



MODERN ISSUES OF LABOR SAFETY DEVELOPMENT AND PROMISING WAYS OF THEIR SOLUTION

Abstract

The article analyzes a semantic meaning of the term "**sustainable development**" followed by its proper interpretation.

It has been determined that in recent years, the number of natural and man-made disasters has increased rapidly due to the processes of technogenic environment expansion, the active growth of our planet population and large-scale urbanization. It is established that in recent decades the number of major man-made disasters consistently exceeds the number of natural ones. In the structure of man-made disasters (among industrial, transport and mixed), the largest number of victims and material damage were induced by industrial disasters.

Definition of the main principle of sustainable development was interpreted. It is concluded that trends of the modern human development model directly contradict the above principle. The known studies were reviewed concerning directions of the humanity's sustainable development concept realization globally and in Ukraine, as well as to the role of labor protection and industrial safety within the above process. The evolutionary development of labor protection has been provided as a science from ancient times to the present, as well as the contribution of great scientists to the development of labor protection and industrial safety.

Modern trends of professional risks and man-made hazards in Ukraine, in particular, in the flour-grinding industry and the world are analyzed. Based on the analysis, it was determined that currently a particular danger is the comprehensive application (availability, trafficking) of chemicals in all without exception workplaces feed mills, grain mills, flour mills and other enterprises of our country, as well as the large-scale use of pesticides of the first and second class of hazard. Another concern is the fact that modern personal protective equipment is not able to protect people from fine particles of chemicals (size 1 – 100 nanometers (nm), widely applied in modern industries thanks to the comprehensive use of nanotechnology in the world. It has been established that 4.4% of world stocks of unsuitable for use pesticides are accumulated in the territory of Ukraine. An increase in the number of chemicals in the air of the working area during the technological processes at the enterprises of the flour-grinding industry has caused 86% of all deaths associated with professional human activities.

The leading role of labor protection as a necessary element of ensuring the implementation of the sustainable development concept in the world is indicated. Main modern problems of labor protection development as a science in Ukraine are defined and promising ways of their solution are offered.

Keywords: Labor protection, occupational risk, sustainable development, danger, industrial injuries, occupational diseases, actualization, industrial safety

Introduction

The concept of sustainable humanity development, as the most promising ideology of the 21st century, has become a logical response to concerns of the world's leading scientific institutions engaged in the study of global processes on our Planet (such as the International federation of advanced research institutes, the Club of Rome, the International institute for systems analysis, etc.) concerning the limited natural resources, environmental pollution and, as a consequence, the deterioration of living conditions of the society.

The term "*sustainable development*" is still ambiguous. Many scientists interpret its meanings differently, but the general idea that unites them is to meet needs of modern and future generations while preserving the environment [1].

The author proposed his own, refined definition of the term "*sustainable development*" for a clearer vision of problems that need to be solved in the implementation of the above concept. Thus, sustainable development is a continuous systematic positive process of changes, in which economic, environmental and socio-spiritual aspects of the existence of society are harmoniously combined with each other, ensuring the continuous life quality development of modern and future generations of humanity.

Articulation of an issue

The harmonious combination of economic, environmental and socio-spiritual aspects of the existence of society depends on the personal level of knowledge and

culture of an each individual, which in turn is formed and changed (positively or negatively), starting with pre-school, secondary and higher education institutions and ending with professional activities at the enterprises of the national economy. A key role in the implementation of a harmonious combination of such contradictory aspects should be assigned to such sciences as life safety and labor protection, as they are known to have begun their existence together with the emergence of labor relations in society and have always been and will be an integral part of the past, present and future models of human development. It is them which are aimed at ensuring a comfortable coexistence of man (society) and the environment. The main objective indicators of such coexistence are the dynamics of man-made accidents and catastrophes reduction, as well as material losses and human losses from their actions.

The constant expansion of the man-made environment, a sharp increase in the world's population (currently an average of 86 million people annually) and large-scale urbanization processes (in developing countries, the urban population increases annually by 60 million people) cause an increase in the number of man-made and natural disasters in the world [2]. Comply with data provided by the consulting firm *Risk Management Solutions* and company *Swiss Re*, a number of major technological disasters in recent decades consistently exceeds the same of natural ones; when analyzing their structure (UN), industrial disasters (disasters at industrial facilities) appeared the largest for material losses and



human victims, with 4 times higher losses from them than that of the transport and nearly 54 times higher of mixed man-made disasters [3]. The total number of victims in the world over the past 100 years, followed consequences of industrial disasters, amounted to 4.5 million people and exceeded the total figure of other man-made disasters by 400 thousand people [4]. Such trend violates the main principle of sustainable development - that is the priority of human life and health in the process of ensuring a stable life quality of modern and future generations (Note: the definition belongs to the author).

Literature review

Problems of the sustainable development concept implementing were studied in works of such scholars as N.N. Marfenin [5], L.R. Brown [4], D.H. Meadows, D.L. Meadows, Y. Randers [4, 5, 6, 7], A.D. Ursul [8], M. Redclift, D. Pearce [9], V.S. Vernadsky [10] and others. However, given the global nature of the issue, the proposed in these works directions of its solution are still somewhat vague and generalized. It must be noted that the role of labor protection and industrial safety as necessary elements of sustainable development of humanity remained almost ignored by researchers.

Considering that Ukraine is an integral part of the world community on its way to sustainable development, the author considers it necessary to pay attention to the modern issues of labor protection in our country and promising ways to solve them.

The purpose of this work is the actualization of labor protection and industrial safety in the sustainable development of humanity. Achieving the goal in the work is provided in the process of solving the following tasks:

- labor protection and industrial safety evolution in the sustainable development of humanity;
- analysis of current trends in occupational risks and man-made hazards in Ukraine and the world;
- aspecting of labor protection and industrial safety as essential elements for sustainable development;
- modern issues of labor protection development in Ukraine as a science and promising ways to solve them.

Actualization of labor protection and industrial safety in sustainable development of humanity.

The importance of science for society is determined by the contribution of great scientists to its development. The importance of labor protection issue since ancient times was determined by the scientific contribution of such major scientists as [3, 7, 11] Aristotle and Hippocrates, who in their works considered the physiology, human psychology, as well as working conditions and their features in that period of time. Paracelsus invented an explanation of the nature and causes of silicosis (miners' occupational disease), as well as was the first to laid the idea of a normalization principle.

Georg Agricola, an outstanding German scientist, once said: "...there can be no decent compensation for the death or injury of a person". He was the first to trace the impact of working conditions on the health of workers in the mining business and for the first time made a record of the mine gas release and explosion (in

1545), as well as provided a description of ventilation and drainage devices for mines.

Bernardino Ramazzi, an Italian physician, in his book "On diseases of artisans", provided a description of diseases of workers for more than 70 professions, as well as recommendations related to the reduction of a harmful lead and mercury evaporation impact on employees, proved the dependence of occupational diseases from working conditions, workplace organization, and the like.

M.V. Lomonosov made a significant contribution to the development of occupational safety, by analyzing working conditions of miners, considering the relevant issues of organization, health and safety, as well as rest, in his scientific work on basics of metallurgy and ore mining. He justified modes and principles of ventilation in mines, developed tools to fix mine excavations, to remove water from mines, etc. He was the first to observe the glow of gases, when passing an electric current through a glass flask filled with hydrogen (a prototype of a fluorescent lamp).

K. Marx and F. Engels studied working conditions and human security as a factor of social and economic development of capitalism. The following statement belongs to K. Marx: "*Economic ages differ not by what is produced, but by ways and means it is produced.*" V.I. Lenin studied working conditions as a factor in the growth of revolutionary sentiments of masses. In such works as "Development of capitalism in Russia", "Scientific system of driving hard", "Law on the remuneration of workers from accidents" he formulated ideas that became a foundation for the modern labor protection system ("*labor should be organized without any harm to a laborer*").

V.L. Kirpichov, the first rector of the Kharkiv Technological and Kyiv Polytechnic institutes, devoted his developments to the theory of industrial equipment safety and occupational safety at industrial enterprises.

F.F. Erisman, Russian-Swiss doctor-hygienist, the creator of fundamental principles of public hygiene and socio-hygienic direction in medicine. He worked on problems of rational school furniture design and is considered the inventor of the school desk. Erisman wrote such well-known scientific works as "Guide to Hygiene" in three volumes and "General Hygiene". During the Russian-Turkish war (1877-1878) he supervised disinfection operations in the Russian army.

A.A. Skochinsky, academician, the founder of the scientific school in the field of mine atmosphere, aerodynamics, mine thermodynamics, dust control in mines and mine fires, has made significant progress in creating safe and healthy working conditions and production comfort for miners. For many years, A.A. Skochinsky headed and coordinated work related to problems of combating sudden emissions of coal and gas, and silica.

I.M. Sechenov, an outstanding scientist-physiologist, in his works "Physiological criteria for setting the length of the working day" (1895) and "Essay of working movements of laborers" (1901) theoretically justified the need for 8-hour working day, proposed a method of active rest.

G.V. Khlopin, scientist-hygienist, who by the way, is the author of original methods of basic hygienic



research (determination of ozone in the air, oxygen in water and air, methods of chemical analysis of food, etc.), studied the effect of industrial poisons, problems of school and occupational hygiene, mental health on the human body.

D.P. Nikolsky, Doctor of medicine, devoted his activities to the study of occupational injuries and the characteristics of measures for the prevention of occupational diseases. He was the first to teach the course of occupational health and first aid in case of accidents in leading educational institutions of the Russian Empire.

N.D. Zelinsky, academician, in the early twentieth century created one of the most famous and widespread means of individual respiratory organs protection – a gas mask.

S.I. Vavilov, academician, studied the nature of light. He became a co-developer (in the Soviet Union) of fluorescent lamps, which, being close to the natural spectrum (more favorable to the human eye), made it possible to normalize the lighting of premises, while reducing energy costs.

G.G. Gogitashvili, professor of the Labor protection department at the national University "Lviv Polytechnic", in the 70-ies of XX century was the first in Ukraine to develop a system of occupational safety management, the introduction of which has significantly reduced the number of cases of industrial injuries and occupational diseases in enterprises.

The Research Institute of electric welding of the Academy of Sciences of Ukraine, under the leadership of B.Ye. Paton, twice Hero of Socialist Labor, the first Hero of Ukraine, is successfully engaged in creation and implementation of automated electric welding systems (industrial robots), which allowed to replace a man in the most harmful and dangerous working conditions (space, work at depths, under water operations, etc).

The evolutionary path of labor protection and industrial safety development can be continued indefinitely, but even from this far from complete list it is clear that not every science can boast of close attention from outstanding personalities.

However, not all issues in labor protection have been solved, so the way of the world community to implementation of the sustainable development concept requires scientists to take effective measures aimed at eliminating or at least minimizing modern professional risks causing occurrence of current and future dangers.

Special attention in the latest report of the International labour organization (ILO), devoted to occupational safety when using chemicals in the workplace [12], was paid to occupational risks, the presence of which is associated with the large-scale application (distribution, release) of these substances in hazardous concentrations in almost every workplace, regardless of the specialization of employees. ILO estimates that 2.34 million people worldwide die each year as a result of work-related accidents, of which 2.02 million die as a result of occupational diseases or their consequences. The annual number of such diseases worldwide is fixed at the level of 160 million cases [4, 13]. Material losses associated with industrial injuries and occupational diseases in the world were estimated at 4% of global GDP or 2.8 trillion USD.

The relevance of this problem was emphasized in the last year ILO report, which was devoted to the growing trends in the increase of a number of occupational diseases in the world. The World Health Organization (WHO), at the beginning of the current century, published data on 5 million deaths (9% of the total number of deaths) in the world, occurred directly or indirectly due to the use (presence, emissions) of hazardous chemicals in the production. A particular danger is caused by the comprehensive use in the production and everyday life of chemicals in a finely dispersed form (particle size 1 – 100 nm). Harmful substances in this form are not only quickly absorbed by the body and show their effect in the form of occupational diseases, but also are not retained by existing personal protective equipment, which makes them essentially ineffective. An increase in the number of chemicals in the air of the working area during the technological processes at the enterprises of the flour-grinding industry has caused 86% of all deaths associated with professional human activities. However, not only employees of grain-processing, flour-grinding, feed-fed and other enterprises suffer from the use of harmful substances. Almost every inhabitant of our planet suffers from emissions of harmful substances and their compounds, as well as the widespread use of pesticides in agriculture as a result of the increase in man-made accidents and catastrophes in recent years (almost by 70 times over the past 50 years) [3, 4].

Ukraine is not aside from such trends, we can even say more, a significant industrial potential of the former Soviet Union was concentrated on the territory of our country. 140 cities and 48 settlements house about 900 chemically dangerous objects and more than 300 thousand objects (much of which belongs to the grain-processing industry) using poisonous substances or their derivatives in the production [12]. Since times of the former USSR, there are more than 15,000 tons of accumulated unsuitable and prohibited for application pesticides in Ukraine, most of which belong to the 1st or 2nd class of danger. Totally, the world accumulates up to 5×10^5 tons of obsolete pesticides comply with data provided by the Food and Agricultural Organization of the United Nations company [12]. That is, the amount of accumulated waste in Ukraine is about 5% of the world's deposits. For comparison, the population of Ukraine is less than 0.6% of the total world population, and its area is about 0.4% of the total area of world powers.

The latest ILO report [12] notes the need for immediate actions at the national level, taken by every state in the world, to address issues related to the minimization of these occupational risks and hazards. The relevant ILO Conventions and Recommendations on labor protection, as well as provisions of ILO – OEMS 2001, should form the basis for the development of such measures, comply with [12]. In other words, the International Labour Organization, which is known to be the only tripartite UN Agency, which includes representatives of Governments, employers and employees of member-states, *recognized with its mandate the leading role of labor protection in addressing the relevant issues of implementation of the humanity sustainable development concept on a global scale.*



Being a member-state, Ukraine has ratified 61 ILO Conventions, among which the following are the core ones on labor protection and occupational safety:

- Forty-hour working week Convention (No. 47, 1935);
- Convention on medical examination of young persons (No. 77, 1946);
- Convention on medical examination of adolescents in non-industrial occupations (No. 78, 1946);
- Convention on night work of adolescents in non-industrial occupations (No. 79, 1946);
- Labour inspection Convention (No. 81, 1947));
- Convention on night work of adolescents in industrial occupations (No. 90, 1948);
- Convention on protection against radiation (No. 115, 1960);
- Convention on the equipment of machinery with protective devices (No. 119, 1963));
- Convention on hygiene in commerce and offices (no. 120, 1964);
- Employment policy Convention (No. 122, 1964));
- Paid leave Convention (No. 132, 1970));
- The minimum age Convention (No. 138, 1973);
- Convention on occupational cancer (No. 139, 1974));
- Convention on human resources development (No. 142, 1975);
- Labour regulation Convention (No. 150, 1978));
- Occupational safety and health Convention (No. 155, 1981));
- Convention on vocational rehabilitation and employment of persons with disabilities (No. 159, 1983);
- Labour statistics Convention (No. 160, 1985);
- Occupational health services Convention (No. 161, 1985);
- Convention on prevention of major industrial accidents (No. 174, 1993);
- Convention on mine safety and health (No. 176, 1995));
- Convention on occupational health and safety in agriculture (No. 184, 2001).

Having analyzed the historical aspects of adopting relevant Conventions, it can be concluded that they meet pressing issues of the time when they were ratified. For example, Conventions No. 77, 78 and 79 were adopted in the first year after the Great Patriotic war ended, when adolescent labour was widely used in Ukraine. On the contrary, the latest Conventions show that modern dangers (risks) in our country are associated with industrial accidents, industrial injuries and occupational diseases. The possibility of implementing these risks increases many times when considering the stable difficult economic situation and the low level of wages in our country. Today the average salary of the laborer in Ukraine makes about 5,500 UAH, or about \$ 200 US per month or \$ 2,400 US per year [4]. As UN experts noted, employees with incomes below \$ 3,000 US per year, have a very limited motivation not only to productivity,

but, most importantly, to measures aimed at achieving their own safety (that is, labor protection measures)[4]. Trends in the collapse of the Ukrainian economy are such that it is impossible to expect an increase in workers' incomes within the foreseeable future. Such a difficult situation can be corrected only by the development of labor protection as a science, by increasing its social significance and state priority. And, first of all, it is necessary to start this process with the future labor resource of the country, that is our youth.

The priority of science development in each state belongs to higher educational institutions. However, despite the obvious relevance of labor protection as a leading science in minimizing (eliminating) occupational risks and hazards, the universities of our country show the emerge of negative trends, expressed in reduction of training time for studying such regulatory disciplines as "Life Safety", "Fundamentals of labor protection", "Labor protection in the industry" and "Civil protection". In addition, relevant sections on labor protection and industrial safety, which in fact is a qualification assessment of graduates' professional compliance, are excluded from the graduation papers of students – future managers of industrial enterprises, who are incidentally, bear administrative and criminal liability for non-compliance with requirements on labor protection and industrial safety according to the existing legislation. The absence of sections "Labor Protection" and "Civil protection" in the diploma projects of higher educational institutions' graduates, as well as signatures of consultants – experts from relevant departments (as well as the absence of such specialists in state qualification commissions) challenges the professional level of students, as well as the safety of technical systems designed by them. The proposed by universities of Ukraine test way to transfer counseling on such sections to teachers of graduate departments can only lead to such sections formalization and illegitimacy. But training these teachers to issues of labor protection in specialized institutions of the State Service of Mining Supervision and Industrial Safety (Derzhgirpromnaglyad), is contrary to the existing legal framework on labor protection.

Briefly, I will try to explain this message in terms of the existing legislation analysis and common sense.

According to Article 18 of the law of Ukraine "On Labor Protection", the order of training and examination of officials on labor protection is carried out comply with the "Model regulations on training and testing of knowledge on labor protection" (NPAOP 0.00-4.12-05). According to this legal document, in relation to higher education institutions, the list of such officials includes *only*:

- heads, deputy heads of educational institutions responsible for the organization of safe work performance;
- *heads and teachers of labor protection departments*;
- heads and staff teachers of educational institutions engaged in training of officials in labour protection.

These persons are required to undergo training in order to *improve their skills*, based on the Main training center of Derzhgirpromnaglyad of Ukraine. Accord-



ing to results of training, teachers of labor protection departments receive a certificate of the established sample, giving them the right to teach relevant legal disciplines, as well as to be advisers in terms of sections "Labor Protection" and "Civil protection" in diploma projects. Teachers of graduate departments *without an appropriate qualifications*, which is normally confirmed by PhD, associate Professor (Professor) Certificates plus scientific and methodological developments in this area of knowledge, *cannot improve their qualification*, as they do not have the necessary level of training in labor protection matters. The legislative base of Ukraine, which is a foundation for labor protection, contains two main laws, the Labor Code, many by-laws and about 700 units of legal documents. Considering this, it is simply impossible to form even the minimum necessary level of theoretical knowledge among teachers of the graduate departments, taking into account their workload, as well as the need for continuous training in special disciplines.

The pragmatic angle linked with issues of the correct choice and application of primary fire extinguishing means, measures and tools of preventing electric injuries, evacuation of people in case of an emergency, as well as with peculiarities of first aid for various injuries, ignorance of which, according to statistics, leads mainly to human victims, requires many-many years of special training from teachers.

Relevance of the issue increases in connection with the need not for just self-learning, but transfer of knowledge and experience to students. After all, it is no secret that an ordinary teacher of the graduate department, figuratively speaking, does not even know which side to approach the fire extinguisher in case of fire in the training laboratory, not to mention what fire extinguishing agents are to be applied in a particular case, because the potential danger of emergencies requires a certain automatism.

Therefore, the adoption of such decisions not only contradicts the legislation of Ukraine on labor protection and jeopardizes the implementation of international Conventions on labor protection ratified by our country, but also, most importantly, is aimed at the destruction of basic knowledge and competencies of the future generation of national economy laborers. The extension of these trends will undoubtedly be reflected in a sharp increase in the number of industrial injuries, occupational diseases (the number of which already exceeds the European average by almost 2 times), as well as industrial accidents and catastrophes, which in turn will lead to the final degradation of economic, environmental and social aspects of the state development, that is, the degradation of the gradual sustainable development of our state.

The solution of these *urgent issues* should be implemented in the following promising ways:

- introduction of changes in the legislative base of Ukraine on labor protection that would at the state level determine the priority of teaching disciplines, aimed at improving the level of knowledge on labor protection and industrial safety;

- correction of discrepancies in the legislative base of Ukraine related to ensuring the quality of training of students on labor and civil protection;
- equal distribution of academic load in the model curricula between specialized disciplines and such academic subjects as "Life safety", "Fundamentals of labour protection", "Labour protection in industry" and "Civil protection";
- promotion of issues on protection and industrial safety among students, University teachers, as well as among employees of industrial enterprises;
- development and assignment to graduates of the corresponding certificates on issues of quality of knowledge on labor protection and industrial safety and providing of priority to such persons before other applicants at employment on the part of employers;
- state level support aimed at the development of material and technical educational base of the "Life Safety" and "Labor protection" departments;
- mandatory availability of relevant departments in all higher education institutions of the country without exceptions (regardless of training programs of students);
- mandatory availability and qualified consultation by experts in sections "Labor protection" and "Civil protection" in diploma projects of students of all majors and directions of preparation;
- mandatory availability of experts in labor protection, industrial safety and civil protection within the composition of state qualification commissions for the defence of graduate projects.

The performed studies allow us to draw the following conclusions:

1. The importance of labor protection as a science for society, from ancient times to the present, is determined by the contribution of great scientists to its development.
2. Current trends in occupational risks and hazards in Ukraine and the world over are determined by the growth of occupational diseases associated with the large-scale application of chemicals and compounds, as well as by the increase in the number and severity of consequences of industrial accidents and disasters.
3. Actualization of labor protection on a way to minimize occupational risks and hazards is determined by the mandate of the International Labour Organization, as well as by the concept of decent work.
4. Modern issues of labor protection development as a science in Ukraine connected with imperfection of the legislative and regulatory framework on labor protection, as well as with the fact that Ukrainian higher educational institutions underestimate, considering world tendencies, the importance of training of students-future specialists and managers of industrial enterprises and their divisions on issues of labor protection and industrial safety. Thus, ways of solving these issues center around changes in the legislative and educational spheres of the country.

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СУЧАСНІ ПРОБЛЕМИ РОЗВИТКУ ОХОРОНИ ПРАЦІ ТА ПЕРСПЕКТИВНІ ШЛЯХИ ЇХ ВИРІШЕННЯ

Анотація

У статті проаналізовано смислове значення терміну «сталий розвиток» і на основі аналізу запропонована власна його інтерпретація.

Визначено, що за останні роки завдяки процесам розширення техногенного середовища, активного приросту населення нашої планети та масштабної урбанізації стрімко зростає кількість катастроф природного та техногенного характеру. Встановлено, що в останні десятиліття, кількість великих техногенних катастроф стабільно перевищує кількість природних. В структурі техногенних катастроф (серед промислових, транспортних та змішаних) найбільшими за кількістю постраждалих і за матеріальними збитками стали промислові катастрофи.

Інтерпретовано визначення головного принципу сталого розвитку і зроблено висновок, що тенденції сучасної моделі розвитку людства йому прямо суперечать. Проведено огляд відомих досліджень щодо напрямів реалізації концепції сталого розвитку людства у світі та Україні, а також ролі охорони праці і промислової безпеки в цьому процесі. Наведено еволюційний розвиток охорони праці як науки з давніх часів до сьогодення, а також внесок великих вчених в процес розвитку охорони праці та промислової безпеки.

Проаналізовані сучасні тенденції професійних ризиків та техногенних небезпек в Україні, зокрема на підприємствах борошномельної та круп'яної промисловості, та світі. На основі аналізу визначено, що особливу небезпеку на сьогоднішній день викликає всебічне використання (наявність, обертання) хімічних речовин на всіх без виключення робочих місцях комбікормових, зернопереробних, борошномельних та інших підприємств країни, а також масштабне використання пестицидів першого та другого класу небезпеки. Занепокоєність викликає і той факт, що сучасні засоби індивідуального захисту не спроможні захистити людину від тонкодисперсних частинок хімічних речовин (розміром 1 – 100 нанометрів), які поширені на сучасних виробництвах, завдяки всебічному застосуванню нанотехнологій у світі. Встановлено, що на території України накопичено 4,4% світових покладів непридатних до використання пестицидів. Збільшення кількості хімічних речовин в повітрі робочої зони під час технологічних процесів на підприємствах борошномельно-круп'яної промисловості стало причиною 86 % всіх смертей, що пов'язані з професійною діяльністю людини.

Зазначено провідну роль охорони праці як необхідного елемента забезпечення реалізації концепції сталого розвитку у світі.

Визначено основні сучасні проблеми розвитку охорони праці як науки в Україні та запропоновані перспективні шляхи їх вирішення.

Ключові слова: охорона праці, професійний ризик, сталий розвиток, небезпека, виробничий травматизм, профзахворювання, актуалізація, промислова безпека.

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ОЦІНЮВАННЯ ЯКОСТІ БІЛКА НАСІННЯ ЛЬОНУ МЕТОДОМ DIAAS

Анотація

Розробка нових харчових продуктів та раціонів підвищеної біологічної цінності, а також удосконалення вже існуючих виробів неможливо без наявності точних критеріїв оцінки отриманого результату. Білкова складова в харчуванні переважної більшості людей є найбільш дефіцитною, тому оцінці якості білкового компонента їжі приділяється особлива увага. Сьогодні існує досить багато методик оцінки біологічної цінності харчових продуктів. Хоча медико-клінічні дослідження забезпечують отримання більш точних результатів, однак вимагають значних фінансових затрат.

Для ефективного удосконалення рецептур існуючих виробів і розробки нових продуктів з підвищеною біологічною цінністю необхідно мати точні методики оцінки якості білка, які не вимагають значних витрат часу і коштів.

В роботі наведені необхідні формули та дані для використання методики DIAAS. На прикладі білка насіння льону показано зміни амінокислотного складу до і після його пророщування, а також наведено розрахунок показника DIAAS.

Насіння льону (*Linum usitatissimum*) відносять до білково-олійних культур, оскільки в своєму складі (залежно від сорту та умов вирощування) містить 17-30% білків та 32-50% жирів. Білок насіння льону, представлений альбумінами і глобулінами, має повний склад незамінних амінокислот (НАК), схожий до складу соєвих білків, які вважаються найбільш поживними протеїнами рослинного походження. Пророщування льону дозволяє використовувати всі анатомічні частини насінини у технологіях продуктів оздоровчого призначення, адже у процесі пророщування помякшуються оболонки і з'являється приємний солодкий присмак. Пророщування веде до деградації антихарчових речовин (фітинова кислота) та появи нових фізіологічно активних речовин (вітаміну С, токоферолів).

У статті подано опис нової методики DIAAS (digestible indispensable amino acid score – укр. амінокислотне число незамінних амінокислот з урахуванням їх засвоюваності), яка рекомендована Продовольчою та Сільськогосподарською Організацією Об'єднаних Націй (ФАО) з 2013 року після Міжнародного симпозіуму “Харчові білки для здоров'я людини”. На симпозіумі визнано, що амінокислоти слід розглядати як окремі поживні речовини і взявши до уваги зростаючий масив даних щодо їх істинної засвоюваності, було рекомендовано поступовий перехід на методику розрахунку біологічної цінності продуктів і раціонів з урахуванням біологічної доступності окремих амінокислот.

Нова методика DIAAS дозволяє кількісно оцінити засвоюваність кожної амінокислоти окремо з білка продукту. Перетравлення незамінної амінокислоти повинно базуватися на справжній засвоюваності ілеї (тобто визначається наприкінці тонкої кишки) кожної амінокислоти, яка визначається у продукті для людини, але якщо це неможливо, слід використовувати значення засвоюваності незамінної амінокислоти у продукті для зростаючої свині або для зростаючого щура.

Методика може бути корисною при визначенні біологічної цінності нових видів сировини та конструюванні нових функціональних харчових продуктів.

Ключові слова: льон, пророщування, DIAAS, якість білка, незамінні амінокислоти, біологічна цінність, функціональне харчування.