Bioresources in the Formation of New-Generation Products

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Abstract: The development of new-generation products using the potential of Siberian bioresources is relevant in modern conditions. This process is aimed at protecting the health of people living in a polluted urban environment and the threat of the COVID-19 coronavirus pandemic. The article highlights and describes the characteristic distinctive features of the beneficial properties of the wild flora of Siberia, presents the results of the research conducted by the authors, and provides an assessment of the state and potential of the natural resource base and bioresources of the ecosystem of the Siberian taiga. The study summarizes the current trends of the active part of the population of developed countries towards a healthy lifestyle, indicating an annual increase in demand for natural products. The article presents an analysis of scientific developments and their advantages over previously used methods of protection against infections in an indoor air pool. With the help of laboratory tests, the authors evaluated and justified the feasibility of a new proposed product created using bioresources of wild flora of Siberia which are valuable and useful for humans. It is established that the proposed scientific and technical solutions improve the quality of the products offered, stimulate the consumer to preserve health, and encourage reasonable environmental management. The production and implementation of the developed anti-aging products will contribute to the reduction of consumer race and improve the quality of life of the population of large cities.

Keywords: new-generation products; bioresources; safe living environment; indoor air infection protection

1. Introduction

The evolution of human development has formed a society whose characteristics are predetermined by the processes of globalization, as well as interaction (mergers and divisions) and integration of individual communities of the world space. The past century of economic industrialization and technological progress has brought significant changes to the lifestyle of people and the social structure. Anthropogenic human activity has led to a violation of the ecology of large cities and turned their habitats into ones unsafe for everyday life. At the turn of the XX and XXI centuries, computerization and digitalization of most life processes transformed communications and showed trends towards the concentration of the active part of the population in large megacities. This was also influenced by the emergence of pandemics and closed time periods for work and communications [1].

With the growth of industrialization, the norms of the maximum permissible concentration of harmful substances in the air basin of a city began to reach threatening values. Suspended particles in urban air contain not only bacteria, viruses, and fungi, but also heavy metal salts, sulfur dioxide, nitrogen, and carbon, the concentration of which varies cyclically depending on meteorological and topographic features. The correlation between the concentration of suspended particles in the air and the pathology of external respiratory
functions is directly proportional and is related to an increase in disease statistics of various human systems and organs. The correlation is more than 60% for different systems, and 34.2% for respiratory systems [2]. Scientists from the University of Colorado (USA) have proved that carbon dioxide (CO₂) is the most important component of the biosphere of our planet, but such an amount of it in millions of tons per year, which is currently emitted into the atmosphere by the 10 leading economies of the world, is destructive for the planet.

British economist Nicholas Stern, one of the founders of the initiative to transfer the world economy to a low-carbon type of development as a driving force for GDP growth, described mechanisms to reduce the anthropological impact of humans on the environment and climate change in order to avoid the risk of negative consequences in the medium and long term [3]. On the other hand, science also clearly identifies the conditions of climate change and global warming as a comfortable environment for the active reproduction of viruses. This factor focuses the attention of governments of different states not only on the development of healthcare, but also on regulating the activities of economic entities to preserve the environment through rational use of natural resources and a significant reduction in anthropogenic impact on the noosphere [4]. The influence of anthropogenic human activity on the ecology of large cities should be considered as a factor forming an unsafe environment for human life [5]. The study of the processes of formation of environmental responsibility in society at the level of human consciousness and awareness of his relationship with nature is an important factor in the accomplishment of society and its norms of behavior [3]. Studies by the British and American scientists M. Hurst, H. Dittmar, R. Bond, and T. Kasser indicate the relevance and importance of a deep scientific approach in the study of social psychology in the aspect of rational use of natural resources for the benefit of people. It should be noted the concept of ecological value, which predetermined the origin and development of ecological attitudes and behaviors, starting from the reduction of the use of gasoline cars and the recycling of raw materials, which became the primary manifestations and segments of the formation of a low-carbon economy. It also includes the economy of preserving biological resources and improving the living environment of the majority of the population, separated from natural ecosystems and living in large cities [6].

In April 2019, before the start of the COVID-19 pandemic, the key idea of science was a directive to accelerate the implementation of plans to develop alternative antimicrobials and mitigate the consequences of using drugs to which microbes have developed resistance. Also important was the message about the need to unite the efforts of scientific organizations of all countries to coordinate research in a single health context [7]. In addition, high passenger traffic and mobility of the world’s population are prerequisites for the potential threat of the spread of new diseases [8]. An example was the situation with atypical pneumonia, which showed how active markets in Southeast Asia create challenges for the entire healthcare industry. Preventive measures are mandatory here, and the World Health Organization and national governments play an important role in organizing control and coordination [9]. Many countries have taken a number of preventive measures to contain epidemics. Modern trends tend towards the depletion of products of the daily diet in terms of nutrient content; this is a consequence of a decrease in the resistance of the human body to the effects of polluted urban ecology, which in turn has created prerequisites for the appearance on the market of a new category of products enriched with natural vitamins.

The study of issues of rational use of natural bioresources for the benefit of people in the format of drugs of the new generation is predetermined by the following factors:
- The need to address public health concerns in the context of the COVID-19 pandemic and the weak human capacity to protect against modern modified viruses;
- The need to ensure activities aimed at developing environmental liability [10] and pro-environmental behavior [11].

The problem of prevention of acute respiratory infections due to the pandemic of modified viruses SARS, SARS), MERS, SARS-CoV-2, and their derivative COVID-19 has become a new challenge for modern science and medicine. The old methods and approaches
for protection against airborne infections according to the criteria of benefit–harm and safety have a number of limitations for mass use [12]. Science faces new challenges and the need to develop alternative, effective measures of protection against infections in the air of enclosed spaces in solving the problem of preserving the health of the population of cities [13]. Therefore, the relevance of new developments of medical anti-infective drugs is supported by the need not to reduce, but to increase the immunity of the population. According to many scientists and the authors of this study, the solution is to create a new generation of products based on plant bioresources of the Siberian region with the expansion of the properties of wild plants that can resist airborne (respiratory) infections of various origin [14]. A distinctive feature of this category of products is special technology for isolating active bio-components from the wild flora of Siberia. It is also possible to assert an evidence-based level of research that ensures the mass and safe use of these products in groups of people for immune prophylaxis and protection against respiratory infections [15]. It should be noted that bioresources are mainly agricultural crops, as well as their waste, waste from forests and various industries, and marine products, as natural materials that are renewable and biodegradable [16,17]. In nature, there are a large number of biological resources from plants and animals that are used for various purposes in the cultivation of agricultural crops, in marine and other farms [18]. In modern conditions, bioresources are used in such industries as agriculture, paper, chemical, energy, and so on [19].

The resources of Siberia for the production of healthy food products, including organic products and medicines, are quite large. For successful farming in the region there are fertile lands, an abundance of clean water, and abundant sun and rain. Only in the Siberian Federal District, which unites 12 regions of Russia, cultivated land currently occupies more than 15,000 thousand hectares, which is almost 19 percent of the total sown area of Russia. The analysis of the resources of the Siberian region for food production demonstrates the significant advantages of Siberia against the background of global climate change in other, including densely populated, areas of the earth, and especially in conditions of growing shortage of water resources [20].

The purpose of this study is to develop and justify the feasibility of a new product created from the biological resources of the wild flora of Siberia as a protection against infections in the airspace which has passed laboratory tests and has valuable and useful properties for human health, based on the study of theoretical provisions and practical developments.

Objectives of the study:

1. Analysis of the scientific base of research on the properties of wild flora of Siberia in the development of new-generation products;
2. Generalization of the value, uniqueness, and advantages of this type of bioresource and product;
3. Formulation of proposals for the practical application of advanced scientific developments.

The scientific significance of the developed product offer is characterized not only by technological solutions, but also by the creation of special value for the modern consumer who makes a choice in favor of conscious investments in their health. The authors proposed solutions for the creation of an antispastic agent from bioresources, based on scientific research and developed methods of application (including in medical practice), which will, in the future, ensure safe living in the urban environment without renouncing the benefits of civilization.

2. Materials and Methods

This study is based on reviews of the research base of authors and analytical agencies. Methods of empirical and theoretical research are used: methods of systematization, generalization, grouping, factor analysis, and expert and statistical methods. The design of the study is determined by the generalization and systematization of the results of research by Russian scientists on the study of active bio-components of wild plants of Siberia and
technological solutions for the development of alternative means of maintaining health and protecting against airborne infections.

The research methodology consisted of the following stages. At the first stage is justified the necessity of developing a new generation of drugs from Siberian bioresources that will protect the health of the population from infections and increase its immunity. This is predetermined by the modern industrial impact on nature and water management, where the level of environmental impact is growing. This certainly affects humanity and as a result has a negative impact on the level of immunity. In addition, technogenic impacts affect the emergence of new viruses, infections that are quite complex for the resistance of the human body. The next stage of the research was the search for the necessary effective bioresources, which are important to consider when developing a new-generation product. The results of this study have been published in previous articles. At the third stage, a new product and a method for obtaining it from the bioresources of Siberia were developed. As part of this stage, it is important to analyze and show its competitive advantages from the standpoint of ensuring health and ecology. At the fourth stage, to show the possibility of introducing this drug in a pandemic, it is important to show the ecological consciousness of the population regarding the use of biological resources. As part of the study, tests were carried out in addition to analysis of the composition and purity of materials and substances. This includes analysis of the chemical and biological properties of materials and substances, and tests and analysis in the field of food hygiene, including veterinary control and control over food production.

A special place in solving the studied problem is occupied by developments in the fields of plant chemistry, microbiology, and medicine on the creation of natural stimulants using technologies for preserving the structure of a living cell of wild plants, the so-called adaptive nutrition complexes.

This direction, due to its novelty, as well as the evidence-based scientific base, belongs to a separate category of a new kind of products that allow a person to functionally adapt to the stresses of the modern world, fill up the missing supply of vitamins, minerals, and nutrients in the products of the daily diet, and normalize the work of organs and systems with minimal energy consumption in the human body. Adaptive nutrition complexes include the entire library of valuable fruit and medicinal crops of the Siberian taiga and demonstrated their effectiveness and safety, including for patients with diabetes mellitus.

The technology of preserving the structure of a living plant cell [3,8], in the production of natural stimulants based on research and practical experience, can be used in the development of a new segment of products—adaptive specialized nutrition for athletes. The need to limit the use of doping in high-performance sports has actualized research and development in the field of creating specialized sports nutrition products of a new generation, which by their physicochemical characteristics are adapted to human physiology and do not harm the health of athletes [21]. Performing the functions of natural stimulants, biologically active components of the wild flora of Siberia contribute to the preservation of health and improvement of functional fitness of athletes in any period of training, during weight loss, dehydration, metabolic disorders, decreased immunity, or desynchronosis, to increase adaptation. Natural compounds act at the cellular level, preventing the breakdown of adaptive mechanisms in the body of athletes under extreme loads. The authors identified trends in the formation of demand for sports nutrition products (SNP), and new consumer segments (NCS) in addition to the main target audience of athletes [15] in the development of markets for a new type of products.

The priority and most relevant task is the direction of scientific research in the field of essential oil plants that actively secrete phytoncidal masses into the air pool and create the conditions necessary for the normal functioning of all living things. Evidence-based medicine has previously given an answer to the fact that the bulk of cross-infection with various infections occur not in the open air, but in confined spaces. The concentration of pathogenic microbes in the indoor air reaches several thousand individuals per 1 m³. Natural carriers are humans and animals [22]. Of the known methods of air disinfection,
the method of ultraviolet irradiation prevails. One of the safest and most affordable is aromatherapy. It was not considered as a method of effective protection against respiratory infections until recently, when the composition of active essential bio-components (plant phytoncides) was studied in the course of research. The topic of research on the properties and production of essential oils from the vegetative part of plants is inextricably linked with the process of isolation of phytoncides by plants—active substances that suppress various types of pathogenic microorganisms in the air basin, creating a favorable and safe environment for human health. An example is Siberian coniferous forests; a hectare of such a forest releases more than 30 kg of volatile organic substances per day. According to the researchers, phytoncides are actively involved in the synthesis of vitamins and biologically active substances of the taiga’s wild flora. According to the International Forest Institute, the boreal forests of the Siberian taiga are considered to be the lungs of our planet. In Russia and the EU countries, the problem of active circulation of viral infections causes mass morbidity of the population.

Polluted city air is a favorable environment for the development of viruses and bacteria that spread through ventilation systems. The statistics of diseases of urban residents are on average twice as high as those of rural residents [23]. Of particular concern is the cyclical nature of new and returning infections, which have an uncontrolled rate of spread due to the high intensity of human movement [24].

Limitations of the study. Quoting previous scientific papers forms the basis of a literature review and helps to understand the subject of the study. However, past results on the issue under consideration are not enough.

3. Results

Nature has a huge potential of bioresources for solving the problems of the development of modern society, including the tasks of preserving the health of both humans and the planet as a whole. Boreal forests of the Siberian taiga are one of the richest planetary biomes that determine the state of the noosphere and biosphere. Taiga is a natural ecosystem characterized by the presence of huge territories with special mineralization of soils and fresh water reserves. In search of effective methods for the prevention of viral epidemics and the fight against nosocomial infections, a group of Siberian scientists, SPA “LATTA” LLC, including authors of this article, over the past 12 years has developed, researched and clinically tested, on the basis of essential biocomponents of wild flora, a unique barrier protection against almost all types of infections in indoor air (viruses, bacteria, fungi, parasites, and protozoa)—a medical and preventive air disinfection agent, AirFit.

Within the framework of this study, the specifics and features of Siberian bio-resources that could be used in the production of antiseptic agents were studied. Siberia is rich in forests and water bioresources, which are a source of clean water and antiseptic agents. The results of these studies were presented in a previous publication [8] (Figure 1).

The tests were carried out in the certified laboratory of the FBUN SRCAM of Federal Service for Supervision of Consumer Rights Protection and Human Welfare of the Russian Federation “Examination of the target effectiveness of the medico-prophylactic disinfectant “Spray antibacterial AirFit” for air disinfection with an exposure of 15 min (Table 1).

The table shows that the value of the total microbial number (PM) in the room air after aerosol disinfection decreases by 99%. This is a very high indicator, taking into account the fact that this method does not require the use of protective equipment and is safe to use in the presence of people. In addition, the effectiveness of the disinfecting action of the agent “Antibacterial Spray AirFit” has been developed and proven for the hygienic treatment of hands through laboratory tests of the FBUN SRCAM of Federal Service for Supervision of Consumer Rights Protection and Human Welfare of the Russian Federation (Table 2).
Figure 1. Siberia map from the perspective of natural wealth of forests and rivers [7].

Table 1. Characteristics of the medico-preventive disinfectant developed by the authors of the article “Antibacterial Spray AirFit” for air disinfection with an exposure of 15 min.

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Before Processing</th>
<th>After Processing</th>
<th>Aerosolization</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli</td>
<td>$(4.8 \pm 0.4) \times 10^3$</td>
<td>$(4.3 \pm 0.4) \times 10^3$</td>
<td>3 mL/m$^3$</td>
<td>99.1</td>
</tr>
<tr>
<td>S. aureus</td>
<td>$(3.5 \pm 0.3) \times 10^3$</td>
<td>$(4.2 \pm 0.4) \times 10^3$</td>
<td>98.8</td>
<td></td>
</tr>
<tr>
<td>P. aeruginosa</td>
<td>$(3.9 \pm 0.4) \times 10^3$</td>
<td>$(4.2 \pm 0.4) \times 10^3$</td>
<td>98.9</td>
<td></td>
</tr>
<tr>
<td>C. albicans</td>
<td>$(5.7 \pm 0.5) \times 10^3$</td>
<td>$(7.9 \pm 0.7) \times 10^3$</td>
<td>98.6</td>
<td></td>
</tr>
<tr>
<td>T. mentagrophytes</td>
<td>$(4.6 \pm 0.4) \times 10^3$</td>
<td>$(8.2 \pm 0.8) \times 10^3$</td>
<td>98.2</td>
<td></td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

Table 2. Characteristics of the effectiveness of the disinfecting effect of the medium “Antibacterial Spray AirFit” in the hygienic treatment of hands.

<table>
<thead>
<tr>
<th>Skin Contamination</th>
<th>Type of Microorganism</th>
<th>Number of Colony-Forming Units (CFU)</th>
<th>Decontamination Method/Holding Time</th>
<th>Decontamination Efficiency, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>General microbial contamination</td>
<td>525 ± 52 / 7 ± 2</td>
<td>Rubbing liquid 3 mL/30 s.</td>
<td>98.6</td>
</tr>
<tr>
<td></td>
<td>Gram-positive microorganisms</td>
<td>391 ± 39 / 4 ± 1</td>
<td></td>
<td>98.9</td>
</tr>
<tr>
<td></td>
<td>Gram-negative microorganisms</td>
<td>63 ± 8 / 0</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Artificial</td>
<td>coli</td>
<td>943 ± 95 / 0</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

Table 2 shows the effectiveness indicators of the product when applied to a surface, which reach 100% and have a prolonged effect of action. The agent and the method of its application are developed on the basis of pharmacokinetics and the suppressive
effect of phytoncides of wild taiga plants against infections of various genesis. It has been scientifically established that infectious agents have become resistant to antibiotics and selective against various combinations of vaccines, but do not develop resistance to biologically active and complex natural compounds. The difference in this solution is the clinically proven effectiveness and safety of using the drug in the presence of people, both for individual use and for use in groups of people using aerosol disinfection, to prevent cross-infection and for immunoprophylaxis [14].

Confirmation of the relevance of the means of prevention from respiratory infections available to the average consumer is the appearance of antibacterial sprays on the shelves of pharmacy chains ASNA—the largest Russian pharmaceutical distributor. Against the background of the pandemic, due to the increase in demand for this category of products, the dynamics of sales of this product significantly exceeded the planned values and continue to grow (Figure 1). The graph (Figure 1) shows that sales growth in pharmacies has practically doubled since the beginning of 2021 and by the end of the annual period.

The graph (Figure 2) shows that the increase in sales within pharmacies from the beginning of 2021 and by the end of the annual period has almost doubled. Online sales of antibacterial spray are also marked by an increase in assets news; the product is presented on the OZON marketplace and is gaining popularity among the Russian consumers. The statistics of website visits of the manufacturer are growing.

![Figure 2. Sales of antibacterial sprays in Russian pharmacy chains, taking into account the COVID-19 pandemic, 1000 units of products. Source: Compiled by the authors.](image)

Figure 3 shows the sales statistics for the period 2021 in the context of the traffic of the website of the Russian manufacturing company. Of these, 54% is the share of repeat purchases, which indirectly indicates the high consumer properties of this product. The use of the spray aeration method for both individual and collective use in order to prevent the spread of infections of various etiologies, including protection from bacteria in indoor air conditioners (apartment, office, car, public places, workplaces, children’s and medical institutions), seems to be an effective and timely solution.

When using the technique of aeration of enclosed spaces of preschool and school institutions with the means based on natural phytoncides of wild flora of Siberia, an indicator of a 2.2-fold decrease in the incidence rate in groups of children was recorded [20]. Such protection is especially relevant in the conditions of the aggressive ecology of large cities, where the population has reduced protective functions of immunity, and prevention from respiratory infections becomes a necessary norm.
the method of irradiation with UV irradiators of the indoor type. However, it has a number of limiting features due to the fact that there are restrictions on use in the presence of people, and the fact that a significant number of different types of microorganisms are resistant to UV radiation [3]. In the practice of using closed-type irradiators, it was not possible to avoid additional costs. The method is less effective in suppressing microorganisms in contrast to open-type irradiators and also requires control over the calculation of dosages and cycles of irradiation.

Thus, the criterion of benefit–harm and side effects with the beginning of the use of ultraviolet light for disinfection of indoor air in everyday life, without proper control over the norms of use, led to the need for alternative solutions in the development of effective means of protection against respiratory infections which can be safely used in the presence of people.

After the COVID-19 pandemic, when society faced the problem of returning to normal life without isolation and restrictions, science used empirical experience to find solutions to create new tools that can solve this problem, instead of the old ones that have fulfilled their role in history. The emergence of a new-generation product category using Siberian plant bioresources is the result of scientific research, testing, and implementation and the solution of this problem in practice.

The presented scientific developments in the field of respiratory medicine are the result of the work of research teams from the leading SPA “LATTA” LLC, the Research Institute of...
the Ministry of Health of the Russian Federation, departmental medical organizations and clinical diagnostic centers, with the participation of the authors of this article. The evolution of research on the new development of safe disinfection of indoor air in the presence of a person has a history of several years and stages that formed the evidence base in chemistry and microbiology long before the COVID-19 pandemic. Evaluation and analysis of the effectiveness of the use of the drug in the category of “childhood and motherhood”, and in particular the morbidity of mothers during their joint stay with the child in the conditions of sanatorium treatment, deserve serious attention. Placement of mothers with children under 3 years of age in separate wards of the sanatorium using the technique of aeration of premises with antibacterial spray based on essential bio-components of Siberian cedar contributed to a significant reduction in acute respiratory diseases, prevention of cross-infection, and improved dynamics of the immune system of patients. One of the main tasks in the course of clinical studies in the conditions of the Malakhovka children’s sanatorium (FMBA of Russia) was to present the clinical and laboratory characteristics of frequently ill children aged 3–7 years with the determination of the effect of indoor spraying of AirFit sprays on the occurrence of recurrent acute respiratory diseases in frequently ill children. The use of the calculated benefit–harm formula for the occurrence of acute respiratory infections in frequently ill children in both groups showed how many times the probability of an unfavorable outcome (the appearance of acute respiratory infections) decreased. Calculation of the benefit–harm risk criteria indicates that disinfection of indoor air with the AirFit antibacterial spray during the stay of the frequently ill children in the sanatorium reduces the risk of acute respiratory infections by 57% or two times, and the chances of a particular patient by 3.34 times (Table 3).

**Table 3.** Criteria for the risk of benefit–harm when using AirFit spray sprays indoors for 3 weeks during the recovery of frequently ill children aged 3–7 years in the Malakhovka sanatorium (FMBA of Russia).

<table>
<thead>
<tr>
<th>Criteria, %</th>
<th>Intervention and Comparison Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Values</td>
</tr>
<tr>
<td>Adverse event rate in the intervention group</td>
<td>26.3%</td>
</tr>
<tr>
<td>The frequency of adverse events in the comparison group</td>
<td>83.3%</td>
</tr>
<tr>
<td>Absolute Risk Reduction (ARR)</td>
<td>57</td>
</tr>
<tr>
<td>Relative risk (RR)</td>
<td>0.58</td>
</tr>
<tr>
<td>Relative Risk Reduction (RRR)</td>
<td>0.42</td>
</tr>
<tr>
<td>Number of patients who need to be treated to prevent an adverse event (un)</td>
<td>4.14</td>
</tr>
<tr>
<td>The ratio of the odds of an event to the absence of an event (units)</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

Studies of the effectiveness of disinfection of ward rooms with AirFit during the rehabilitation period (3 weeks) of the category of frequently ill children in the conditions of sanatorium treatment, conducted in the clinical and diagnostic laboratory of the Moscow Regional Research Clinical Institute M.F. Vladimirsky, proved that AirFit contributed to a significant reduction in acute respiratory infections, facilitating their course during this period, and reducing the duration of antibacterial treatment in the next 3 months. The study showed an improvement in conditions capable of preventing respiratory morbidity: inactivation of pathogens in the oropharynx, a decrease in the carriage of rotaviruses, and cryptosporidia in the gastrointestinal tract.

The positive results obtained in frequently ill children without additional medicinal load and the absence of adverse reactions from the use of AirFit became the basis for
recommendations for its further use in rehabilitation measures aimed at reducing acute respiratory infections in sanatorium treatment [11]. Clinical studies among the age group from 8 to 17 years in the Children’s Medical Center of the Presidential Administration of the Russian Federation with the participation of the Moscow Regional Research Clinical Institute of M.F. Vladimirsky, “Ministry of Health of the Russian Federation” and the Research Institute of Epidemiology and Microbiology named after Gabrichevsky of “Federal Service for Supervision of Consumer Rights Protection and Human Welfare of the Russian Federation” covered almost the entire spectrum by gender and age among the surveyed children’s groups [9].

The findings of the research indicate the need for systematic rehabilitation of children with the inclusion of indoor spraying of the antibacterial spray AirFit in the complex of recreational activities. This technique contributes to the reduction and relief of respiratory tract diseases and the completeness of recovery processes. The positive results obtained in the course of studies without side effects and adverse reactions from the use of the antibacterial spray AirFit allowed us to recommend it as a means of reducing respiratory tract diseases, protecting against SARS and preventing the spread of infections in children’s groups. This technique helps to reduce and alleviate respiratory tract diseases and the recovery process.

Research was carried out within the framework of preventive measures of influenza and SARS in preschool and school educational institutions of the Main Department of Education of Krasnoyarsk. The aim of the study was to evaluate the effectiveness of preventing the incidence of influenza and SARS using the spraying (aeration) of AirFit spray (based on natural phytoncides) and without spraying in children of pre-school and primary school age. Four groups of children with a total number of more than 100 were under observation; examinations were conducted two times a week by doctors and were recorded in the observation log. Questionnaires were filled out by parents in two groups: one intervention group where the technique of aeration of premises with AirFit spray was used, and a comparison group where spray aeration was not used.

In the course of observations, along with a decrease in the frequency of SARS cases among children who regularly received aeration for 4 weeks, an easier course of SARS and the absence of the number of complicated forms were noted by 2.2 times in the observed children from group 1 and 1.5 times in group 3 (Table 4).

<table>
<thead>
<tr>
<th>Group, Number</th>
<th>Easy Current</th>
<th>Moderate Severity, Complicated by Tracheobronchitis, Sinusitis</th>
<th>IE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abs.</td>
<td>%</td>
<td>Abs.</td>
</tr>
<tr>
<td>Intervention group 1 MAOU secondary school No. 151 (n = 31)</td>
<td>5</td>
<td>16%</td>
<td>0</td>
</tr>
<tr>
<td>2nd comparison group MAOU secondary school No. 151 (n = 32)</td>
<td>7</td>
<td>22%</td>
<td>4</td>
</tr>
<tr>
<td>Intervention group 3 MBDO “Kindergarten No. 36” (n = 20)</td>
<td>9</td>
<td>45%</td>
<td>0</td>
</tr>
<tr>
<td>4th comparison group MBDO “Kindergarten No. 209” (n = 18)</td>
<td>5</td>
<td>28%</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Compiled by the authors.

The high efficiency of reducing diseases up to 2.2 times in a group of children of various age categories in pre-school and school institutions was highly appreciated and supported by the medical community [25]. The technique of spraying sprays as part of the prevention of a new coronavirus infection (COVID-19) among the main measures aimed at “breaking” the mechanism of transmission of infection based on successful clinical
testing and confirmed target effectiveness was included in the recommendations of the Federal Service for Supervision of Consumer Rights Protection and Human Welfare of the Russian Federation. Methodological recommendations for immunoprophylaxis “Aeration of premises within the framework of measures to prevent influenza, SARS and coronavirus infections”, approved by the Chief State Sanitary Doctor of the Russian Federation on 25.09.2020 [10]. Recommendations were issued for 10 client categories, covering almost all groups, ranging from preschool and school institutions [26], administrative, public and work premises, and sports facilities to catering establishments, and ending with passenger cabins of all types of transport, including air [26].

Taking into account the climatic features of the predominant number of developed countries, including the limited vegetative period of plants in their territories, the main threat factor to human health is the lack of natural protection [27]—plant phytoncides, which counteract the proliferation of viruses and bacteria in the air basin [18]. People in large cities are at risk of contracting respiratory infections, especially in enclosed spaces. [17,28] The mass application of a unique remedy based on active phytoncides of wild plants of Siberia, and the accompanying methods of disinfection of indoor air based on fundamental research, meets the requirements of the times and confirms the relevance of the development.

The new development in air disinfection of premises with phytoncide aerosol in contrast to the multi-year method of air disinfection in rooms with the use of ultraviolet devices has a number of advantages:

1. Air is purified at 95–99 per cent and is not depleted (not devoid of living content), but is enriched with natural phytoncides, to which viruses and bacteria dangerous to humans do not develop resistance;
2. The microflora of the mucosa of the rotoglobin is normalized when the phytoncidal composition enters the respiratory tract, and the production of own interferon is activated; the protective functions of the immunity are enhanced;
3. It prevents cross-infection, and reduces the level of impact on the health of infections (3.34 times) and disease statistics (2.2 times).

Accomplishment of three of these tasks at the same time with clinically proven safety of use in the presence of people has not yet been achieved by any method or drug in the world [18]. Based on the evidence base, this product offer solves the problem of reducing the statistics of diseases of people in public places, including with increased traffic, allows for timely collective immunoprophylaxis, and neutralizes the influence of harmful factors of disturbed urban ecology.

5. Conclusions

Modern researchers characterize the new stage of development of information and communication technologies as a period in which growing digitalization and globalization predetermine the political and economic processes [15,17]. Modern megacities are the main centers of attraction for the active part of the population and the concentration of financial resources, science, business, and culture [29,30]. Large cities have become territories capable of satisfying the highest ambitions of human activity and ensuring the well-being of millions of people. However, along with these positive aspects of the evolution of urban life, there is also the fact that the disturbed balance between the urban and natural environment, on the territory of the city, has gradually pushed the boundaries of natural ecosystems [31]. The polluted environment of the megalopolis has begun to have a devastating impact on both human health and the state of the natural zone, which lost the ability to self-repair, reduced the possibility of air filtration, and began to degrade [32,33].

The scientific potential of many years of research by Siberian scientists and technologists has served as the basis for developing alternatives to safe and effective methods of maintaining a comfortable living environment for residents of megacities and offering new-generation products in the relevant markets. The search for effective medicines and methods to protect residents of megacities from the harmful effects of the environment and...
other factors that pose a threat to health has predetermined a new direction of research. This article considers a description of the problem of the remoteness of a modern urban dweller from the natural habitat of a person—a natural zone. Also described is the influence of the disturbed ecology of megacities on health and life expectancy as a result of anthropogenic human activity. Based on research and development, a new product and a new form of application in the field of safe and effective means of protection against infections that increase immunity and provide a safe living environment have been developed.

The introduction of this method of using a unique tool will reduce the threshold of morbidity, prevent cross-infection of people in transport, in public places, and organized collectives, significantly reduce government spending on combating the pandemic, reduce financial losses, and increase the share of revenues to budgets of all levels. The new products and techniques proposed by the authors, based on the unique properties of the wild flora of Siberia, have a confirmation of novelty and a scientific evidence base, are aimed at reducing government spending on combating the COVID-19 pandemic, reducing financial losses and losses while increasing the share of income to budgets of all levels, and improving the quality of life of the population of large cities. In order to expand the geography and develop the successful history of new-generation products based on Siberian bioresources, a systematic approach is needed to unite the efforts of science and business around a common task, an approach using models of cooperation and networking with the use of integration mechanisms of trade and business relocation.

Scientific, technical, and administrative support of projects based on business competencies using modern means of communication, and regulatory [34] and logistics solutions, with the active participation of relevant ministries, departments, institutions responsible for indicators of innovation, and startup support programs at the international level, will ensure accessibility to new-generation products in global markets.

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References


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