

FARM MACHINERY AND TECHNOLOGIES

DOI: 10.34677/1728-7936-2019-5-4-8

RESISTANCE TO AGING AND VIBRATION LOADS OF A POLYMERIC COMPOSITE MATERIAL BASED ON THE AH-111 ANAEROBIC SEALANT

ALEKSANDR S. KONONENKO, DSc (Eng), Professor¹

E-mail: as-kononenko@yandex.ru

DMITRIY N. PSAREV, PhD (Eng), Associate Professor²

E-mail: psarev_380@mail.ru

ANDREY B. ROZHNOV, Senior Lecturer²

E-mail: smart-68@yandex.ru

¹ Bauman Moscow State Technical University; 105005, 2nd Baumanskaya Str., 5, Moscow, Russian Federation

² Michurinsk State Agrarian University; 393760, Internatsionalnaya Str., 101a, Michurinsk, Russian Federation

The paper presents methodology and research results of the influence of aging processes on the change in the strength characteristics of adhesive joints made with the AH-111 sealant and its nanocompositions. The thickness of the test polymer layer was 0.2 mm. Polymeric materials were aged using an accelerated method (based on GOST 9.707-81). Upon completion of 5, 10, 15, 20, 25, 30, 35, and 40 cycles, the adhesive strength of the AH-111 sealant and its composition were determined under axial shear. For research, an explosive machine P-5 was used. It was shown that the aging resistance of the nanocomposite is 15.4% higher than that of the unfilled composition. The authors describe the methodology and bench test results characterizing the resistance of the studied polymer compositions to vibration loads. The oscillation amplitude of the plate was 1.0...1.2 mm. The thickness of the test polymer layer amounted to 0.2 mm. After completion of the tests on the vibration bench, after 5, 10, 15, 20, 25, and 30 hours, the samples were tested for strength with a P-5 tensile testing machine. The authors have established regularities of changes in the strength of adhesive joints depending on the number of loading cycles. It has been shown that the effect of vibration loads leads to a decrease in the strength characteristics of the AH-111 anaerobic sealant by 20.4%. In turn, the vibration resistance of the AH-111 + Taunit-M composition is 16.5% higher than that of a filler-free (non-pigmented) polymer composition.

Key words: polymer composition, carbon nanotubes, vibration loads, anaerobic sealant, aging, cyclic loads.

TECHNICAL SERVICE IN AGRICULTURE

DOI: 10.34677/1728-7936-2019-5-8-13

EVALUATION OF QUALITY INDICATORS OF “SHAFT-CUFF” PARTS AND ASSEMBLIES

OLEG M. MELNIKOV

E-mail: ommelnikov@rambler.ru

SERGEI P. KAZANTSEV, DSc (Eng), Professor

E-mail: kspts@bk.ru

OLGA V. CHEKHA

E-mail: olgachekha@rgau-msha.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

The service life of the running gear, the drive line and other units of agricultural machines depends on the durability of sealing assemblies. The author lists reasons for the loss of sealing performance: surface wear along the inner diameter (87%), edge cracking as a result of aging and fatigue failure (14%), sticking of a cuff to a shaft with subsequent destruction of the former (9%). To analyze the parameters of new seals, a batch of cuffs sized 1.1-45x65-1 GOST 8752-79 in an amount of 200 pcs were studied. The paper presents some parameters for evaluating new and worn cuffs and shafts. The histograms and theoretical curves of the scattering of the interference fit and contact pressure of the working edge of cuffs are presented. A one-factor experiment was conducted to analyze the relationship between the interference of new cuffs and the contact pressure on the shaft $N = f(p)$. It has been found that these values are independent, as evidenced by the obtained correlation coefficient that is equal to 0.016. The paper lists characteristic defects of shafts: wear of the surface contacting with a cuff, scratches, cracks and corrosion damage of the surface. It is indicated that the shaft wear can be reduced by increasing the hardness of its surface. Reducing the wear of the cuff's working edge is possible due to the use of more wear-resistant and antifriction rubber.

Key words: quality, rubber reinforced cuff, shaft, tension, pressure, size, wear, deviation.

ECONOMY AND ORGANIZATION OF AGRICULTURAL ENGINEERING SYSTEMS

DOI: 10.34677/1728-7936-2019-5-14-19

ALLOCATION OF BAKERY PRODUCTION CAPACITIES IN REMOTE AREAS OF RUSSIA

VALERIY M. KOSHELEV, DSc (Econ), Professor

E-mail: vmkoshelev@gmail.com

LYUDMILA V. SHUSHKINA

E-mail: lyudmila.shushkina@mail.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

Russia faces an urgent problem of economic and local availability of bread in remote northern regions, the Republic of Karelia being a typical example of it. The process of launching new bakery enterprises in such areas could essentially improve the current situation on the market and meet the residential demand. The conducted analysis of the sector has shown that the existing location of bakery facilities in different parts of Karelia is extremely uneven. It leads to a deficit of bread in several cities and districts of the Republic. This problem could be at least partly solved by establishing a well-tuned logistic network between areas with a surplus and those with a deficit. However, it is impossible to compensate the total bread deficit just by internal transportation from surplus areas to deficit ones. Conversely, sustainable solution requires new capacities: the large ones – in densely populated areas in the south, while the modest ones – in the north with a low population density. To solve the problem of optimal allocation of bakery enterprises with various production capacities, the authors used a methodology of the integrated application of economic and mathematical modeling methods and the analysis of investment projects. According to the optimal solution, 28 new bakeries of different capacity should be built and 852 tons of bread (about 7% of the internal deficit) should be transported between areas inside Karelia to substitute for imports. The conducted analysis of the investment project reveals its high economic efficiency: NPV = 72.3 mln rub., IRR = 20%, and a discounted payback period of 7.8 years. This methodology allows enhancing the quality of management decisions, so it can be used not only in the bakery industry, but also in other sectors of Russian economy.

Key words: food security, baking industry, capacity allocation, economic-mathematical modeling, economic efficiency, investment projects.

DOI: 10.34677/1728-7936-2019-5-19-25

DESIGNING A LOCAL COMPUTER NETWORK OF AGRICULTURAL ENTERPRISE BASED ON SIMULATION MODELING

NATALIA L. KATASONOVA, Associate Professor

E-mail: nkatasonova@mail.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

Currently, local-area network and corporate information system are widely used in the management of enterprises, the functioning of which also required the application of the rational organization principles. Purchase, installation and maintenance of an enterprise information system is a high-cost activity. Therefore, the network economic efficiency, which determines its topology, degree of loading, cost and the software functionality is rather relevant. To design a rationally organized computer network, use can be made of the method of simulation. In this case, the local area network (LAN) is represented as a queuing system with random frequent generation of transactions established in a certain interval in accordance with the planned volume of computer transactions in the enterprise activity. A rationally organized computer network should be characterized by a high load factor of nodes (devices) of the system (personal computers (workstations), servers, switches, routers) with small queues of requests to these devices. Simulation modeling provides not only for developing a model of a computer network and determining its "bottlenecks", but also conducting experiments with the model to determine its most rational structure. The paper describes the topology and structure of LAN for storage facilities of the agricultural enterprise "EcoAgro" engaged in the cultivation of greenhouse vegetables. Running the model with LAN parameters proposed by the company showed that the network is underutilized, and therefore, inefficient. Underutilization of the network increases the cost of production due to high specific costs of depreciation and electricity. Based on the conducted experiment with the model, the enterprise was offered, first of all, to purchase less expensive computers with lower performance, and, secondly, to provide access to them for various departments of an enterprise to ensure their increased workload.

Key words: local area network, rational computer network parameters, simulation, distributed computer network transactions.

DOI: 10.34677/1728-7936-2019-5-26-30

TECHNICAL RE-EQUIPMENT OF SMALL-SIZE MILK FARMS

NATALIA V. SERGEYEVA, PhD (Econ), Associate Professor

E-mail: sergeewanv78@mail.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

Insufficient financing of agricultural enterprises leads to a relatively slow renovation of production means and the modernization of production processes. Machinery and equipment of cattle farms are worn by 80-100%, their service life exceeding 10 years. As a result, the cost of their maintenance, and, consequently, the cost of milk produced, grows. Using an example of the Zimnitsky dairy farm of the Bryansk region operating 156 heads, the author proposed to replace equipment and mechanization means according to three main technological processes: feed distribution, milk storage, and manure removal from the farm. The KT-6 trailed feed feeder-mixer was replaced with a more modern and productive model KTY-10A. For the process of primary processing and storage of milk on the farm, the horizontal milk cooler tank of the open type PO-2.5 was substituted with a tank from the Wedholms company. To remove manure from the farm, the author suggested replacing the TCH-2.0Б conveyor with a transporter scraper TCH-160 equipped with a conveyor belt. According to the design version of the equipment, the number of workers can be reduced by 6 people, which will reduce the payroll budget by 1,061.3 thousand rubles. In addition, depreciation and electricity costs can be decreased. The total savings in operating costs will amount to 1,144.5 thousand rubles. The labor intensity of milk production will decrease by 0.62 man-hours per cent, which will lead to an increase in labor productivity by 1.31 centners per person-hour. The payback period of capital investments on new equipment in the amount of 893.5 thousand rubles is expected to be approximately one year if the savings in operating costs are taken as the amount of additional profit with other things being equal.

Key words: technical re-equipment, innovative technologies, modernization, means of mechanization, production cost, operating costs, economic efficiency.

POWER SUPPLY AND AUTOMATION OF AGRICULTURAL PRODUCTION

DOI: 10.34677/1728-7936-2019-5-31-39

ENERGY SOURCES IN INNOVATIVE ENERGY TECHNOLOGIES OF VEGETABLE PROCESSING

ALEKSANDR V. GAVRILOV, PhD (Eng), Associate Professor

E-mail: tehfac@mail.ru

Academy of Life and Environmental Sciences, Crimean Federal University named after V.I. Vernadsky, 295492, the Crimea Republic, Simferopol, Agrarnoye

The analysis of numerous scientific works shows that the intensive development of innovative types of technology exceeds the development of the methodological foundations of power engineering management. There are no clear comparisons of the energy efficiency of electrical technologies and heat technologies, since different types of energy are used; there are no objective indicators of energy efficiency in various technologies of dehydration of raw materials. The present study proposes a methodology based on the hypothesis that when comparing energy efficiency in the processing of raw materials, objective results can be obtained through a system analysis of the entire energy conversion chain from fuel to a finished product. The research purpose is to experimentally prove the validity of this hypothesis. The author suggests using the indicator of the share of fuel energy in the finished product and the amount of moisture removed when burning 1 kg of fuel. This figure does not depend on fluctuations in energy prices, which may vary for different countries. The paper presents a heat balance analysis of drying and evaporation plants. It is shown that with the same technical tasks, non-optimized evaporation is several times more efficient than the optimized drying process. The authors present structural models of energy conversion in combined processes for the production of concentrated food products. The energy efficiency of using fuel in conventional drying, evaporation, and cryoconcentration techniques has been calculated. The obtained parameters are compared with the data for innovative models of machines developed by the author. It is shown that the evaporating installations developed by the author are not inferior in efficiency to conventional ones, and allow obtaining concentrates up to 90 brix. The developed microwave dryers and unit freeze installations significantly exceed the efficiency of their counterparts, allowing to withdraw, respectively, up to 6 and 100 kg of moisture, while conventional dryers for fuels with an oil equivalent of 40 MJ per 1 kg can remove no more than 3 kg of moisture, and cryoconcentrators – 20 kg.

Key words: energy management, food production, energy efficiency, drying, cryoconcentration, microwave field, dehydration, food concentrates.

DOI: 10.34677/1728-7936-2019-5-40-45

TEACHER TRAINING FOR INNOVATIVE PEDAGOGICAL ACTIVITY UNDER DIGITIZATION OF AGRARIAN EDUCATION

PETR F. KUBRUSHKO, DSc (Ed), Professor, Corresponding Member of the Russian Academy of Education

E-mail: pkubrushko@mail.ru

LIUDMILA I. NAZAROVA, PhD (Ed), Associate Professor

E-mail: nazarova@inbox.ru

ALEKSEI S. SIMAN, PhD (Ed), Associate Professor

E-mail: s-lex-man@mail.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

The authors consider the core of innovative pedagogical activity and present a model developed for preparing agrarian university teachers for innovative pedagogical activity to be used in the system of continuing professional education. The ability and willingness of the teachers to carry out innovative pedagogical activity reflects their innovative competence, in the structure of which the authors distinguish motivation-and-value, cognitive and activity-driven components that are formed in the process of formal, non-formal and informal education. These components are correlated with the main sections of the course of “Pedagogical Innovation Activity”, which is an apical component of the process of developing the innovative competence of a teacher. In the context of the active development of the digital educational environment in the professional education system, the goals, content, forms, methods and means of preparing for innovative pedagogical activity are being transformed, so digital technologies are becoming increasingly important, as they determine the features of applying many training technologies (problem, context, modular, project training, etc.). The key role in the integration of innovative educational technologies in the digital educational environment is played by blended learning technology combining classroom learning and distance learning based on digital technologies (asynchronous – assignments placed on the training platform and synchronous – webinars, online conferences and other forms of collective learning activities). The paper presents study results of the development degree of motivation-and-value, cognitive and activity-driven components in teachers of secondary vocational and higher educational establishments. According to the results obtained, all components of the innovative competence of teachers (both in the system of secondary vocational and higher education) are insufficiently formed, especially in terms of digital literacy, and therefore, under digitalization of agrarian education, teachers should be targeted at innovative pedagogical activity within the framework of further agricultural education.

Key words: innovative pedagogical activity, innovative competence, vocational education teacher, pedagogical innovation, digitalization of professional education, digital technologies, digital literacy, blended learning technology.

DOI: 10.34677/1728-7936-2019-5-46-50

COGNITIVE-ACTIVE STYLE AS A FACTOR IN THE SUCCESS OF VOCATIONAL TRAINING

TATIANA P. KOVALENOK, PhD (Psy), Associate Professor

E-mail: tkovalenok@yandex.ru

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

The paper discusses the features of the cognitive-activity style of adults who master the working professions in the training centers of the Russian Railways. Style is defined as a parameter of educational activity, which should act as a criterion for evaluating the educational content created for distance learning of adults. To identify the features of cognitive activity, the authors have used the methodology from “Learning Style Survey” by Rebecca L. Oxford. Diagnostic results of the components of the learning style in a sample of workers (53 people) made it possible to describe its significant features: the predominance of the audio-visual channel for receiving information, the focus on joint activities, the combination of intuitive and logical methods for solving problems, the preference for strictly regulated activities, analyticity and concentration of thinking on details. The analysis of the influence of the learning style on the mastery of the “Labor Protection” subject has shown that significant differences in grades are associated with the predominance of the audiovisual type of perception and synthetic thinking. Students with these style features tend to be more successful. The data obtained in the course of the study on the characteristics of the cognitive style of adult men mastering working professions made it possible to formulate recommendations for creating training content taking into account the laws of andragogy: study materials should maximize the use of all channels of perception, but the main thing should be voice articulation of information; it is necessary to apply active and interactive teaching methods, involving the interaction of students; the study process should be maximally algorithmized, the sequence of students’ actions and the rules for their implementation should

be clearly expressed and objectified; it is important to present the training material not only in a precise, but also in a synthesized and generalized form, to stimulate the development of abstract theoretical thinking, demonstrate the place of a particular case in the general system of phenomena or concepts.

Key words: vocational training, cognitive-activity style, adult education, andragogy, educational content, types of perception, learning efficiency.

DOI: 10.34677/1728-7936-2019-5-51-56

CONCEPT OF COMPETENCE INVARIANCE FROM THE STANDPOINT OF THE THEORY OF EDUCATION CONTENT STRUCTURE

NINA A. LOZHKINA, *Lecturer*

E-mail: ninalozhkina@yandex.ru

Russian Timiryazev State Agrarian University; Timiryazevskaya Str., 49, Moscow, 127550, Russian Federation

The paper shows why competencies serve as the ultimate learning outcome that determine study process restructuring, other approaches to content planning, teaching organization and technology, and actually play the role of a tool in the implementation of the new educational paradigm. The author dwells on the concept of competence invariance in professional education, which is defined as immutability and constancy, the property of any object (or its elements) not to change under changing conditions of its existence. In systemic formations, the invariant acts as a system-forming structure. There are logical grounds for the concept of competence invariance from the standpoint of the theory of professional education content structure, where the most important rule says that the teaching content structure is determined by the structure of activity and the structure of the studied object. Based on the analysis of the theory and practice of the competence approach implementation, the tendency to differentiate the concept of competence invariance is revealed in three aspects: the concept of invariance of a set (list) of competences required for a specialist of any profile (reflects the invariant structure of the professional education content); the concept of invariance of general competences (common for all, important for all and formed in all specialists regardless of their training profile); the concept of invariance of the structure of competences themselves (reflects the universal composition of the components that determine the structure of professional competences). The paper reveals the nature and dialectics of differentiation of the concept of competence invariance from the standpoint of the theory of education content structure. The existence of an invariant set of competences allows to develop invariant and variable parts of their content and fully implement the flexibility of mastering study programs when developing curriculum documentation in the training areas.

Key words: invariance, invariant competences, invariant structure of competences, invariant set of competences, professional education, theory of education content structure.

TRIBUTE TO THE SCIENTIST

DOI: 10.34677/1728-7936-2019-5-57-62

IVAN F. BORODIN – MEMBER OF THE ALL-UNION ACADEMY OF AGRICULTURAL SCIENCES

MIKHAIL N. YEROKHIN, *DSc (Eng), Member of the Russian Academy of Sciences, Professor*

E-mail: Er.mihn@mail.ru

VLADIMIR I. ZAGINAILOV, *DSc (Eng), Professor*

E-mail: energo-viz@mail.ru

SERGEY A. ANDREYEV, *PhD (Eng), Associate Professor*

E-mail: s.andreev@aol.com

Russian Timiryazev State Agrarian University; 127550, Timiryazevskaya Str., 49, Moscow, Russian Federation

The paper describes the life path and the main stages of the scientific and pedagogical activity of Ivan Fedorovich Borodin, Member of the All-Union Academy of Agricultural Sciences (VASKHNIL), laureate of the State prize and two prizes of the Russian Government, honored worker of science and technology of the RSFSR, honorary worker of higher education of the Russian Federation. The scientist laid the theoretical foundations for using non-linear capacitors as sensors in agricultural automation devices. His recommendations were widely used in practice by design organizations involved in the development of domestic electric agricultural equipment. I.F. Borodin studied in detail the effect of natural and industrial electromagnetic fields on the development of plants and animals, as well as developed an effective bioelectric method for diagnosing the physiological state of seeds. He made a significant contribution to the development of the theory and practice of optoelectronic technology for sorting agricultural materials. Ivan F. Borodin thoroughly studied the

electrophysical properties of several dozen types of agricultural products. The knowledge gained was widely used in the development of automated machines for sorting, calibrating and cleaning grains, fruits and vegetables. The scientist was the first to use microwave energy to change the properties of biological objects. A research laboratory was established under his scientific supervision to develop competitive technologies implementing the effects of electromagnetic fields of ultrahigh and extremely high frequencies on plants and animals. Fundamentally new resource-saving and environmentally friendly technologies, universal technical means of quality control of agricultural raw materials and products of its processing developed by the scientific school of I.F. Borodin have been introduced in 68 Russian regions. By their indicators, these products rank among the best world analogues. Ivan Borodin was the founder and Head of the Department of Automation of Agricultural Production, the author of a number of new academic courses. He published more than 600 scientific papers, 47 textbooks, study manuals and monographs, registered 105 copyright certificates and patents in the field of automation and electrotechnological support of agricultural production. He supervised 48 PhD and 28 DSc holders.

Key words: I.F. Borodin, electrical technology, automation of agricultural production, optical and electrical properties of agricultural materials, microwave electromagnetic field, teaching and administrative activities.