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Abstract.*The results of physical and mathematical modeling trybosystemy "working body - the soil." The processes taking place in the dynamic state and trybosystemy task for further research.*

Keywords: trybosystemy, physical, mathematical model, working bodies, soil

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Keywords: trybosystemы, physical and matematycheskaya model Rabochie orhanы, Soil

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STUDY REGIME polyfrequency ELECTROMAGNETIC VIBRATIONS SHOCK-VIBRATION SYSTEM

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Abstract.*The article discusses the creation polyfrequency mode vibrations of the working body of the electromagnetic shock vibration settings for seals*

concrete mixtures. As a result of theoretical studies found changes in the rigidity of rational law drummer suspension within a period of oscillation. A new drummer suspension design that allows to realize polyfrequency

regime movement. A laboratory model dvomasovoyi electromagnetic shock-vibration installation of the magnetic structure pidvishanoyu drummer.

Keywords: polyfrequency mode vibrations, shock vibration setting, magnetic pidvishana design drummer

Formulation of the problem. The use of shock vibration compaction machinery concrete operating at frequencies humble and realize he ezhymy complex interactions with the environment (superharmoniynyy, polyphasic etc.) Proves the effectiveness of their use. The study of the dynamics of the movement of these vehicles is quite thorough [1, 2, 6].

Analysis of recent research. However, today made new sealing technology that require the implementation of complex modes of movement of the working body under the conditions obtaining products of high quality and minimum energy consumption. Therefore, the question of creating polyfrequency mode vibrations of the working body of the electromagnetic shock vibration settings and study of the behavior of the car in terms of interaction with multi-component environment.

Results. Efficiency polyfrequency impact on the conditions of the concrete mixture vibrouschilnennya subject of many works, among which should be mentioned of Kunnosa GY, OA Savinov, Lavrynovych EV, Shmyhalskoho VN, Nazarenko I. etc. The practical implementation of these provisions is largely confined to the implementation of the principle of superposition. It is known that the process of compacting the concrete mix in terms of the effectiveness of different vibration parameters is quite protyrichnym. Low mode provides a good insight into the thick of the energy mix, but does not carry enough energy to effectively seal a multidimensional environment. In contrast, the high-energy regime is a carrier of high intensity, but has a low degree of insight and quickly absorbed by the environment. Therefore, it was decided to seek the solution of this problem in a rational combination of low and high bearing that is nakladayemyh modes of vibrations of the working body. The logical result of the above is the need to create a vibration that will allow to realize polyfrequency the motion of the working body and thus provide the necessary technology compaction mode. There are many companies and organizations involved in research of vibration of complex structure. To companies that develop vibrotestovoho equipment include: MRAD-Corp, TMC's ElectroDamp, Monarch Instrument, Unholtz-Dickie Corporation, Prodera-Sys-Modal and Prodera-Win-Modal, Brüel &Kjær's, Honeywell, Motorola and others.

Some of these developments should introduce. This vibration setting firm MOOG (USA) (Fig. 1) which has a horizontal platform,

installed on six hydraulic jacks, has 6 degrees of freedom and a computer control system in wide amplitude and frequency range. Another company is vibroustanovka TMS (USA) (Fig. 2) having electromagnetic exciters vibrations 6 degrees of freedom and a digital control system that makes it possible to reproduce complex spectrum of vibrations.

One of the developers of vibrating equipment is a US company DTE, which represents vibroustanovku with three degrees of freedom in the computer system which manages the hydraulic servo (Fig. 3).

Fig. 1. Vibration setting MOOG (USA):frequency range - low, medium, high; number of degrees of freedom - 6; Drive - hydraulic servo; computer system management mode oscillation.

Fig. 2. Vibration setting TMC (USA): frequency range -> 100 Hz; number of degrees of freedom - 6; Drive - electromagnetic exciters; digital control system.

Also interesting is the vibrating structure installation company MOOG (USA), operating at a frequency of oscillation 50 ... 100 Hz has 6 degrees of freedom and is driven by means of hydraulic drives (Fig. 4). For the experimental studies were created Experimental stand consisting of dvomasovoyi shock-vibration installation with electromagnetic actuator and analog-to-digital recording equipment and data processing (Fig. 5).

Fig. 3. Vibration installation

Fig. 4. Vibrating table

company DTE (USA): Frequency range - low, medium, high; number of degrees of freedom - 3; Drive - hydraulic servo; computer system management mode oscillation.

company MOOG (USA):the oscillation frequency - 50 ... 100 Hz; number of degrees of freedom - 6; Drive - hydraulic.

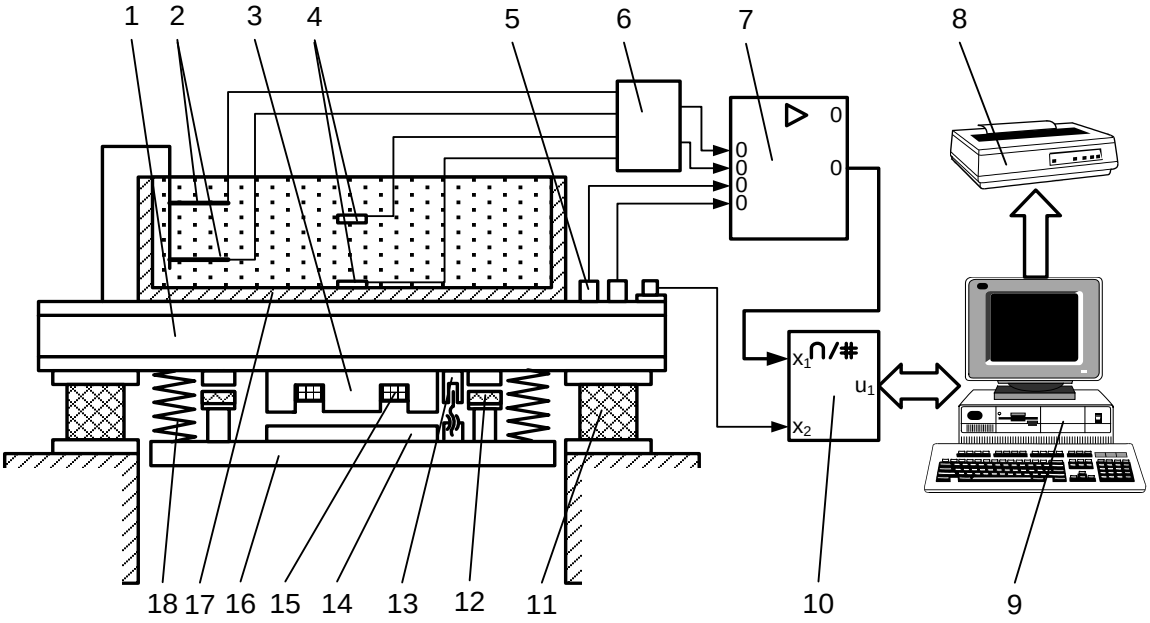


Fig. 5. Scheme of research and experimental complex: 1 - vibroustanovky working body; 2 - displacement sensor layer mixture; 3 - stator electromagnet; 4 - Pressure (mezdoza); 5 - re-mischennya sensors, speed and acceleration; 6 - additional resistors; 7 - Tenzo station; 8 - printer; 9 - computers; 10 - analog-to-digital converter (ADC); 11 - basic shock absorbers; 12 - buffer elements; 13 - Power breaker; 14 - anchor electromagnet; 15 - electromagnet coil; 16 - drummer; 17 - form; 18 - elastic elements (stiffness - C1).

The aim of experimental research was assessment of the nature and magnitude of the impact of dynamic characteristics of movement of the working body of the machine on the work environment. For this form of meter used to seal concrete mixture which placed displacement sensors Strain the mixture and the layers of tension. The data recording readings of sensors indicate that the range of stress environments in the contact "form-mix" during sealing shifted towards high frequencies (the maximum contribution makes 2nd harmonic - ω2 = 125.66 rad / s, the second peak corresponds to the 5th harmonic - ω5 = 314.16 rad / s, maximum three sets 7th harmonic-ω7 = 439.82 rad / s). The results of experimental studies prove the need for a polyfrequency mode of movement of the working body vibration.

This raises the question first account of this phenomenon in the method of calculating the parameters of the machine and secondly to create new vibration that can more effectively carry out the transfer of vibroenerhiyi working body to seredovyscha.Vidomo [1], purposeful change suspension stiffness drummer - and C1 time delay in switching power magnets - tz can control the settings of the machine to provide the necessary technology AC consolidation mode, but change the parameters in this study is the whole cycle of compression and does not provide polyfrequency mode vibrations of the working body. To create polyfrequency mode oscillation most "user" parameter dynamic system is tightening spring C1, but change the stiffness of a mechanical system with a frequency higher than the fundamental frequency of the machine is not efficient and requires additional energy costs, so it was decided to replace the mechanical spring electromagnetic hanging drummer. Electromechanical system in its physical principle of action by this problem and allows as stiffness parameter serves as magnetic field strength elastic suspension change with high frequency and minimal power consumption.

When in computer modeling in the environment MathCAD a study of parameters of the machine under conditions of changing spring stiffness in mizhudarnyy period [3]. The results of modeling steady retrieve polyfrequency the motion of the working body.

Dynamic parameter that the most significant impact on the stress-strain state of the environment is accelerating the mixture of single layers, so conventional criteria for evaluating the quality of the working body accept acceleration.

Obviously, finding the optimal mode of movement taking into account all process parameters is not possible at this stage, therefore, setting the necessary restrictions, we find the optimal spring stiffness of the variation C1 = f (t). You must set the following conditions:

1. The frequency of higher harmonics is: $f_{в.г} = (3...10)\omega_0$ (Take the results of spectral analysis).
2. Acceleration amplitude of higher harmonics accept: $\ddot{X}_{â.ã} = (0{,}05...0{,}1)\ddot{X}_1$.
3. The delay in switching on the power of magnets is constant: $t_z = 0{,}035$ c.

Then you need to set criteria optimization. If the main parameter law of motion which we want to endure under the above conditions, the acceleration of the working body, then it is necessary to minimize the dynamic loads that occur in electromechanical system resulting in the generation of higher harmonic components. Write integrated functionality by using the energy acceleration Apel [4]

$$I_v = \int_0^{t_1} V dt \,, \qquad (1)$$

where: $V = \frac{m_1 \ddot{X}_1^{\,2}}{2}$ - Energy working body vibration acceleration.

To determine the optimal movement of the working body of law should minimize the functional integral (1). The condition of minimum functional (1) is the Euler-Poisson [4]

$$\frac{\partial F}{\partial q_k} - \frac{d}{dt}\frac{\partial F}{\partial \dot{q}_k} + \frac{d^2}{dt^2}\frac{\partial F}{\partial \ddot{q}_k} = 0 \,, \text{ (K = 1, 2, ... s)} \qquad (2)$$

where: F - measure of motion or action of a mechanical system, qk - generalized coordinate system.

In our case, the function F is energy and energy is dynamic acceleration component third-order working body vibration W, instead of accepting the generalized coordinates movement of the working body X1. After substituting these substitutions in expression (2) obtain the fourth order equation:

$$X^{IV} = 0 \,, \qquad (3)$$

Solution equation (3) will carry out numerical method. As a result of the solution of equation (3) graphs (Fig. 7). For the analysis of criteria as a management tool used triangular suspension elasticity (sawtoothed), rectangular and sine law (Fig. 8 b). The modeling was conducted under the following initial conditions: load vibrobloka100 kg, rigidity C_1 = = 80000 ... 480000 N / m delay t_z = 0.03 ... 0.04 sec. Charts are system parameters (displacement, velocity, acceleration) during the control functions $C_1 = f(t)$ (Fig. 8 a).

We write ratio for traction electromagnet:

$$\frac{dF_e}{dx} = \frac{d}{dx}\int_0^{\psi} i \cdot d\psi \,; F_e = -\frac{ab\psi_p^2}{2(b+x)^2} \,; \frac{dF_e}{dx} = \frac{ab\psi_p^2}{(b+x)^3} \,. \qquad (4)$$

Constructing a graph of the original thrust electromagnet taken along the x on the relative movement of the masses (Fig. 6) and comparing the schedule changes rigidity suspension in time for the criterion of Euler - Lagrange - Poisson (Fig. 7) we can conclude: control function should be similar the function vymushuyuchoyi force. This is logical, since the dynamic parameters of the system change in law vymushuyuchoyi strength, and if exercise is technically elastic suspension using an electromagnet, then it is clear that the function that "easiest" thing to realize is the variation of thrust electromagnet. Rational frequencies management features based on the results of Fourier - analysis below. Rational frequency management functions elasticity suspension drummer on the results of the Fourier analysis of experimental data:

$\omega_1 = 62{,}8\ рад/с$, $\omega_2 = 125{,}66\ рад/с$, $\omega_4 = 251{,}33\ рад/с$, $\omega_5 = 314{,}16\ рад/с$.

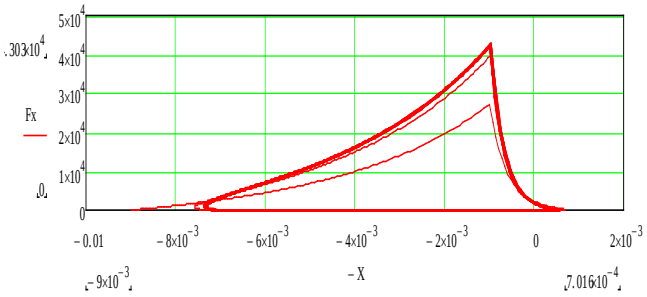


Fig. 6. Graph of the traction of the electromagnet in the magnetic gap.

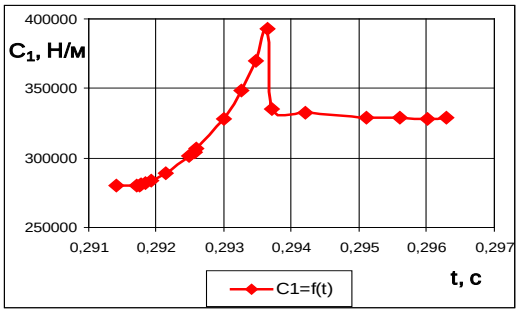
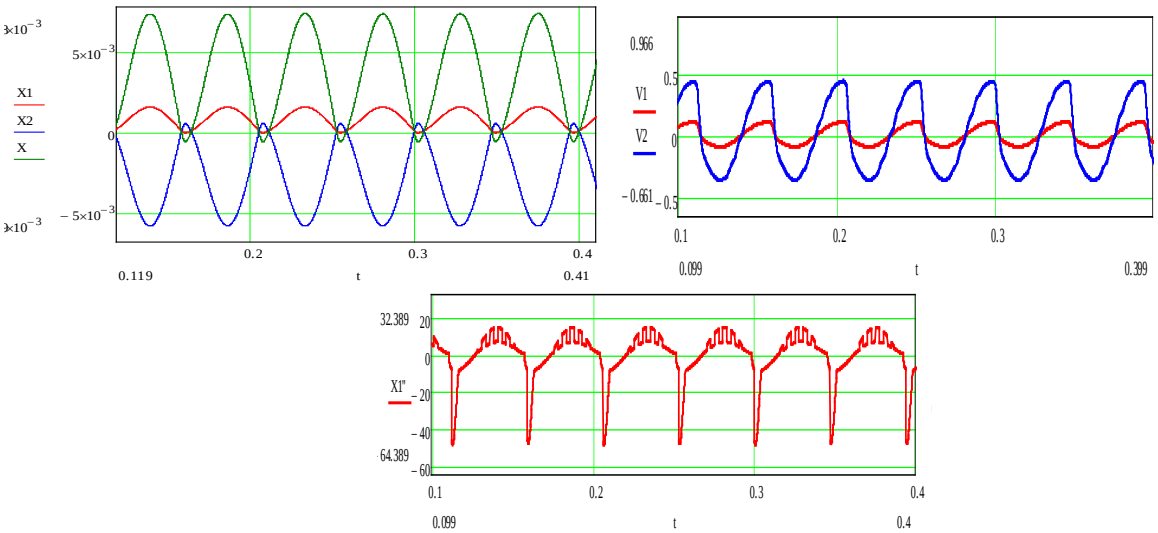


Fig. 7. Schedule changes stiffness in spring-time criterion of Euler-Lagrange-Poisson.

In order to implement the process control suspension stiffness drummer offered a new solution - hanging drummer using electromagnets that enable high-frequency vibrations create lagless drummer imposed on the fundamental frequency vibrations [5]. Process control is made programmable microcontroller.

To verify that the system established laboratory model dvomasovoyi electromagnetic shock vibration settings. The installation consists of a working body drummer that suspended permanent magnet, the supporting frame, rubber supports, electromagnet drive and control equipment (Fig. 9). Magnets are hanging from the top and bottom of the impactor. From the axial movement of the firing pin is held in both runners axes. General view of the installation, magnetic suspension designs, and installation of an electromagnet and buffers shown in Fig. 10.



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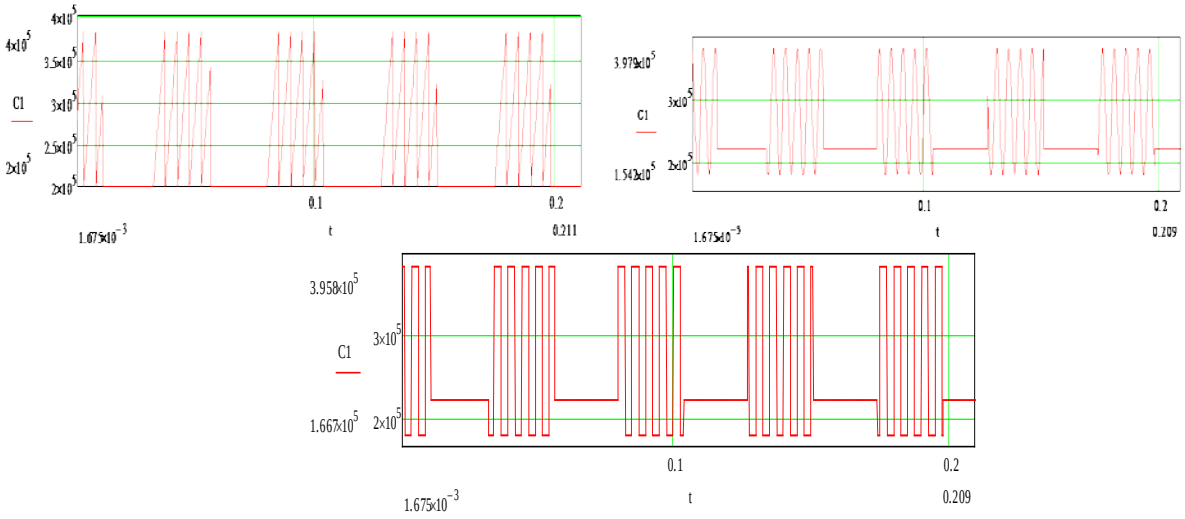

b

Fig. 8. The schedule change basic system settings provided management action C1 = f (t): a) basic graphics system parameters b) changes in schedules spring stiffness.

The new suspension design solution drummer confirmed their performance - setting work effectively in a stable mode with a frequency of 25 Hz. Experiment conducted simulations of the working environment proved effective transfer shock vibration forms fluctuations. The tests confirmed the feasibility of using magnetic suspension drummer.

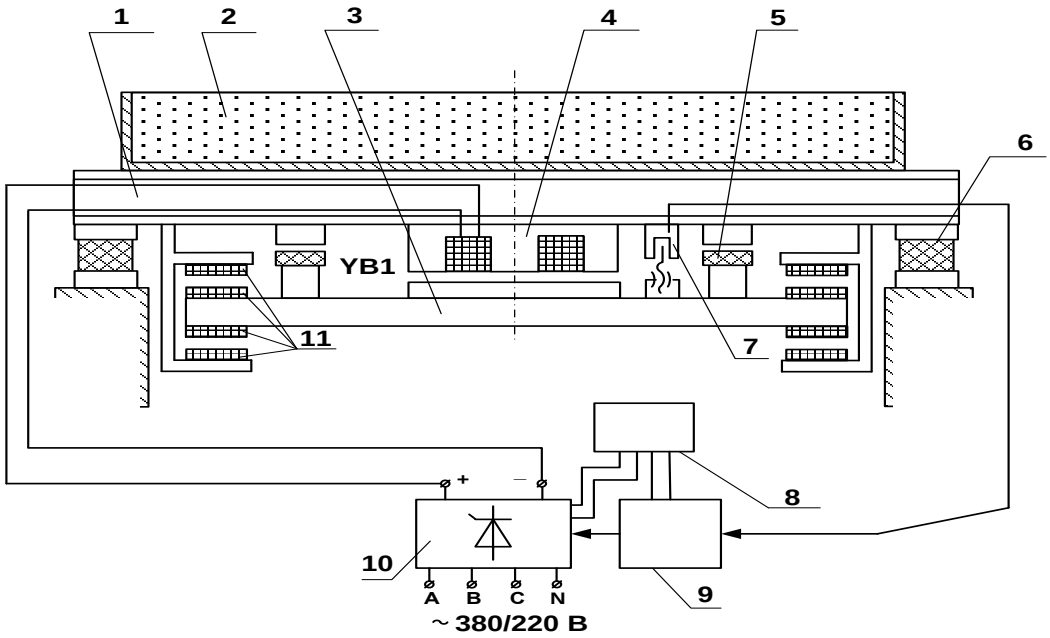

Fig. 9. The electromagnetic shock vibration machine for forming concrete products 1 - working body; 2 - a form of mixture; 3 - drummer; 4 - the main magnet (YB1); 5 - buffering elements; 6 - supporting dampers; 7 - inductive sensor; 8 - programmable microcontroller; 9 - control unit; 10 - thyristor rectifier; 11 - permanent magnets.

Fig. 10. Laboratory dvomasova electromagnetic shock-vibration installation of redesigned suspension drummer.

Conclusions

1. The results of theoretical research polyfrequency received a steady movement of the working body.
2. Found rational law change suspension stiffness drummer within one period of oscillation.
3. A new drummer suspension design that allows to realize polyfrequency regime movement.
4. A laboratory model dvomasovoyi electromagnetic shock-vibration installation of the magnetic structure pidvishanoyu drummer.

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Abstract.*In Article rassmatryvaetsya question polychastotnoho creation mode oscillations Rabocheye body elektromahnytnoy shock vybratsyonnoy seal installation of concrete mixture. As a result of Nayden of research Theoretically ratsyonalnыy Law Changed zhestkosty*

podvesky Limit drummer in one period oscillations. Novaya proposals Constructions podvesky drummer, kotoraja daet Ability realyzovыvat polychastotnыy regime movement. Created laboratornaya model dvohmassovoy эlektromahnytnoy shock vybratsyonnoy installation with magnetic podveshennoy Constructions drummer.

Keywords: polychastotnыy mode oscillations, shock vybratsyonnaya setting, magnetic podveshennaya Constructions drummer

Annotation.*The problem to create poliharmonic vibration conditions of work platform electromagnetic vibroimpact machine for concrete compression was described. Rational mathematic equation of suspended impactor springiness within one period of oscillation was determined as a result of theoretical investigation. The new suspended impactor design which gives a possibility to realize poliharmonic vibration conditions was proposed. The laboratory model two-mass electromagnetic shock-vibration machine with magnetically suspended construction of impactor was created.*

Key words: ***poliharmonic vibration conditions,shock-vibration machine, magnetically suspended construction of impactor***
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RESEARCH TRAINING SYROVYNYDO BIOTECHNOLOGY MECHANICAL EXTRACTION POLISAHARYDIVDLYA MUSHROOM PRODUCTION MIKOBIOPREPARATIV

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Abstract. *Studied engineering approaches to machining raw performance crusher, fractional composition of fungal biomass and proposed experimental variable sieve crusher, which provides requirements for the preparation of mushrooms biotechnology extraction of fungal polysaccharides.*

Keywords: biomass mushroom, mushroom, grinding, mikobiopreparat, fruit body, faction, dimensions, weight

Formulation of the problem. For biotechnology production mikobiopreparativ proposed use of fruiting bodies afiloforalnyh tree destroying fungi. One of the main manufacturing operations are grinding production mikobiopreparatu fruiting bodies of these fungi in order to