microorganisms: water from 100:0:21 to 100:21:21 after 30 days of compost maturation, a decrease in nitrogen loss from 19,45 to 13,84%, and organic matter from 14,72 to 8,72%. Based on the degree of humification of organic matter, the optimal ratios of the initial substances and the duration of compost maturation were determined. At the same time, from an agrochemical point of view, the optimal ratio of the preparation of compost based on cattle manure and a solution

Table 5

Changes in the chemical composition of composts prepared on the basis of manure, slurry phosphorite and treated with a solution of the association of microorganisms containing 10 strains of lactic acid bacteria with probiotic properties, 2 strains of yeast and a culture liquid micromycetes from the family of cellulose-degradable Trichoderma

Mass ratio of cattle manure: SHF: RAM	P_2O_5 total, %	$P_2O_{5ass.}$ for citric acid /P_2O_{5total}. (100 %)	$P_2O_{5ass.}$ Trilon B /P_2O_{5total}, (100 %)	CaO total, %	organic matter, %	humic acid, %	fulvic acid, %	water-soluble organic substances, %	K_2O ,%	N total,%	Mois ture, %
1	2	3	4	5	6	7	8	9	10	11	12
On the day of preparation											
100 : 10	1,322	17,63	16,54	3,841	17,72	1,92	2,01	1,79	0,443	0,351	65,63

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 11 , November 2021

100 : 10 : 0,5	1,332	17,72	16,65	3,871	17,85	1,93	2,02	1,80	0,446	0,354	63,35
100 : 10 : 1	1,343	17,80	16,73	3,901	17,99	1,95	2,04	1,81	0,450	0,357	63,07
100 : 10 : 2	1,353	17,91	16,86	3,931	18,13	1,96	2,05	1,83	0,453	0,359	62,78
100 : 10 : 3	1,364	18,03	16,98	3,962	18,28	1,98	2,07	1,84	0,457	0,362	62,49
After 10 days											
100 : 10	1,243	21,25	20,95	3,901	18,81	2,26	2,40	2,21	0,440	0,321	65,07
100 : 10 : 0,5	1,353	23,91	23,71	3,931	18,57	2,28	2,42	2,22	0,453	0,331	62,78
100 : 10 : 1	1,369	24,10	23,84	3,978	18,40	2,30	2,43	2,25	0,458	0,342	62,34
100 : 10 : 2	1,382	23,96	23,62	4,016	18,31	2,30	2,43	2,25	0,463	0,352	61,98
100 : 10 : 3	1,408	23,99	23,43	4,091	18,03	2,31	2,43	2,25	0,472	0,363	61,27
After 20 days											
100 : 10	1,343	26,60	25,07	4,393	19,19	2,48	2,62	2,41	0,473	0,317	62,30
100 : 10 : 0,5	1,454	31,35	30,97	4,225	18,92	2,69	2,83	2,61	0,487	0,351	60,00
100 : 10 : 1	1,465	31,75	31,27	4,257	18,73	2,72	2,84	2,63	0,491	0,362	59,70
100 : 10 : 2	1,477	31,53	30,90	4,290	18,62	2,75	2,88	2,68	0,494	0,373	59,39
100 : 10 : 3	1,475	32,18	30,99	4,286	18,35	2,81	2,92	2,70	0,494	0,376	59,42
After 30 days											
100 : 10	1,406	30,67	30,35	4,761	19,44	2,78	2,95	2,71	0,481	0,334	61,57
100 : 10 : 0,5	1,518	40,43	39,87	4,410	19,08	3,22	3,36	3,10	0,508	0,359	58,25
100 : 10 : 1	1,530	41,11	40,36	4,445	18,94	3,26	3,37	3,14	0,512	0,370	57,92
100 : 10 : 2	1,529	41,76	40,73	4,441	18,81	3,28	3,42	3,18	0,512	0,378	57,95
100 : 10 : 3	1,541	43,25	41,23	4,477	18,61	3,34	3,44	3,20	0,516	0,385	57,62
After 40 days											
100 : 10	1,575	37,15	36,04	4,575	19,47	3,42	3,46	3,30	0,527	0,343	56,69
100 : 10 : 0,5	1,588	49,51	48,75	4,612	19,21	3,75	3,91	3,61	0,532	0,355	56,33
100 : 10 : 1	1,601	50,46	49,45	4,651	19,10	3,80	3,93	3,66	0,536	0,364	55,97
100 : 10 : 2	1,614	52,00	50,57	4,690	18,97	3,83	4,00	3,71	0,541	0,376	55,60
100 : 10 : 3	1,643	54,81	51,92	4,774	18,79	3,94	4,01	3,73	0,550	0,393	54,80
After 50 days											
100 : 10	1,682	42,68	41,35	4,885	19,75	3,57	3,61	3,52	0,563	0,352	53,75

100 : 10 : 0,5	1,696	56,11	55,21	4,929	19,52	4,18	4,35	4,01	0,568	0,367	53,34
100 : 10 : 1	1,711	57,69	56,47	4,972	19,40	4,23	4,36	4,06	0,573	0,381	52,92
100 : 10 : 2	1,727	59,56	57,84	5,017	19,25	4,24	4,42	4,12	0,578	0,394	52,50
100 : 10 : 3	1,742	63,48	59,93	5,062	19,12	4,37	4,44	4,14	0,584	0,407	52,07
After 60 days											
100 : 10	1,667	47,54	46,12	5,012	19,82	3,86	3,95	3,73	0,522	0,316	54,39
100 : 10 : 0,5	1,784	59,00	58,04	5,182	19,96	4,49	4,66	4,30	0,597	0,382	50,94
100 : 10 : 1	1,800	60,24	58,95	5,231	19,85	4,53	4,66	4,34	0,603	0,396	50,48
100 : 10 : 2	1,817	62,24	60,41	5,280	19,71	4,52	4,71	4,38	0,609	0,411	50,01
100 : 10 : 3	1,835	65,88	62,16	5,331	19,58	4,64	4,71	4,39	0,614	0,424	49,53

Table 6

Loss of nitrogen, organic matter and the degree of humification of organic matter during composting of cattle manure, sludge phosphorite and treated with a solution of the association of microorganisms containing 10 strains of lactic acid bacteria with probiotic properties, 2 yeast strains and a culture liquid micromycetes from the cellulose-degradable Trichoderma family

Mass ratio	100 : 10	100 : 10 : 0,5	100 : 10 : 1	100 : 10 : 2	100 : 10 : 3
Loss of nitrogen, %	19,45	18,58	17,44	16,76	15,22
Loss of org. substances, %	14,72	13,43	12,52	11,67	9,82
Degree of humification of organic matter, %	67,75	67,58	68,35	69,20	70,34

by the association of probiotic bacteria is 100:21, while the degree of humification of organic substances was 70,20%. The composition of the organomineral fertilizer obtained under optimal conditions has the following composition (wt%): P_2O_{5total} – 2,01; $P_2O_{5ass.}$ Trilon B – 1,21; $P_2O_{5ass.}$ for citric acid – 1,18; organic matter – 19,87; humic acids – 4,80; fulvic acids – 4,95; water-soluble organic matter – 4,63; nitrogen – 1,85; K_2O -1,73; moisture – 49,06. Thus, the results show that composting cattle manure with the addition of phosphate raw materials and the association of probiotic bacteria can accelerate the maturation of the compost. It was found that composting manure with the addition of phosphorite flour and the association of probiotic bacteria increases the degree of humification of organic substances, reduces the loss of nitrogen and organic substances, and also has a positive effect on increasing the content of assimilable forms of phosphorus.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 11 , November 2021

REFERENCES

1. Ivanov V.M. Humus: the basis of fertility // AgroONE (Ukraine). 2018. No. 24. - pp.12-13.

2. NG Kovalev Modern problems of production and use of organic fertilizers // Bulletin of the All-Russian Scientific Research Institute of Livestock Mechanization. 2013 No. 2 (10). - pp.82-92.

3. Titova I.N. Humates and soil. Moscow: ILKO, 2006. - pp. 9-12.

4. Derzhavin L.M., Sedova E.V. On the issue of humus reproduction // Agrochemistry. - 1988. - No. 9. - pp. 117-127.

5. Reference book on the chemicalization of agriculture - M .: Kolos, 1980. Pp - 560.

6. Popov P.D., Khokhlov V.I., Egorov A.A. and other organic fertilizers. Reference // M .: Agropromizdat, 1988. - pp. 62-63.

7. Zhukov A.I. Reproduction of humus in intensive farming // Agrochemistry. - 1991. - No. 3. - pp. 121-133.

8. Derzhavin L.M., Polyakov A.N., Florinsky M.A. and others. The content of humus in arable soils of the USSR // Khimizatsiya agriculture. - 1988. - No. 6. - pp. 7-8.

9.O.D. Sidorenko Biological technologies for utilization of animal waste // Moscow: Publishing house of the Moscow Agricultural Academy, 2003. –pp 72.

10. Suvendu Das1, Seung Tak Jeong, Subhasis Das, Pil Joo Kim. Composted Cattle Manure Increases Microbial Activity and Soil Fertility More Than Composted Swine Manure in a Submerged Rice Paddy // Frontiers in Microbiologu, Frontiers in Microbiologu, 8: 1702. doi: 10.3389 / fmicb. 2017.01702.

11. Das, S., Adhya, T. K. Effect of combine application of organic manure and inorganic fertilizer on methane and nitrous oxide emissions from a tropical flooded soil planted to rice // Geoderma 213, 185–192. doi: 10.1016 / j.geoderma. 2013.08.011.

12. Roba, T.B. The Effect of Mixing Organic and Inorganic Fertilizer on Productivity and Soil Fertility // Open Access Library Journal, Pub. Date: June 26, 2018.doi: 10.4236 / oalib.1104618.

13. U.Sh.Temirov, A.M. Reimov, Sh.S.Namazov, N.Kh.Usanbaev. Humification of organic matter of manure by composting them with substandard phosphorites. // Electronic scientific journal. Universum: Technical sciences: Novosibirsk. - 2016. - No. 8 (29). -pp. 43-47.

14. U.Sh. Temirov, A. M. Reymov, Sh.S. Namazov, N.H. Usanbaev. Novel type of phosphorus-humic fertilizers based on low-grade phosphorite of Central Kyzylkum. // Uzbek chemical journal. - 2017. - Specal issue. - pp. 21-30.

15. U.Sh. Temirov, A. M. Reymov, Sh.S. Namazov, N.H. Usanbaev, Seytnazarov A.R. Organic-mineral fertilizer based on cattle manure and sludge phosphorite with superphosphate. // International Journal of Recent Advancement in Engineering & Research. Volume 04, Issue 01. India –January –2018 – pp. 39-46.

16.U.Sh.Temirov, P.Kh.Ganiev, Sh.S.Namazov, N.Kh.Usanbaev. Features of composting cattle manure and phosphorite sludge with the addition of phosphogypsum. // Electronic scientific journal. Universum: chemistry and biology: - Novosibirsk, 2018. - No. 8 (50) - pp. 25-33.

17. Shafoat Namazov, Uktam Temirov, Najimuddin Usanbayev. Research of the process of obtaining organo-mineral fertilizer based on nitrogen acid decomposition of non-conditional phosphorites of central Kyzylkumes and poultry cultivation waste // International Journal of Innovative Technology and Exploring Engineering (IJITEE). Volume-8, Issue-12, October, India-2019. - RR. 2260-2265.

18. VL Gritsenko The effectiveness of the drug "Baikal - EM 1" in the disposal of fresh chicken manure // Agrarian Bulletin of the Urals. No. 3 (39), 2007 2007 No. 3 (39). - pp.61-63.

19. Patent No. 2322427 Russia. C1. CO5 F 11/08, C12N 1/20. Method for biological processing of poultry droppings / E.M. Kulagina, S.Yu. Egorov, S.A. Azizov, V.P. Barabanov. - B.I. 2008, No. 11.

20. Patent No. 2704434 Russia. CO5 F 11/08. Method for microbiological processing of poultry droppings / L.R. Valiullin, V.Yu. Titova, A.M. Tremasova, Yu.M. Tremasov, I.I. Idiatov, S.R. Mukhammadieva, S.R. Mukhammadiev, V.V. A. A. Konyukhova. - B.I. 2019, no. 31.

21. Patent No. 2704434 Russia. CO5 F 11/08. A method of obtaining biocompost based on agricultural waste, mainly litter poultry droppings and poultry manure and domestic animals, with aerobic - anaerobic fermentation (options) // V.G. Pravdin, G.A. Bobritsky, N.I. Tolstoy, V.G. Germashev ... - B.I. 2009, no. 33.

22. Patent No. 2522523 Russia. CO5 F 11/08. Method for microbiological processing of poultry droppings // M.Ya. Tremasov, L.E. Matrosova, A. V. Ivanov, V. Yu. Titova, A.V. Ivanov, A.M. Tremasova, E.I. Semyonov. - B.I. 2014, No. 20.

23. Patent No. 2629589 Russia. CO5 F 3/00. Method of obtaining organic fertilizers from poultry manure and animal manure // G.A. Osipov, A.Kh. Aminov - B.I. 2017, no. 25.

24. Patent No. 2437864 Russia. CO5 F 3/00. Method of microbiological processing of poultry droppings // V.I. Dmitriev, I.V. Martynova, L.I. Kochkina - B.I. 2011, No. 36.

25. Pestov N.Ye. Physicochemical properties of granular and powdery chemical products. - M .: AN SSSR, 1947. -pp 239.

26. Guide to practical training in the technology of inorganic substances / M.E. Pozin., B.A. Kopylev., E.S. Tumarkina., G.V. Belchenko - L.: Goskhimizdat, 1963, pp 376.

27. D.S. Orlov, L.A. Grishina Workshop on the chemistry of humus. - M .: Publishing house of Moscow. un