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ИЗВЕСТИЯ

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OF THE REPUBLIC OF KAZAKHSTAN

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DEVELOPMENT OF FOOD WASTES UTILIZATION TECHNOLOGY

Abstract. At the present stage of the food industry are sources of significant quantities of wastes of organic origin. These wastes are a valuable feed product, however, quickly decomposing, they become unsuitable for further use and, moreover, are harmful to the environment in General and man in particular. Therefore, the main waste processing food production is an important task to ensure forage agriculture and the prevention of environmental pollution. The main wastes of food industry wastes are canning, wine industry, fruit and vegetable waste, meat and fish waste, bones, bread, dairy products, waste, brewery and distillery industry waste essential oil industry, waste oil and fat industry, waste confectionery and dairy industries, waste from livestock farms and meat processing industry.

Listed wastes for food production may be considered as secondary material resources (BMP), as they contain protein and minerals, carbohydrates and vitamins.

Based on the above, seems highly relevant topic of this thesis, is devoted to the development of technologies for recycling food waste.

To date, the levels of recycling of these wastes in our country and, in particular, in Shymkent, were small, despite the fact that they contain up to 25% of the nutrients of raw materials, which again confirms the relevance of the development of resource-saving technologies of processing food waste into feed products. Such technology should be low-waste to ensure environmental protection.

Keywords: extrusion processing, composting, microbiological bioconversion, recycling, landfill, burial.

Objective: development of technologies for recycling food waste. The goal involves the following tasks:

- development of a system of selective collection of household waste,
- review of technologies for the treatment of food waste;
- development on the basis of the information technology systems of disposal of food waste;

Scientific novelty of the research. On the basis of monitoring of the collection, storage, recycling food waste, the proposed introduction of selective waste collection that will minimize inefficient and environmentally unsafe handling of food waste. The proposed scheme sort or separate collection of waste, which is a major trend in the reduction of emissions of harmful substances into the environment. The proposed technology microbial bioconversion of waste into high-quality carbohydrate-protein feed and feed additives. Also provides a process flow diagram of the extrusion processing of solid food wastes into animal feed.

The practical significance. Worldwide recycling and disposal of household waste is becoming more urgent problem. This mainly concerns large densely populated cities, where the annual accumulated millions of cubic meters of all kinds of garbage. Steaming dumps, piles of discarded rubbish, overflowing garbage cans – is familiar to many urban residents. It is estimated that every year in the country only accumulates solid waste 140 million cubic meters. The developed technology of food waste allows to minimize the environmental effects from pollution by landfills, translating them from waste into feed proteins, the proposed scheme of selective collection of waste is to minimize the cost of mechanical processing of household waste. Problem of literacy such a huge amount of waste, no doubt, can be classified as environmental; on the other hand, it is most closely associated with solving complex technical and economic issues.

Objects of research: cannery waste, the wine industry, fruit and vegetable waste, brewery and distillery industry waste essential oil industry, waste oil and fat industry, waste confectionery and dairy industries, waste from livestock farms and meat processing industry.

Extrusion - perfect technological process for the production of products with a normalized amount of proteins, fibers, vitamins corresponding to the indications of your dietician. The ability to control the composition of the products of proteins, vitamins or minerals plays an important role in the prevention of many human diseases.

It is extrusion – very progressive method of obtaining high-quality and balanced composition of foods, the main advantages of which lie in the flexibility of its technological schemes, high performance and small dimensions of the extruder, the continuity of the process, low production cost.

Extrusion processing of food waste involves obtaining biologically valuable, secure and persistent storage of food. A necessary condition for achieving this purpose is the thermal treatment of waste, in which occur the disinfection and dehydration of raw materials. From the correctness of its implementation depends on the quality of the resulting feed.

Traditionally, the most common hours of heat treatment at elevated pressures in the apparatus of periodic action, in particular in vacuum boilers (boilers-utilizers Lapsa) dry (no contact with live steam or water) or wet method. In such boilers raw material is slowly heated to a temperature of 11 8-1 30° C which kills the majority of bacteria, and sterilized for 30 to 60 minutes at a pressure of 0.3-0.4 MPa. Then tenderized the mass is dried for several hours under a pressure of 0.05-0.06 MPa at 70-80° C. From heat-treated wastes get meat, bone, meat, blood, bone, feather meal. It should be noted that recently in EU countries, sterilization is carried out at a temperature 1 33° C and a pressure of 0.3 MPa for 20 minutes, excluding the time for the ascent and descent of the steam pressure in the boiler.

We can distinguish the following main shortcomings of traditional technologies:

- the duration of the process of obtaining the finished product (up to 10-1 2 hours);

- hours of heat treatment causes denaturation of 70-75% protein, thereby reducing the nutritional value of the product (it is poorly absorbed by the bird);

- high intensity: for installations in addition to the electricity needed gas, steam and hot water;

- environmental pollution malodorous and toxic substances (hydrogen sulfide, sulfur dioxide, mercaptans, etc.);

- the formation of fat-containing waste water, which increases the load on local wastewater treatment facilities.

The use of continuous-flow lines for disposal of biological wastes reduces the time of manufacture of the finished product (meat and bone meal) to 1-2 hours and slightly increases its nutritional value. Continuous-flow lines vary as to heat the raw materials, and temperature regimes. The raw material may be heated either by direct contact with hot liquid coolant - fat or steam, or by using the conductive method. The temperature treatment can be both above and below 100 C. However, these lines are also characterized by high energy intensity, environmental imperfection and the additional load on local wastewater treatment facilities.

To obtain high quality feed product, where maximum stored biological value of raw materials, it is necessary to minimize the heat treatment. Thus it is desirable to use efficient and environmentally friendly technologies.

Modern extruders, depending on the nature of the processed material temperature can reach 200° C, a pressure of 4-5 MPa. At the same time, the negative effects of the treatment are minimized due to its brevity. The processed material in the extruder is not more than 30-90 seconds.

The development of extrusion technology has allowed us to offer new ways of recycling wastes of food industry, fur farms, pig and poultry breeding. The proposed technology is a dry extrusion method in which heating of the extruded material occurs due to friction as within it, and the barrel of the extruder.

The fundamental problem is high humidity waste (85%). For its solution the crushed wastes of animal origin (including case and confiscated SES) is premixed with vegetable filler. In this way, reduce the humidity of the mass fed into the extruder, to 28-30 percent. The resulting mixture is subjected to extrusion processing, getting suitable for feeding pigs and poultry product. As filler can be used for grain, grain waste, bran, meal. Filler volume 3-5 times more animal waste and is determined by their moisture content.

With the passage of the mixture through the compression aperture in the barrel of the extruder inside her rises the temperature over 110 C and the pressure is 40 atmospheres. The passage of the mixture through the extruder does not exceed 30 seconds, and in the zone of maximum temperature, it is only 5-6 seconds, so the negative effects of the heat treatment is minimized. However during this time the mixture:

- sterilized and disinfected (disease-causing microorganisms, fungi, mold completely destroyed);
- increases in volume (due to rupture of molecular chains of starch and cell walls at the exit of the extruder);
- homogenized (a process of grinding and mixing of raw materials in the barrel of the extruder continues, the product becomes completely homogeneous);
- stabilized (is neutralized by the action of enzymes that cause rancidity of the product, such as lipase and lipoxygenase, inactivated anti-nutritional factors, toxins);
- dehydrated (humidity is reduced by 50-70% of the original).

As a result, the digestibility of the protein reaches 90 percent. Amino acids are becoming more affordable due to the destruction of molecules in the protein secondary links. The content of available lysine reaches 88%. At the same time are totally or substantially destroyed anti-nutritional compounds such as urease, protease inhibitors, and trypsin. Starch gelatinizes that increases its digestibility.

Fats are evenly distributed throughout the mass of the product, forming complex compounds with starch in a ratio of 1:10, which increases their accessibility. Stability of fats increases as destroy enzymes that cause oxidation and rancidity, such as lipase and lip oxidase, and lecithin, and Tocopherols, which are natural stabilizers, retain full activity. The digestibility of dietary fiber increases due to chemical modification.

The rigidity of the extrusion processing, destroying pathogens, allows to obtain high-quality food, even if the filler is represented substandard grain products. The sterility of the resulting feed is especially important when feeding the young, as up to 90% of the livestock are dying due to diseases of the gastrointestinal tract or infections listed through the digestive system.

For the first time such technology for processing wastes of poultry and livestock was proposed by American specialists in 1995 (according to the figurative expression, delivered at one of the seminars, the Americans are extruded everything I see).

Extrusion technology biological waste disposal developed by Wenger Manufacturing (USA), including preliminary heat treatment of the mixture in the conditioning of the extruder, extruding the steaming and drying of the extradites. The necessity of operations of steaming and drying increases the cost and complicates the process, since in addition to electricity requires the use of other energy sources (steam and gas).

The company's technology InstaPro (USA) does not require steaming, however, the moisture content of the resulting extradites exceeds 14-16 percent. Because product storage humidity more than 14.5% is not allowed, to ensure a sufficiently long shelf life are the extradites optionally dried. For waste disposal in the meat case of pig and get cheap sterile protein feed Supplement, I suggest the following scheme (figure 1).

The method allows excluding using special dryers and diverse sources of energy to reduce temperature effects on the product. As a result it is possible to obtain a product suitable for long-term storage (6 months) even with considerable humidity of raw materials.

Production line extrusion recycling can be designed to almost any performance. Complete technological process consists of:

1) shredding;
2) mixing the crushed mass in certain proportions with vegetable filler;
3) extrusion of the mixture;
4) cooling;
5) packing unit.

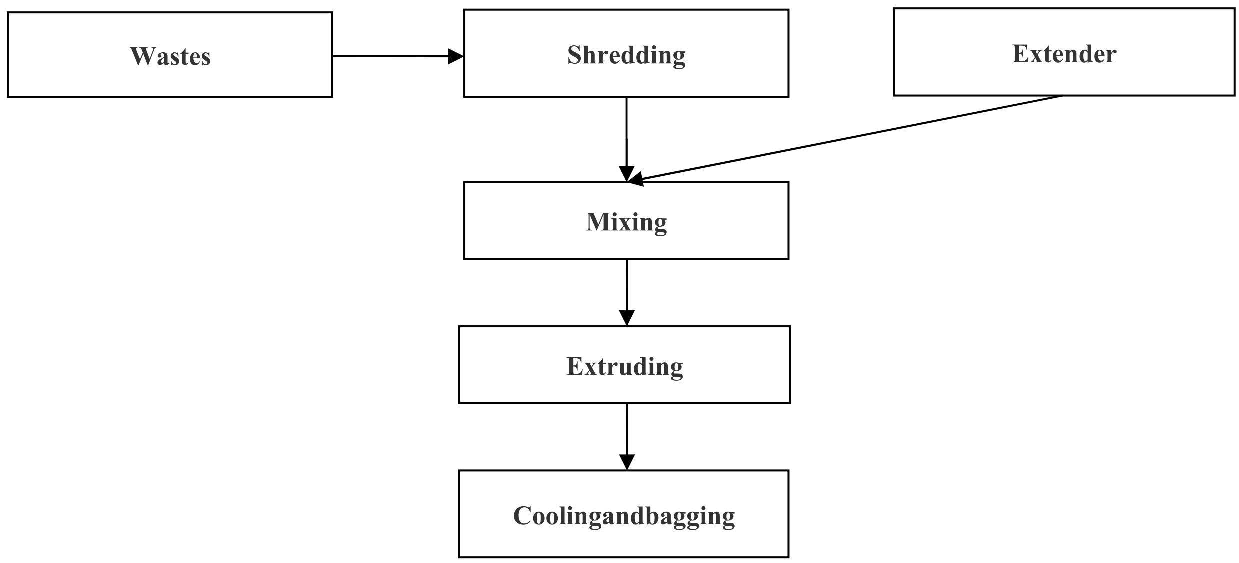


Figure 1 – Scheme of waste disposal in the meat industry

To the resulting product (protein feed additives) is characterized by:

protein content - between 14 and 20% (depending on the type of processed wastes and vegetable filler);

- high digestibility (90%);
- exchange energy - 290-31 0 kcal per 100 g;
- bacterial clean - not more than 20 thousand units (at a rate of 500 thousand units);
- humidity - not more than 14%;
- long shelf life - at least 6 months.

The cost of the resulting product is determined mainly by the cost of the filler. In this case the energy consumption for processing of 1 kg of biological wastes do not exceed 80 tiyn, whereas in the processing in package boilers - not less than 4 tg.

The use of extrusion technology allows:

- to intensify the production process;
- to reduce energy consumption (excluding electricity for the technological process does not need other energy sources: gas, steam, hot water);
- reduce labor costs;
- increase the utilization of raw materials;
- to improve the digestibility of foods;
- to reduce microbiological contamination of the products;
- reduce the pollution of the environment (no emissions, effluents and waste secondary).

In conclusion, we should say that the potential income households from the use of feed additives derived from its own biological waste, can be comparable with the income from the sale of basic food production.

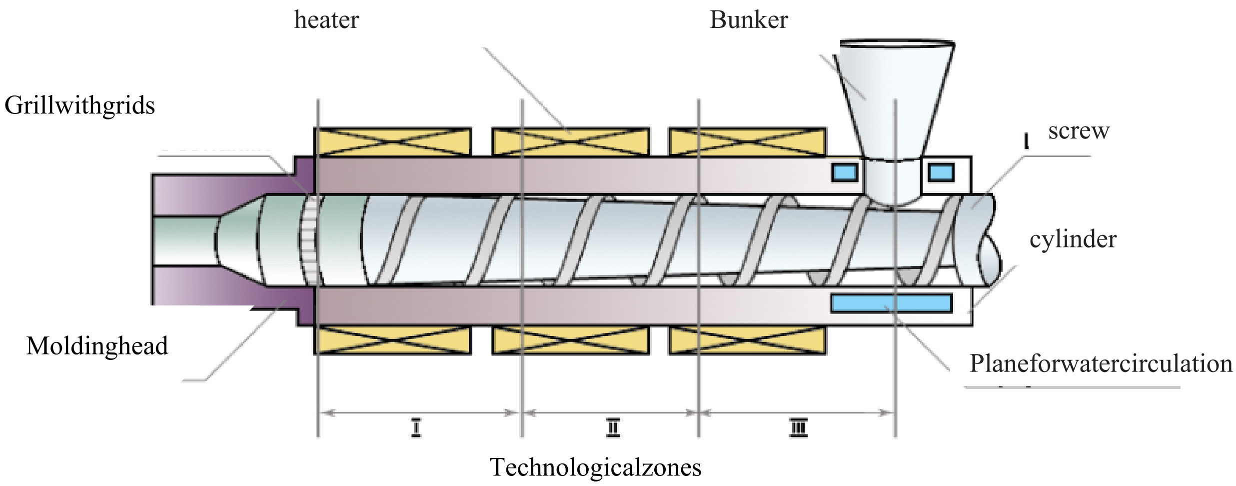
The main technological machine for the production of extruded products - extruder, which consists of several main components: the housing, equipped with heating and cooling elements, a working body (auger, disc, piston),

Arranged in the housing, the core matrix, loading unit of processed product, power drive, system tasks, and maintaining the temperature and other measuring and control devices.

The most important node of the extruder is the screw special design, which can be collected from the individual model elements of different configurations. It is the auger determines the modes of material handling, machine performance and the quality of the finished product.

Currently overseas industry offers a wide range of extrusion machine - from laboratory to high-performance industrial plants of various designs and modifications to meet the ever-increasing requirements to the quality and range of products.

Analysis of engineering and technology of extrusion of the Western countries allowed to systematize the most important types of these machines and to classify them according to various criteria that, in our opinion, best reflects the essence of the extrusion process and is an important auxiliary material in the design of modern extrusion lines to produce new products.



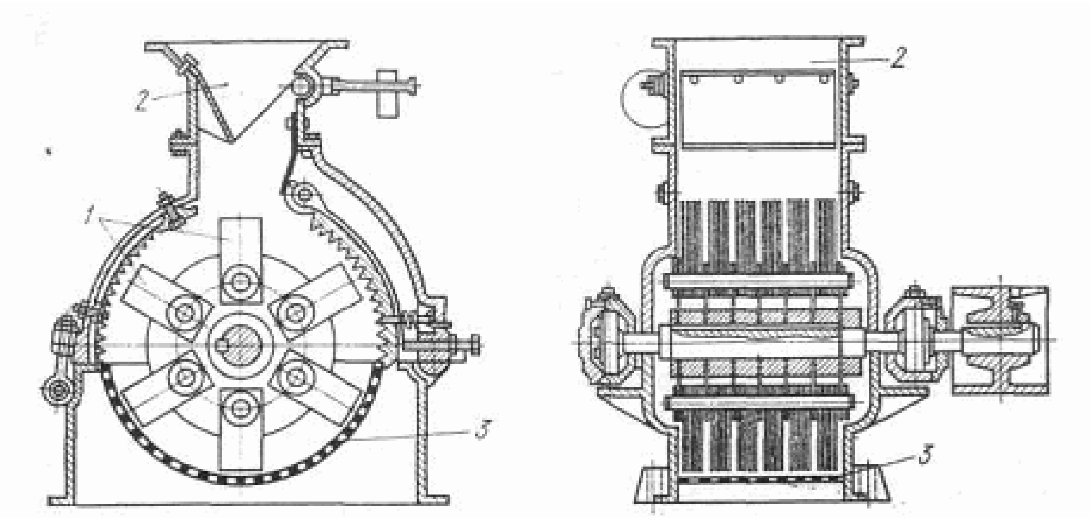


Figure 2 – Scheme extrusion processing of food waste into feed: 1 – cylinder; 2 – hopper; 3 – grid with grids

The apparatus operates as follows. Base composite screw is a stud with left-hand thread on which are mounted: the screw of the first stage (input auger); auger second stage (middle part); auger third stage (the output part);the heating of the washer.

The main auger is the most critical node of the screw extruder, which determines the performance of the machine, the processing modes of the mixture and the quality of the finished product. Usually the screw is single - or double-threaded worm, consisting of several sections, separated by the compression diaphragms (steam locking or heating washers) that create resistance to movement of the mixture and facilitate the compression and heating. Auger design provides a gradual increase of pressure and temperature in the extruder. In some extruders depth of the helical grooves of the worm is reduced to the output end of the auger to provide additional compaction and increasing pressure and temperature.

Sections of the worm are mounted in removable housings having on the inside longitudinal ribs for providing movement of the mixture along the axis of the screw. In places the washers all the material takes part of it is returned through the horizontal grooves back in the feeder and moves them to the exit again. Through internal recirculation of the product under pressure, its temperature increases and reaches at the exit of the extruder of considerable magnitude.

When the output of the extruder finished product "blows up", you lose the humidity, the temperature falls and swells the stream of extradited. The use of different dies or granulating head allows you to obtain an extradited in the form of cords (strands) various shapes, or granules of a certain size, which then require refrigeration.

Transmission of rotation from the main drive shaft precast auger comes with dowels. Precast closed auger housings consisting of two halves each, and one piece body. The latter is screwed to the bearing housing press-extruder. Rectangular window in the housing is used for mounting of the tray through which the mixture flows from the auger dosing in prefabricated housing screw. On the inner surfaces of the housings is provided with longitudinal grooves for moving the mixture along the axis of the screw. To reduce wear of buildings in places over the heating washers installed replaceable wearing rings (three pieces).

At the output section of the screw part is the regulator granulator (depending on the configuration can be set to normal output or oil separating console), consisting of the nose of the housing, the adjustment disc (matrix) with a handle, a drive roller with a cutting knife, pressed against the adjusting disc spring. The rotation of the drive shaft with a knife is passed through the leash and fingers. Seal on drive shaft end, consisting of a replaceable bronze details: bushing in the nose body ring and a driven roller.

The output of the extradited is affected by the combined openings in the nose housing and the adjusting disk. Rotate adjustment disc alters the flow area, thereby regulating the temperature and pressure. The adjusting disc is secured in position by a bolt and is pressed against the nose-body disk. The thermocouple in the housing serves for measuring the temperature in the pressing zone.

On the screw applies an axial force f, the torque MD and uniformly distributed load g from the own weight of the worm. The force P and g cause the deflection of the worm. Task strength calculation is to check the predefined dimensions of the worm and of determining allowable deflection.

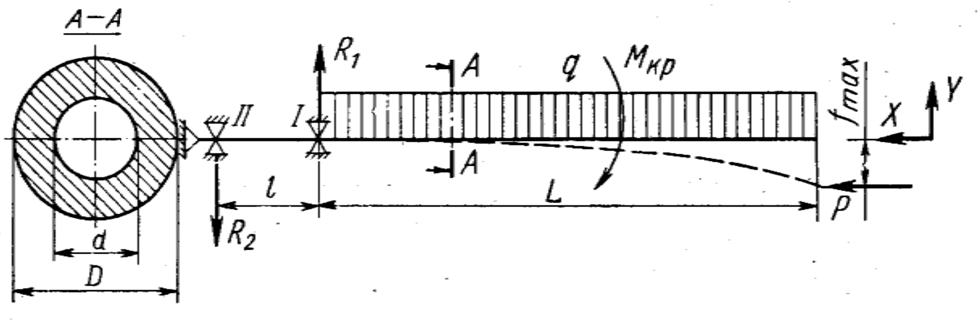


Figure 3 – Scheme to the calculation of a worm

To determine the design scheme of the worm is checked for flexibility according to the formula:

$$\lambda = \frac{k \cdot L}{R_i} \le 120, \tag{1}$$

where k – coefficient depending on the method of fastening the end portion of the shaft k = 2; L – length of the worm, m; Ri is the radius of gyration of the cross section, m.

$$R_i = \sqrt{\frac{J}{F}},$$

where J is the moment of inertia of the cross section of the shaft screw, M4; F – cross-sectional area of the worm, m^2;

$$J = \frac{\pi \cdot D^4}{64}\left(1 - i^4\right),$$

where $i = d_0/D$ – the ratio of the diameters of the worm (in the middle of the height of the ridge).

$$F = \frac{\pi \cdot D^2}{4}\left(1 - i^2\right)$$

$$i=\frac{0,066}{0,08}=0,825;$$

$$F=\frac{3,14\cdot 0,08^2}{4}\left(1-0,825^2\right)=1,6\cdot 10^{-3}\,м^2;$$

$$J=\frac{3,14\cdot 0,08^4}{64}\left(1-0,825^4\right)=1,08\cdot 10^{-6}\,м^4;$$

$$R_i=\sqrt{\frac{1,6\cdot 10^{-3}}{1,08\cdot 10^{-6}}}=38,51\,м$$

$$\lambda=\frac{2\cdot 2}{38,51}=0,103\leq 120,$$

The condition is satisfied.

Technical characteristics of the geometric shape of the channel surrounding the head. Composite materials based on polyethylene is subject to degradation, therefore, the transition from the cylindrical part of the extruder to the profile of the product output end of formalizing the head should be smooth.

Head is divided into three conditional, characterized by the geometrical shape of the parts: two parts of a circular conic section which fades into one another and a circular annular channel of constant cross section along the length.

The shape factor for round tapered channel section K1:

$$k_1=\frac{3\pi D^2 d^3}{128\mathrm{L}\left(D^2+Dd+d^2\right)},$$

where L is the length of the channel, m; D is the largest diameter of the zone head, m; d – the smallest diameter of the head m.

$$k_1=\frac{3\cdot 3,14\cdot 0,082^2\cdot 0,05^3}{128\cdot 0,115\cdot\left(0,082^2+0,082\cdot 0,05+0,05^2\right)}=4,04\cdot 10^{-5}\,м^3;$$

The shape factor for round tapered channel section K2:

$$k_2=\frac{3\pi D^2 d^3}{128\mathrm{L}\left(D^2+Dd+d^2\right)}$$

$$k_2=\frac{3\cdot 3,14\cdot 0,05^2\cdot 0,032^3}{128\cdot 0,06\cdot\left(0,05^2+0,05\cdot 0,032+0,032^2\right)}=1,96\cdot 10^{-5}\,м^3;$$

The shape factor for a channel of circular annular cross-section K3:

$$k_3=\frac{\pi}{8\mathrm{L}}\left[R_н^4-R_в^4-\frac{R_н^2-R_в^2}{2,3\,lg\left(R_н/R_в\right)}\right],$$

where RL is the outer radius portion of the channel of circular annular cross-section, m; Rв – the radius of the inner part of the channel of circular annular cross-section, m; L – length of the canal zone, m.

$$k_3=\frac{3,14}{8\cdot 0,04}\left[0,016^4-0,0124^4-\frac{0,016^2-0,0124^2}{2,3\cdot lg\cdot\left(0,016/0,0124\right)}\right]=4,8\cdot 10^{-5}\,м^3;$$

The total resistance coefficient of placing head:

$$\kappa=\frac{1}{\frac{1}{k_1}+\frac{1}{k_2}+\frac{1}{k_3}}$$

$$k=\frac{1}{\frac{1}{4{,}04\cdot10^{-5}}+\frac{1}{1{,}96\cdot10^{-5}}+\frac{1}{4{,}8\cdot10^{-5}}}=1{,}82\cdot10^{-5}\,м^3$$

The performance of the extruder.

Performance is determined based on the length of the forming zone:

$$П_t^z=\frac{k\cdot\varphi\cdot n}{k+\beta+\gamma},$$

where k is the total resistance coefficient formalizing the head φ is a constant forward flow, m^3; β is a constant return flow, m^3; γ is a constant of the leakage flow, m^3; n – frequency of rotation of the worm, s^{-1}.

The calculation of the constant forward flow by the formula:

$$\varphi=\frac{\pi\cdot m\cdot D_v\cdot\cos^2\alpha\cdot\left(\frac{t}{m}-e\right)\cdot h}{2},$$

whereφ is the angle of helix m – the number of starts of the worm , is taken m=1.

Calculation of the angle of inclination of the helix by the formula:

$$\alpha=arctg\frac{t}{2\pi R}$$

$$\alpha=arctg\frac{0{,}075}{2\cdot3{,}14\cdot0{,}04}=17{,}65^{o}$$

$$\varphi=\frac{3{,}14\cdot1\cdot0{,}082\cdot\cos^2 17.65\cdot\left(\frac{0{,}075}{1}-0{,}007\right)\cdot0{,}007}{2}=5{,}05\cdot10^{-5}\,м^3$$

The calculation of a constant return flow by the formula:

$$\beta=\frac{m\cdot\left(\frac{t}{m}-e\right)\cdot\cos\alpha\cdot\sin\alpha\cdot h}{12\cdot L},$$

where L is the length of the forming zone of the extrusion head L = 0,215 m.

$$\beta=\frac{1\cdot\left(\frac{0{,}075}{1}-0{,}007\right)\cdot\cos17{,}65\cdot\sin17{,}65\cdot0{,}007}{12\cdot0{,}215}=3{,}73\cdot10^{-6}\,м^3$$

The calculation of the constants of the leakage flow by the formula:

$$\gamma=\frac{\pi^2\cdot D_v\cdot\delta^3\cdot tg\alpha}{10\cdot L\cdot e},$$

where L is the length of the forming zone of the extrusion head L = 0,215 m.

$$\gamma=\frac{3{,}14^2\cdot0{,}08\cdot0{,}001^3\cdot tg17{,}65^{o}}{10\cdot0{,}215\cdot0{,}007}=1{,}67\cdot10^{-8}\,м^3$$

Such a way

$$П_t^z=\frac{1{,}82\cdot10^{-5}\cdot5{,}05\cdot10^{-5}\cdot0{,}5}{1{,}82\cdot10^{-5}+3{,}73\cdot10^{-6}+1{,}67\cdot10^{-8}}=2{,}1\cdot10^{-6}\,м^3/c$$

when the density of the material ρ = 950 kg/m^3

$$П_t = 3600 \cdot П_t^c \cdot \rho.$$

$$П_t = 3600 \cdot 2,1 \cdot 10^{-6} \cdot 950 = 7,17\ кг/час$$

The calculation of the coefficients of viscosity.

The coefficients of viscosity μ1 and μ2 are determined by the value of the velocity gradient within the channel of the worm and in the gap between the crest of the screw and cylinder of extruder:

$$\left(\frac{du_в}{dy}\right)_{h/2} = \frac{u_в}{h} = \frac{\pi \cdot D_ч \cdot n \cdot \cos a}{h} = \frac{3,14 \cdot 0,08 \cdot 0,5 \cdot 0,953}{0,007} = 17,1 c^{-1}$$

$$\left(\frac{du_з}{dy}\right)_{\delta/2} = \frac{u_з}{h} = \frac{\pi \cdot D_ч \cdot n \cdot \cos a}{\delta} = \frac{3,14 \cdot 0,08 \cdot 0,5 \cdot 0,953}{0,001} = 119,6 c^{-1}$$

Using rheological curve of polyethylene and found gradients of velocities defined on the chart $\mu_2 = \mu\left(\frac{du}{dy}\right)$ at the proper temperature values $\mu_ч$ and $\mu_ч$

$$\mu_ч = 80 кгс/м^2$$

$$\mu_ч = 100 кгс/м^2$$

The pressure in the metering zone of the screw.

The extrusion process is possible if the pressure p in the metering zone of the screw will be more resistance ρ of the crosshead or equal to, i.e.

The pressure in the metering zone of the screw.

The extrusion process is possible if the pressure p in the metering zone of the screw will be more resistance ρ of the crosshead or equal to, i.e.

$$p \geq \Delta p$$

As it follows from depending on performance:

$$\Delta p = \frac{П_t \cdot \mu_i}{k_i},$$

where is dynamic viscosity and resistance factor of the corresponding channel. Therefore, you should:

The pressure drop for the first channel "round tapered":

$$\left(\frac{du}{dy}\right)_{кр.кан.} = \frac{256 \cdot П_t}{\pi \cdot (D+d)^3} = \frac{256 \cdot 2,1 \cdot 10^{-6}}{3,14 \cdot (0,082+0,05)^3} = 0,074 c^{-1};$$

$$\mu_1 = \mu_{кр.кан.} = 0,9 \cdot 10^4 кгс/м^2;$$

$$\Delta p_{кр.кан.} = \frac{П_t \cdot \mu_1}{k_1} = \frac{2,1 \cdot 10^{-6} \cdot 0,9 \cdot 10^4}{4,04 \cdot 10^{-5}} = 4,67 \cdot 10^2 кг/м^2$$

The pressure drop for the second channel "round tapered":

$$\left(\frac{du}{dy}\right)_{кр.кан.} = \frac{256 \cdot П_t}{\pi \cdot (D+d)^3} = \frac{256 \cdot 2,1 \cdot 10^{-6}}{3,14 \cdot (0,05+0,032)^3} = 0,031 c^{-1};$$

$$\mu_2 = \mu_{кр.кан.} = 0,5 \cdot 10^4 кгс/м^2;$$

$$\Delta p_{кр.кан.} = \frac{П_t \cdot \mu_2}{k_2} = \frac{2,1 \cdot 10^{-6} \cdot 0,5 \cdot 10^4}{1,96 \cdot 10^{-5}} = 5,34 \cdot 10^2 кг/м^2$$

The pressure drop for the third round of the ring":

$$\left(\frac{du}{dy}\right)_{трк.}=\frac{5{,}58\cdot \Pi_t}{\pi\cdot(R_н+R_в)(R_н-R_в)^2}=\frac{5{,}58\cdot 2{,}1\cdot 10^{-6}}{3{,}14\cdot(0{,}016+0{,}0124)(0{,}016-0{,}0124)^2}=10{,}12c^{-1};$$

$$\mu_3=\mu_{трзкан}=0{,}79\cdot 10^4\,кгс/м^2;$$

$$\Delta p_{трзкан}=\frac{\Pi_t\cdot\mu_3}{k_3}=\frac{2{,}1\cdot 10^{-6}\ \ 0{,}79\cdot 10^4}{4{,}8\cdot 10^{-5}}=3{,}46\cdot 10^3\,кг/м^2$$

The total pressure loss in making the head:

$$\Delta p_o=467{,}12+534{,}24+3460{,}94=4462{,}3\,кг/м^2$$

Thus, the pressure in making the head

$$p\geq\Delta p \quad \text{or} \quad p\geq 4462{,}3\,кг/м^2$$

If the efficiency of the transmission mechanism taken equal to 0.8, then the power of the motor must be

$$N_o=\frac{N}{\eta}=\frac{1117{,}81}{0{,}8}=1397{,}26\ Вт$$

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ТАҒАМ ҚАЛДЫҚТАРЫН ӨҢДЕУДІҢ КЕШЕНДІ ТЕХНОЛОГИЯСЫН ЖАСАУ

Аннотация. Қазіргі кезеңде тағамдық өнеркәсіп кәсіпорындары органикалық қалдықтардың үлкен мөлшердегі шығу көзі болып табылады. Бұл қалдықтар өте бағалы азықтық өнім болып табылады, бірақ, олар тез бұзылатындықтан ұзақ уақыт пайдалануға жарамсыз болып қалады және сонымен қатар, қоршаған ортаға, атап айтқанда адамға зиянын тигізетін болады. Сондықтан, тағам өндірісінен шығатын неізгі қалдықтарды қайта өңдеу ауыл-шаруашылық кешенінің азықтық базасын қамтамасыз ету үшін маңызды міндет болып табылады және қоршаған ортаның ластануын болдырмайды. Тағам өнеркәсібінің негізгі қалдықтарына жататындар, консервілік, шарап жасайын өнеркәсіптен шығатын қалдықтар, жеміс және көкөніс қалдықтары, ет және балық қалдықтары, сүйек, нан, сүт өнімдері, сыра қайнату және спирт өнеркәсібінің қалдықтары, эфир майларын шығаратын өнеркәсіп қалдығы, май өнеркәсібінің қалдықтары, кондитерлік және

сүт өнеркәсібінің қалдықтары, мал шаруашылығымен айналысатын фермалардың және ет өңдейтін салалардың қалдықтары жатады.

Тағам өндірісіндегі бұл айтылған қалдықтар, екінші материалдық ресурстар ретінде қарастырылады, себебі, олардың құрамында ақуыздық және минералдық заттар, көмірсулар және дәрумендер болады.

Жоғарыда айтылғандардан басқа, бұл диссертациялық жұмыстың өте өзекті мәселесі, тақырыбы, тағамдық қалдықтарды пайдаға асыру технологиясын жасауға арналады.

Осы уақытқа дейін бұл қалдықтарды пайдаға асыру біздің елімізде және атап айтқанда Шымкентте көп бола қойған жоқ, олардағы бастапқы шикізат құрамында 25% дейін қоректік заттардың болатынына қарамастан оған назар аударылмай келді, бұл жағдайлар, тағамдық қалдықтарды азықтық өнімдерге қайта өңдеудің ресурстық қордағы технологиясын жасаудың өзектілігін көрсетіп отыр. Бұл секілді технология қоршаған ортаны қорғауды қамтамасыз ету үшін қалдықсыз болуы тиіс.

Түін сөздер: экструзиялық өңдеу, компостерлеу, микробиологиялық биоконверсию, қайта өңдеу, полигон, көму.

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РАЗРАБОТКА КОМПЛЕКСНОЙ ПЕРЕРАБОТКИ ПИЩЕВЫХ ОТХОДОВ

Аннотация. На современном этапе предприятия пищевой промышленности являются источники значительного количества отходов органического происхождения. Эти отходы являются ценным кормовым продуктом, однако, быстро разлагаясь, они становятся непригодными для дальнейшего использования и, более того, наносят вред окружающей среде в общем и человеку в частности. Поэтому переработка основных отходов пищевого производства является важной задачей для обеспечения кормовой базы сельскохозяйственного комплекса и предотвращения загрязнения окружающей среды. Основными отходами пищевой промышленности являются отходы консервной, винодельческой промышленности, фруктовые и овощные отходы, мясные и рыбные отходы, кости, хлеб, молочные продукты, отходы пивоваренной и спиртовой промышленности, отходы эфирно-масличной промышленности, отходы масло- жировой промышленности, отходы кондитерской и молочной промышленности, отходы животноводческих ферм и мясоперерабатывающей отрасли.

Перечисленные отходы пищевых производств могут рассматриваться как вторичные материальные ресурсы (ВМР), так как в них содержатся белковые и минеральные вещества, углеводы и витамины.

Исходя из вышесказанного, чрезвычайно актуальной представляется тема данной дипломной работы, посвященной разработке технологий утилизации пищевых отходов.

До настоящего времени объемы утилизации этих отходов в нашей стране и, в частности, в Шымкенте, были невелики, несмотря на то, что в них содержится до 25 % питательных веществ исходного сырья, что опять же подтверждает актуальность разработки технологии ресурсосберегающей переработки пищевых отходов в кормовые продукты. Такая технология должна быть малоотходной для обеспечения охраны окружающей среды.

Ключевые слова: экструзионная переработка, компостирование, микробиологическая биоконверсия, утилизации, свалку, захоронение.

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