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INVESTIGATION OF ALLERGIC REACTIONS IN HELMINTHIASIS

Abstract

Identification and characterization of allergens associated with helminth infestations is important. These allergens belong to common allergens and have different biological functions. The activity of some allergens associated with helminth infestations has been studied and it has been determined that during helminth infestations, various substances are produced in the host's body, and some of them stimulate the synthesis of specific IgE, and a few of them cause allergic reactions. The activity of allergens associated with helminth infestations (the ability to induce IgE-mediated inflammation) has been studied clinically and experimentally. In several epidemiological studies, it has been established that IgE response to helminths is a risk factor for asthma and atopy (i.e. susceptibility to allergies). Revision of existing diagnostic methods and standards of allergic processes in helminthiasis, and research on molecular mechanisms of metabolism of allergens related to helminth infestations should be continued.

Keywords: *Helminthiasis, immune system, antigens, allergy, IgE*

Introduction

Helminth allergens are common allergens and have different biological functions. The role of helminth allergens in allergic reactions and symptoms in helminths has not yet been fully investigated.

During helminth invasions, various substances form in the host body, and some of them stimulate the synthesis of specific IgE, while a small percentage cause allergic reactions. At the same time, the frequency and intensity of allergic reactions are formed depending on the state of the immune system.

Considering the importance of the identification and characterization of allergens associated with helminth invasions, their allergen activity (ability to induce IgE-mediated inflammation) has been clinically and experimentally investigated (Caraballo, 2018: 99–102). It has been found in some epidemiological studies that the IgE response to helminth is a risk factor for asthma and atopic allergy (i.e. predisposition to allergies).

The official WHO website provides information on the specific antigen (known as Asc s 1 or ABA-1) and two cross-reacting allergens (Asc l 3 and Asc l 13). The role of 3 helminth allergens (ASC 15, ASC 13 (tropomatosis), and ASC 113 (glycation transferase)) in diagnosing allergies in helminth invasions is of particular importance.

During helminth invasions, the body responds to different allergens with different symptoms (Webb, Nampijja, Kaweesa, Kizindo, 2016, 1156-1169; Nkurüngi, Kabagenyi, Nampijja, 2018: 40). Studies among children in Venezuela have seen an increase in asthma and other respiratory diseases. The purpose of these studies was to investigate the possible relationship between the development of bronchial hyperactivity in children and the immune response to **Ascarislumbricoides.** The study was conducted and evaluated on 470 schoolchildren living in the village. Functional tests of the lungs in children found that 20% of them had bronchial hyperactivity. The prevalence of ascariasis and the intensity of invasiveness were determined by examination of feces.

IgE triggers have been set using the modified ELISA method. The results found that IgE against invasion of *Ascaris* lumbricoides caused bronchial hyperactivity among rural children from endemic areas.

During the migration phase of the larvae of*Ascaris*lumbricoides, asthmatic symptoms are common, sometimes involving Löffler syndrome. These changes are also noted at the cellular and molecular level (Caraballo, Acevedo, Zakzuk, 2019: 41; 6). In addition, polyclonal non-stimulation of B cells is observed during ascaridosis (Lee, Xie, 1995: 1246–1254).

Examination of A.lumbricoides excretor using immunoblotting and spectrometry suggests that the allergen *is specific to A.* lumbricoides species (Ahumada, Zakzuk, Coronado, Aglaz, Araujo, Briza, et al. 2020: 13; 8).

Cough is also noted as one of the allergy symptoms during the course of ascaridosis. The larvae that pass into the owner's gastrointestinal system gradually develop and pass through the blood vessel system and lungs into the respiratory tract. The presence of larvae in the uterus causes increased sputum exposure, coughing (Ahmad, Arifin, Nolan, Lok, Anuar, Noordin, 2021: 11; 6). Other helminths have also been studied in this aspect.

Strongiloidosis. Strongyloidosis is often asymptomatic, but in some cases causes allergic diseases of the respiratory system or allergic dermatitis. In laboratory conditions, experiments on mice infected with strongiloid have shown that this helminth is known to cause eosinophilic inflammation, thickening of the bronchus walls, and asthma symptoms (Araujo, de Jesus Pereira, de Moura Pereira, Moreira, de Rezende, Rodrigues, et al. 2016: 3107–3117).

S.stercoralis--antigens are recognized by IgE, IgE-dependent histamine exposure increases, and a positive skin reaction is noted at this time. Another helminth secretory that helps strongiloidosis larvae penetrate the skin is metalloprotease. 100 %of patients with S.stercoralis IgE-induced recombinant protein rA133 are recognized by IgE but are not recognized by those infected with other parasites.

The rate of immunosuppression during helminths depends on the type of helminth and the intensity of the invasion and the genetic characteristics of the host organism. Studies on animal models have found that specific IgE antibodies, along with eosinophils, can destroy helminth larvae. Other types of immune mechanisms have been found in these studies using different helmets (Vacca, Le Gros, 2022: 1212-23; Caraballo, Coronado, 2018: 113-119), but their clinical significance should be further investigated.

All these molecules are allergens and they induce IgE, some of which have been investigated for allergen activity (the ability to cause allergic inflammation), which is important in determining their

clinical significance (Caraballo, Valenta, Puerta, Pomes, Zakzuk, Fernandez-Caldas, et al. 2020: 13; 5). This consideration applies to common allergens but is especially important for helminths (Caraballo, Zakzuk Acevedo, 2021: 1–13).

Invasions in humans can manifest themselves with chronic cough and aggravation of asthma (de las Marinas, Martorell, Felix, 2012: 286-7; Hazan, Orscheln, Kertz, 2022: 2562-4; Salam, Sharaan, Jackson, 2020).

Strongyloidiasis antigens cause IgE-dependent histamine secretion and positive skin reactions in basophiles (Neva, Gam, Maxwell, 2001: 567–572).

Several antigens associated with IgE of Strongilodosis have been investigated. For example, NIE is a larva component recognized by the human IgE. Strongilodose is another secretory metalloprotease with IgE reactivity that helps larvae penetrate the skin (Varatharajalu, Parandaman, Ndao, 2011: 115–122). *S.stercoralis* IgE-induced recombinant rA133 is identified in 100% of infected patients.

There is experimental and epidemiological evidence of asthma in toxocariasis (Mendonca, Veiga, Dattoli, Figueiredo, Fiaccone, Santos, 2012). Meta-analysis examinations show that children infected with toxocaria are more likely to have asthma than those who are uninfected. Identification of components related to IgE has not been fully carried out in these parasites, although several components of human-specific antitopes have been identified.

Ankylostomidoses. Most studies about these nematodes have noted that it has an immunosuppressive effect on the human body. Ankylostomies are shown to cause an allergic reaction in the human body during life cycle. Migration of parasitic larvae from the lungs causes Löffler syndrome.

Ankylostoma secretes the IgE-binding molecule Na-ASP-2, which is structurally similar to SmVALs (Kelleher, Darwiche, Rezende, Farias, Leite, Schneiter, 2014: 2186–2196). Na-ASP-2 can cause positive skin reactions. Both calreticulin and Na-ASP-2 have been investigated as vaccines against ankylostoma helminths (Bethony, Loukas, Smout, 2005: 1743-1745; Winter, Davies, Brown, Stolnik, Pritchard, 2005: 139–146).

High titre of IgE is already detected in children infected with helminth in endemic zones at age 3 (Zakzuk, Acevedo, Cifuentes, Bornacelly, Sanchez, Ahumada, 2013: 788–797). Thus, the detection of specific IgE is more important for determining atopy in areas endemic to the helm. Eosinophilia is observed in both asthmatic patients (Price, Rigazio, Campbell, Bleecker, Corrigan, Thomas, 2015: 849-858) and those infected with helminthosis.

In tropical climatic endemic areas, the rise of eosinophils is more dependent on ascaridosis. Therefore, studies of helminth invasion by examination of feces can help determine the cause of eosinophilia in the blood in asthmatic patients living in endemic zones with tropical climates.

The similarity of inflammatory mechanisms in allergies and parasitoses necessitates a revision of existing diagnostic methods and standards. At the onset of the disease, a specific absence of clinical signs and overlapping symptoms can lead to a misdiagnosis. For this reason, comparative analysis of similar and different symptoms of these diseases and metabolic pathways of molecular mechanisms of allergy should be studied. Research methods for differential diagnostics have been presented in this direction.

Scientific background work in allergy and parasitology indicates that it is advisable to perform a parallel allergy and parasitological examination in patients with non-specific symptoms. This approach helps to diagnose accurately and early and perform effective therapy.

Immune processes and reactions that occur during helminth invasions and allergic diseases may be similar (Cooper, Figueiredo, Rodriguez, 2023: e12232).

An infected organism is usually more likely to react to this invasion if the invasion occurs accidentally in an area that is not endemic to it. At this time, hyperallergic reactions such as Löffler syndrome or eosinophilic pneumonia may occur, which require treatment with corticosteroids (Araujo, de Jesus Pereira, de Moura Pereira, Moreira, de Rezende, Rodrigues, 2016: 3107–3117).

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Occasionally, infection with parasites causes a similar severe allergic response to food allergens in the body.

Intestinal nematodes cause symptoms of impaired gastrointestinal functions, such as general weakness of the body, diarrhea, and abdominal pain (Ravi, Ramachandran, Thompson, 2002: 73–81).

After infection with helminths, the immune system is activated. This process includes T and B lymphocytes, regulatory T cells, eosinophils, neutrophils, basophils, etc. (Dunne, Webster, Smith, 1997: 79–89). T cells are important in regulating the immune response. T-cell cells (Th) stimulate humoral and cellular activity, depending on the activation of a given subpopulation. Th1 is involved in the induction of a cell-type immune reaction, while Th2 mediates a humoral immune reaction. At this time, the blood is characterized by increased amounts of IL-4, IL-5, and IL-13, as well as high titration of eosinophilia and IgE (van den Biggelaar, van Ree, Rodrigues, 2000: 1723-1727). It persists through the action of IL-4, which is described as a key cytokine in the pathogenesis of allergic diseases. Parasites are the most powerful inductors of the Th2-type immune response (Santiago, Hafalla, Kurtis, Aligui, Wiest, Olveda, 1998: 94-104), but are involved in this process in adult dendric cells. Stimulation of Th2 cells leads to secretion of IgE and IgG antitopes by plasma cells and causes eosinophilia (Fitzsimmons, Stewart, Hoffmann, 2004: 371–6).

Both acute and delayed allergic reactions can occur without Ig involvement and with involvement (Schramm, Hamilton, Balog, Wuhrer, Gronow, Beckmann, 2009: 4–14). Proteins with cytotoxic properties include protein (MBP accounts for more than 50% of them), eosinophilic peroxidase (EPX), eosinophilic cationic protein (ECP), and eosinophilic derivative, neuro-toxin (EDN). These proteins play an important role in eliminating helminths. Laboratory tests indicate significant eosinophilia in both allergic diseases and helminth invasions (IL-1β, IL-2, IL-12, and tumor necrosis factor-alpha (TNF-α)). Cytokines that develop inflammation are involved in the regulation of inflammation (Medeiros, Figueiredo, Almeida, Matos, Araujo, Cruz, 2003: 947–951).

Natural regulatory mechanisms that protect the host organism from inflammatory or autoimmune reactions during parasitic diseases, such as T cells (Trig), play a role in tolerance to autoantigens and reducing reactions to alien particles (Wordemann, Diaz, Heredia, Collado Madurga, Ruiz Espinosa, Prado, 2008: 180-186). Parasites secrete a number of specific metabolites that directly affect the host organism. They affect T cells and can alter the function of proliferation or apoptosis (Sangsupawanich, Mahakittikun, Chongsuvivatwong, Mo-suwan, Choprapawon, 2010: 29-34), which affects the balance of their Th1/Th2/Treg response. In addition, some helminths induce apoptosis of different immune cell populations (i.e. programmed death) (Falcone, Telford, Hooi, 2009: 1343–50).

Some helminths affect antithelial levels by converting IgG4, an expression of genes that encode IgE antitheses. Unlike IgG4 IgE, they are not involved in the elimination of parasites, the presence of which indicates the development of allergen tolerance (Phillips, Coward, Pritchard, Hewitt, 2003: 165-171). The parasite disrupts the homeostasis of the infected human body. However, studies have shown that the antagonism between the parasite and the possessor does not always harm the possessor organism. In addition to the pathological effects of invasion due to the evolutionary long-term link between the parasite and the host organism, helminths affecting the maintenance of immune homeostasis may be observed (Medeiros, Figueiredo, Almeida, Matos, Araujo, Cruz, 2003: 947-951).

Conclusion. In recent years, studies on the inhibition of an inflammatory reaction by some intestinal nematodes have been able to prove that some types of parasitic invasion are alternatives to the treatment of autoimmune diseases and allergies (Balfour, Zalka, Lazova, 2002: 368-370). Research into the molecular mechanisms of metabolism of allergens associated with helminth invasions should be continued.

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THE NATURE OF THE CONCEPT OF PRIMARY MEDICAL AID AND ITS PSYCHOLOGICAL ASPECTS

Abstract

Healthcare reform is perhaps one of the most discussed topics in social policy today. In the 1990s, the health care reforms carried out in many countries of the world mainly separated the provision and financing of health care services, leaving the provision of services to the responsibility of the State Insurance Organization (SHI), which was created from the collected insurance premiums. Healthcare reforms in the field of primary care destroy the structures that ensure the provision of integrated health services (Health Centers) and give priority to preventive health services created by the community in the past under the unique conditions of each country. Although the goal is to direct people to therapeutic services, concepts such as efficiency and freedom to choose a doctor are used as the main arguments.

Keywords: *social efficiency, health protection, demand for health, accessibility*

Introduction

Inequality and poverty are the main challenges in healthcare systems today. There are serious disparities in access to health care for low-income individuals both globally and within countries. These inequalities are the reflection of social inequalities. Their elimination is possible only by eliminating social inequalities. However, even in regions with the deepest social inequalities, comprehensive and equitable primary health care has been shown to be highly effective in improving health and reducing health inequalities (Starfield, 2018:36).

Today, the process of fundamental changes in the primary health care service is being implemented in Azerbaijan. There is a serious conflict between the goal and the work done. The proposed new model excludes the most basic features of primary health care, defined by many years of scientific knowledge. The reason for this contradiction is that justifications are being sought for healthcare reforms that are not really about primary care, or even public health. In this environment where concepts are misused and attacks on the health system and the right to health are masked by common phrases, the characteristics of egalitarian and effective primary care have become an issue that needs to be reelucidated.

In the simplest terms, the first healthcare institution that a citizen turns to for various reasons and the healthcare service provided in this institution can be defined as "primary healthcare". This service is offered in different ways in different countries around the world. However, one common feature can be noted. Primary healthcare services are an indispensable part of the healthcare systems of countries (Macinko, Starfield, 2013: 24).

The characteristics of primary health care are grouped under two headings. The first heading is system characteristics, or in other words, structural characteristics, which are linked to national-level policy priorities and support a country's primary care orientation. Characteristics under this heading are the distribution of primary care infrastructure and workforce capacity, the type of funding, the location of services, and the type of health worker responsible for primary health care. The second title defines the functions of primary care based on these system characteristics: initial referral, inclusion, continuity and coordination. The fact that primary medical care is the first stage of individuals entering the health care system, being the first appeal, providing preventive and curative health services to all, except for rare and unusual cases, explains the comprehensiveness and long-term relationship with the patient (Macinko, Starfield, 2013: 26).

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There are two main models for providing primary care services. In the first model, the service is provided by doctors who work independently in their private practices and employ the number and qualifications of staff they want. This model, typical of public and private health insurance systems, is also applied in Italy and England, which are National Health System countries. In the second model, the service is provided by doctors and health workers who work as public employees in public health centers in exchange for wages (Boerma, 2013:47).

In a group of countries, including England, Italy, the Netherlands, Finland, Sweden, Norway, Iceland and Greece, primary care is provided only by general practitioners. On the other hand, in most countries with public or private insurance systems, such as Germany and the United States, specialists can provide primary care services by opening private medical facilities. Portugal and Spain are a special group. Because general practitioners and specialists work in public health centers in these countries. However, this is because these two countries, which have recently transitioned to the National Health System, do not have enough general practitioners for a system based on primary care and fill these gaps with internists and paediatricians (Carlsen, Norheim, 2015:70).

The success of primary care is determined by the education of the primary care physician. Because primary care services are a whole and healthy type of service that has a special responsibility for the health of the people, provides services to meet the needs of society, makes clinical decisions using information about the society and environment where the patient lives. For this reason, the education of primary care physicians should be planned with content relevant to primary care. Students in pre- and post-medical education, mainly in tertiary care institutions, are generally exposed to very rare and highly differentiated diseases in the community and tend to overestimate the likelihood of encountering serious disease upon discharge from tertiary care hospitals (Guy, 2011:16). This trend, combined with the inability to assess people in their social and physical environment and the economic incentives of expensive technologies, the promotional activities of pharmaceutical companies and the influence of the competitive system, results in the introduction of many unnecessary diagnostic tests. For this reason, it is not suitable for physicians who have completed any specialty training other than primary care or have undergone a process that is not specifically designed for primary care and consists only of rotations in other stages of the health care system (Guy, 2011:16).

In public health centers, the physician is only one of many members of the multidisciplinary primary care team. This team also includes other health professionals such as midwives, nurses, environmental technicians, medical secretaries, social workers, psychologists, dentists, pharmacists, and physiotherapists. The participation of various health professionals in the primary care team allows for the common use of social, psychological, and medical knowledge and skills, resulting in the expansion of the patient service framework, comprehensive assessment of problems, reduction of hospital visits, and continuity of medical care. While teamwork allows physicians to spend more time on patient care, preventing excessive workload, it also allows patients who can more easily communicate with non-physician healthcare providers to benefit from healthcare services. In addition, non-physician healthcare workers working in a team have higher job satisfaction and lower levels of disengagement (Baegelhole, Bonita, 2019:15).

The fact that specialists have higher incomes than primary care physicians means that the health care system encourages medical students to specialize, thereby undermining primary care. Strong primary care requires a type of physician whose income level and status in the community is at least as high as that of other specialists. In countries where the National Health System is implemented, the status and income level of primary care physicians play an important role in the success of primary care (Jarman at. el, 2019:318).

Today, there is a strong trend towards multidisciplinary teamwork in Europe, and teamwork is promoted through national policies in Spain, Great Britain, Finland, Spain and Portugal. However, at this point it is useful to explain what teamwork is, or rather, what it is not. Healthcare workers working together does not mean they work as a team. Teamwork requires shared goals, with

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everyone understanding and appreciating their role and the roles and skills of others on the team. For teamwork to occur, the professional training of primary medical workers should be organized according to the principles of teamwork. Additionally, teamwork can be difficult when team members have different types of employment, for example, some are contracted, some are permanent, or some are affiliated with a separate organization as a subcontractor (Gulliford at. el, 2014:12).

The implementation of primary medical aid takes place in several stages. Those stages are given according to the scheme below.

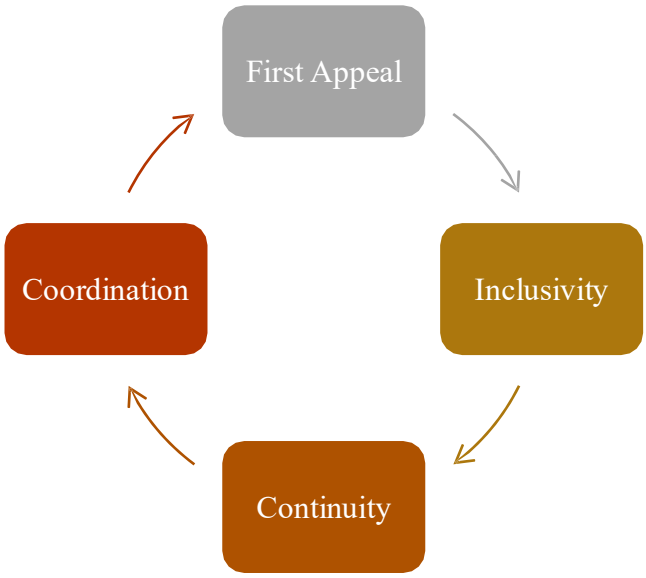

Figure 1. Stages of implementation of first aid

First Appeal. The characteristic of first referral defines primary care as the first stage at which individuals encounter the health care system for each new care need that arises due to a health problem. In a significant number of countries with health systems focused on primary care, specialist services can only be accessed through a referral from a primary care physician. General practitioners' control over patients' use of other stages of the health care system is called "gatekeeping" (Starfield, 2018). Gatekeeping is basically implemented in two different ways. The first model is for general practitioners working in public health centers to serve a geographically defined population, while the second model is for privately employed doctors to serve a patient list of patients registered with them over a period of time (Boerma, 2013). The practice in which patients are not prevented from consulting a specialist at the initial stage of application and access to specialist services is not controlled is called "open system" (Gulliford, at. et, 2014:12). But what this experience brings is not freedom, as the name suggests, but complete chaos in the health care system. In open systems, it is more appropriate to classify health care as ambulatory and inpatient rather than primary, secondary, and tertiary care, and ambulatory care includes all primary care-related services as well as office-based specialist services and outpatient hospital care.

One thing we find particularly useful to note here is that the concepts used involve a certain point of view and therefore care should be taken when using these concepts. Although the term "open" has positive connotations, it describes an unregulated system where anyone can go wherever they want. The concept of "closed" is used instead of a systematic and rational organization, although it gives rise to a negative experience that limits the health rights of individuals. Likewise, gatekeeping emphasizes the blocking function, but is used as a core concept of the system in the sense of filtering out what is not needed.

In private doctor's offices, the service is physician-centered, and other health professionals are only support staff. There are significant differences between doctors and other workers in terms of

type of employment and income level. Today, more and more private doctors come together and share work and opportunities in the private clinics they create, a practice called group practice. A group practice gives physicians significant flexibility and increases the number of tools needed to meet patients' needs under one roof. However, group practice should not be confused with multidisciplinary teamwork and it should not be forgotten that it does not make any difference within the service (Guy, 2011:16).

Gatekeeping brings many advantages, such as ensuring coordinated delivery of services, reducing unnecessary interventions, overuse of specialist services, hospital length of stay and medication use, and preventing inequalities by preventing overuse of services by one segment of the community. Today, there is a trend towards gatekeeping practice, where private general practitioners control the referrals of patients on their lists across Europe, particularly in Eastern Europe. However, this type of gatekeeping, which is part of the process of privatization in health care, only reinforces the physician's responsibility to the patients on his list and distances physicians from providing continuous care to individuals, families, and society at the primary level. Competing with each other to get more patients on their lists, general practitioners are under pressure from patient demands and unable to fulfill their role as gatekeepers to healthcare systems based on patient satisfaction. Gatekeeping can only be applied in countries where primary health services are strong enough and the health system is focused on primary care. The Swedish example is very surprising. The reason for this preference can be attributed to the wide range of services in primary care and the status of general practitioners in society (Guy, 2011:16). When these two conditions are not met, patients prefer to go to emergency rooms or pay to see a specialist directly. In non-community-based, non-community-based primary health care systems based on a market economy, and in countries where the importance of general practitioners is not sufficiently understood by society, the practice of gatekeeping leads to the deterioration of patient-physician relationships, the crushing of doctors under consumer pressure, and the increase of health inequalities.

Inclusivity. The main principle regarding service coverage is that regardless of the type of primary care, it should be able to identify and intervene in all health problems that are common in the community. Therefore, when assessing inclusion, the adequacy of staff training and numbers, institutional capacity, equipment and support services to identify and intervene in these problems is questioned. The level of implementation of activities such as immunization, health education and screening also reflects inclusion. A high application rate, another criterion used to assess inclusion, indicates insufficient inclusion (Starfield, 2018:49).

The World Health Organization, which in the past established the concepts of Primary Health Care and comprehensive primary health care with the Alma-Ata Conference, has now abandoned the principle of "comprehensive care for all" on the grounds that it is expensive. The organization states that governments now have an obligation to provide cost-effective services aimed at protecting the health of their people and treating only the most common health problems, thus improving health statistics and helping economic development, but the goal should not be to provide everything possible. The organization advocates an approach of "inclusiveness but not all-inclusiveness". According to the World Health Organization, governments can prioritize and allocate resources to such areas as immunization, safe motherhood and tobacco control. This depoliticized approach to Primary Health Care is called Selective Primary Health Care. While primary health care (PHC) is based on a broad definition, the concept of selective primary health care (PSHC) offers more technical and limited approaches to health problems - with a focus on child health; While tsh emphasizes equality, tsh considers health as the absence of disease, IHS advocates a multifaceted approach to health, while SIS deals with the management, treatment, and prevention of diseases and major health problems, SIS refers to community participation as full participation, and in SIS, community participation means giving consent. In this context, SISX reduced its work to "immunization, supplementary feeding support, breastfeeding, and distribution of antimalarial drugs" (Kocaturk, 2017).

Continuity. Continuity is the long-term relationship between the patient and the primary care facility regardless of the presence of any health problems. A community definition of continuity includes the availability and use of a regular source of primary care. For a service provider, sustainability reflects the level of knowing the community it serves, knowing the needs of this community, and monitoring whether the needs are met or not (Kutlu, Kapıcıoghlu, 2017:44).

Primary care facilities serving a geographically defined population and having records containing information about these people are key to ensuring sustainability. These records are essential for general practitioners to carry out their public health duties and obtain information that guides the planning of health services. Primary care, which is not organized based on geographically defined regions, is called a practice list system, in which doctors serve only registered patients (Badır, 2015). The roster system does not allow the primary care team to get to know the community. Moreover, in this system, which works with the logic of consumer relations, patients can leave one doctor's list, switch to another, and change doctors again in the next period. In this situation, even if doctors make an effort to get to know their patients, due to the variability of patient lists, it is difficult to obtain results to ensure the continuity of their efforts (Akdemir, Birol, 2015:45).

Coordination. Coordination determines the transfer of information between the first stage and other stages of the system. Three main conditions must be present to ensure coordination. The first condition is the application of "gatekeeping". Other conditions are that, in addition to primary care, all information about patients should be recorded in secondary and tertiary care and that this information be transferred to primary care according to official guidelines. A study evaluating health services in OECD countries reported that coordination remains inadequate even in countries that are quite successful in terms of other primary care characteristics. For this reason, it would not be wrong to define coordination as a feature that is relatively more difficult to achieve.

Conclusion

From the point of view of structural characteristics, it appears that the distribution of the labor force is theoretically predicted. If there is not one family doctor per 3,000 people and there are no volunteers, the appointment approach is based on the principle of equality. In terms of infrastructure, equality is theoretically out of the question. In terms of the financing principle, the choice of family medicine is based on a less egalitarian insurance model and is also evaluated in conjunction with the General Health Insurance model, where user contributions are a form of financing.

The health workers who will provide the service are family doctors who are only trained in treatment services and do not have any responsibility to the community. Obstetricians and gynecologists, nurses and health workers have been defined and de-identified as ancillary health workers and the team concept has been completely eliminated. In terms of practice principles, the choice of family medicine theoretically puts first practice first.

The first step in evaluating the health of a community or the health services provided in that community is to bring together all the relevant variables. However, it is very difficult to interpret these crowded variable lists containing a large number of data and to summarize and analyze the current situation through these lists.

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CANNABIS WEED BIOMASS ADSORBENT FOR BATCH ADSORPTION OF RO16 DYE FROM AQUEOUS SOLUTION

Abstract

This study examined Reactive Orange 16 (RO16) adsorption onto biochar made from cannabis weed biomass (CWB) in aqueous solutions. The adsorption process is negatively impacted by increasing temperatures, which results in a shift toward system stability and energy loss. This indicates that the process is exothermic, as demonstrated by negative enthalpy change (ΔH) values. The negative values of ΔG at different temperatures indicate spontaneous adsorption, highlighting the practicality of using CWB to remove RO16 in practical applications. Monolayer adsorption on homogeneous sites within the CWB structure is indicated by the Langmuir isotherm model, which accurately represents the adsorption behavior. CWB's effectiveness in RO16 adsorption was demonstrated by the greatest adsorption capacity of 33.45 mg/g. Additionally, the starting dye concentration, adsorbent dose, and solution pH have a major impact on the adsorption effectiveness of CWB. The significance of accessible adsorption sites is highlighted because optimal dye removal happens at lower dye concentrations and greater adsorbent dosages. Another important factor is pH; lower pH values result in increased removal efficiency because of the advantageous electrostatic interactions that occur between the protonated surface of CWB and the anionic dye. For removing RO16 dye from aqueous solutions, CWB shows a great deal of promise as an economical, effective, and long-lasting adsorbent.

Keywords: *Cannabis weed biochar, Reactive orange-16 dye, hemodynamic, kinetics of dye adsorption*

Introduction

The textile sector is ranked as a major contributor to environmentally harmful pollution, with 300, 000 t. of synthetic dyes entering into treatment plants whereby dyeing and finishing departments constitute about 20% of total industrial effluents (Rita Kant, 2012). It is reported by the Global Commission on the Economics of Water that the textile sector is contributing to the global scarcity of clean water globally around 40% by 2030 (Cairns, 2023). This not only pollutes the clean water but also induces photosynthetic impairment in aquatic plant (Saravanan et al., 2021). As the dyes are stable due to complex chemical structures, therefore, these are difficult to fade naturally (Carneiro, Nogueira, & Zanoni, 2007). Almost 10 to 15% of color entered into polluted water and besides health problems (Manzoor & Sharma, 2020), constituting a key environmental concern (Kyzas, Lazaridis, & Mitropoulos, 2012).

Numerous treatment methods have been tested on dyes treatment, for instance, fungal degradation (Sen, Raut, Bandyopadhyay, & Raut, 2016), ion exchange (Villalobos, Cid, & González, 2016), advanced oxidation processes (Navarro, Gabaldón, & Gómez-López, 2017) and adsorption (Gopinathan, Bhowal, & Garlapati, 2017; Qi, Yang, Xu, He, & Men, 2017). In these methods, the adsorption is the most prominent treatment method because of simple operation and facile application (Elsherbiny, 2013).

Several adsorbents have been used for dyes and organic pollutants adsorption from aqueous solutions such as sawdust (Khan, Sharma, Khan, & Mukhlif, 2014), corn cob (Salih, Abdul Kareem, & Anwer, 2022), waste woody biomass (Stjepanović et al., 2021), Pineapple plant stem (Chan, Tan, Abdullah, & Ong, 2016), herbaceous weeds (Khandare & Govindwar, 2015), low-cost filters

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derived from invasive weed biomass of *Parthenium hysterophorus* (Kamath et al., 2022), and invasive plant biowaste (Nguyen et al., 2022). The invasive plant species cause huge economic losses to agriculture productivity, for instance, in India yearly monetary loss of US$ 16.8 billion to agriculture (Bang et al., 2022), therefore this pose a serious threat to the agricultural economy worldwide (Paini et al., 2016). This necessitates the transformation of invasive plant species to useful applications such as biosorbents for the removal of hazardous textile dyes from effluent streams. Cannabis weed is also recognized as an invasive agricultural weed (Canavan et al., 2022). This weed can be converted into low-cost adsorbent such as biochar. During this transformation, volatile matters get evaporated and porous carbon material is obtained. In this study, Cannabis weed biomass is converted into biochar without any chemical treatment. Finally, this was explored for the removal of reactive orange 16 dye from an aqueous solution in a batch reactor. The mechanism of dye adsorption was investigated using widely applied isotherms and kinetic models. The spontaneity of chemical reactions was investigated by thermodynamic studies.

Materials and Methodology

The investigation began with the collection of hemp biomass samples from nearby fields. These samples were then carefully cleaned, dried in the sun, and ground into a fine powder. Important characteristics like moisture content, volatile matter, ash content, and fixed carbon were then determined by a thorough proximate investigation. The next step involved the pyrolysis process, which produced biochar. Biochar was tested against reactive dyes as part of the adsorption investigation, and UV-visible spectrophotometry was used to measure the extent of dye removal. The effects of duration, dosage, pH, and initial dye concentration were all carefully investigated in order to determine how they affected the biochar's adsorption efficiency. Additionally, by closely examining various isotherms and reaction models, including the intra-particle diffusion model, pseudo-first order, pseudo-second order, Freundlich isotherm, and Langmuir isotherm, the underlying mechanism of the adsorption process was clarified.

Freundlich Isotherm:

qe=KfCe1/n

qe: Amount of dye adsorbed at equilibrium (mg/g).

Kf: Freundlich constant, representing adsorption capacity (mg/g) * (L/mg)^(1/n).

Ce: Equilibrium concentration of dye in solution (mg/L).

n: Freundlich exponent, indicating adsorption intensity.

Langmuir Isotherm:

qe=1+KLCeQmaxKLCe

qe: Amount of dye adsorbed at equilibrium (mg/g).

Qmax: Maximum monolayer adsorption capacity (mg/g).

KL: Langmuir constant, related to the energy of adsorption (L/mg).

Ce: Equilibrium concentration of dye in solution (mg/L).

Pseudo-first order:

log(qe−qt)=logqe−2.303k1t

qt: Amount of dye adsorbed at time t (mg/g).

1k1: Pseudo-first order rate constant (1/min).

t: Time (min).

Pseudo-second order:

qtt=k2qe21+qe1t

qt: Amount of dye adsorbed at time t (mg/g).

2k2: Pseudo-second order rate constant (g/mg·min).

t: Time (min).

Intra-particle Diffusion Model:

qt=kpt0.5+C

qt: Amount of dye adsorbed at time t (mg/g).

kp: Rate constant of intra-particle diffusion (mg/g·min^0.5).

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t: Time (min).

C: Intercept representing boundary layer effect.

Results and Discussion

Experimental results from 30°C to 50°C show that Cannabis weed biomass (CWB) adsorbs Reactive Orange 16 (RO16) dye molecules. The adsorption effectiveness of CWB for RO16 was found to be 29.43% at a temperature of 30°C. Experiments conducted later at 50°C showed a decrease in adsorption efficiency, which reached 9.50%. The decrease in adsorption efficiency with increasing temperature, suggests that higher temperatures do not promote weaker interaction between the dye molecules and the adsorbent surface, resulting in lower adsorption efficiency (Hajira Haroon et al, 2020). Moreover, thermodynamic investigations are vital for comprehending the characteristics of the adsorption process. Using Equation 1, the equilibrium constant (Kc) was calculated. This Kc was then multiplied by the solution (water) density (ρw = 1000 g/L) to make it dimensionless (Rehman et al., 2018). Thermodynamic parameters utilizing Eqs. (2) and (3) can be used to compute changes in entropy (ΔS, kJ/mol), enthalpy (ΔH, kJ/mol), and Gibbs free energy (ΔG, kJ/mol).

$$ln\, K_d(\rho_w) = \frac{q_e}{C_e} \quad (1)$$

$$\ln K_d(\rho_w) = \frac{\Delta S}{R} - \frac{\Delta H}{RT} \quad (2)$$

$$\Delta G = \Delta H - T\Delta S \quad (3)$$

The plot (ln Kd (ρw) vs 1/T) can be used to compute the parametric values of ΔH and ΔS. The adsorption process's endothermic or exothermic character is defined by ΔH, whereas the value of ΔG aids in determining whether the reaction is spontaneous or not. The unpredictability or disorder in the aqueous system at the solid-liquid interface during the adsorption process is reflected by ΔS. These characteristics are useful for assessing the appropriateness and practicality of a dye adsorption system. The adsorption dataset of each adsorbent against the target dye under a variable temperature range (30 to 50 °C), the initial dye concentration (30 mg/L), the adsorbent dosage (1 g/L), the equilibrium contacts time (variable for different adsorbents), the agitation speed (150 rpm), and the pH of the solution were used to calculate these parameters.

Table 1 Thermodynamic parameters for RO16 adsorption by cannabis weed biomass

ΔH (kJ mol^{-1})	ΔS (J mol^{-1} K^{-1})	ΔG (kJ mol^{-1})		
		T (K)		
		303.15	313.15	323.15
-36.55	70	-58.39	-59.11	-59.83

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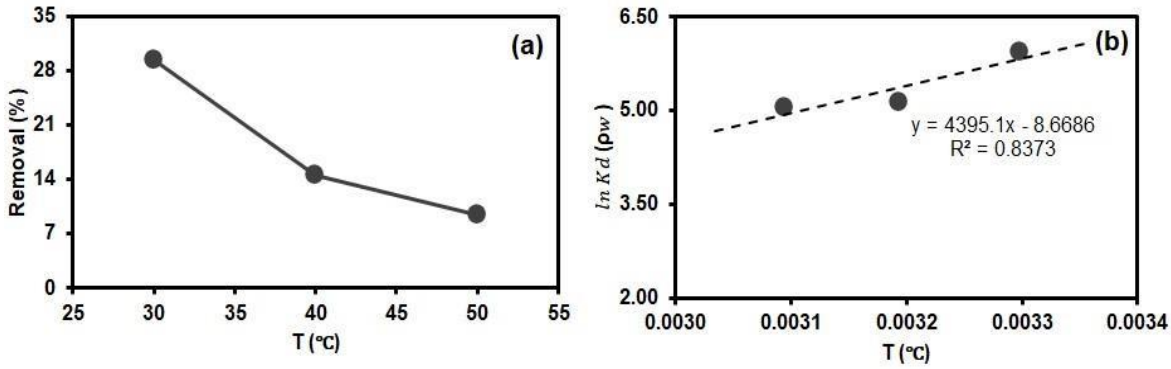

Figure 1. (a) Effect of Temperature on the adsorption of RO16 dye on CWB. (b) Thermodynamic plot for RO16 adsorption by cannabis weed biomass

The Figure 1 illustrates the thermodynamic plot, while the Table 1 provides a summary of the thermodynamic parameters for the adsorption of RO16 dye on cannabis weed biochar (CWB). The negative values of ΔH and positive values of ΔS° were observed when the temperature increased from 303.15 K to 323.15 K indicate that the adsorption process is exothermic and that there is an increase in randomness at the solid-liquid interface. This phenomenon can be attributed to the elevating temperature, which enhances the mobility of adsorbed ions or molecules within the solution. A high negative ΔG value indicates that adsorption process is exergonic and spontaneous in character, CWB loss energy and shift to lower and stable energy state.

Dyes Screening

Five distinct dye types were batch screened in order to choose dyes that would react with the biomass of CWB. Figure 2 illustrates how, in comparison to other dyes like RY145, RB2, MB, and Orange II, the RO16 has a significantly ($p = 0.01$) greater adsorbed content on the biomass at the highest rate of 44.5% in 120 minutes. As a result of these findings, RO16 dye was shown to be adsorbed most on the adsorbent and was chosen for additional research to test the performance of CWB under optimizing ambient conditions. Previously RO16 dye was adsorbed on the softwood bark in the aqueous solution (Averheim et al., 2024).

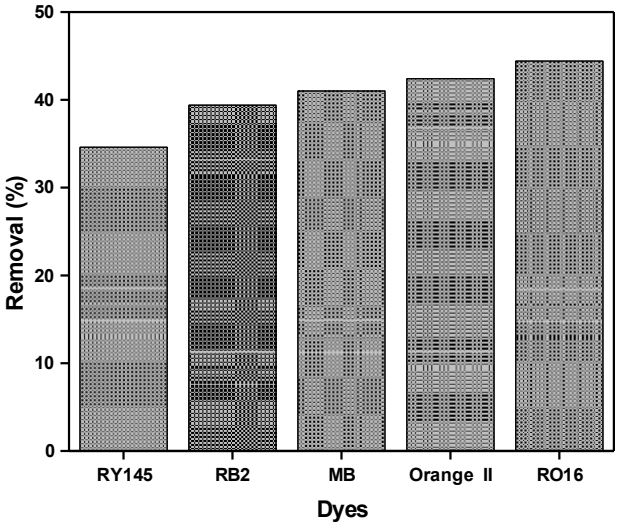

Figure 2. Screening of cannabis weed biomass against various textile dyes

Effect of time

As illustrated in Figure 3, the impact of contact time on the RO16 adsorption on CWB has been assessed. It only takes 120 minutes of contact time to reach equilibrium adsorption, or $q_e = 44.5\%$.

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Extending the contact period up to 240 minutes had no significant effect on the adsorption (p = 0.01). Hence, the duration of the remaining batch experiments was optimized to 120 minutes in order to achieve equilibrium. Since there are a lot of active sites on the adsorbent surface in the first 50 minutes of batch adsorption, the adsorption rate is high at the beginning and slows down as time goes on. Then, as the adsorbent's surface dye molecules reject the aqueous solution's dye molecules, the remaining empty sites get more difficult to be occupied, and the dye adsorption onto the CWB adsorbent decreases. In a previous study, tuja cone biomass exhibited a rapid adsorption behavior for methylene blue dye within the initial 50 minutes. Furthermore, this adsorption was optimized after 120 minutes of equilibrium time (Rehman et al., 2018).

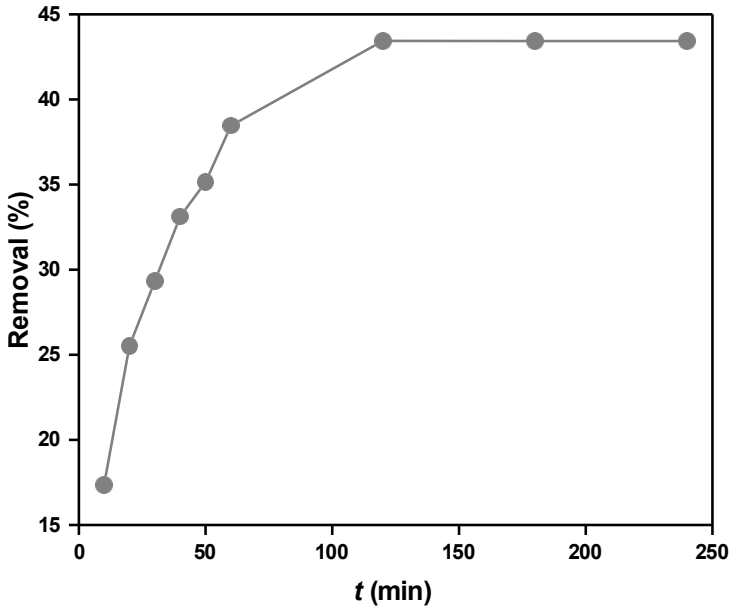

Figure 3 Effect of contact time on RO16 dye removal by Cannabis weed biomass

Effect of CWB dose

The overall efficacy of any adsorption process is significantly influenced by the amount of adsorbent utilized. As illustrated in the Figure 4, the amount of CWB adsorbent utilized influences the RO16 dye absorption from aqueous solution. A considerable increase in RO16 removal occurred from 34.82% to 61.91% when the quantity of adsorbent was increased from 0.4 to 3.2 g/L. The proliferation of binding sites associated with the quantity of the adsorbents present on the surface of CWB is the cause of this trend. As a consequence, a greater number of dye molecules are adsorbed onto the exposed adsorbent during the contact time. Previous research has shown similar patterns for RO16 dye utilizing *Ulva prolifera* (Ravindiran, Gaddam, & Sunil, 2022). The drop in binding ability is likely due to dye molecules building up on the CWB surface and the path distance for effective diffusion getting longer (Shah et al., 2020).

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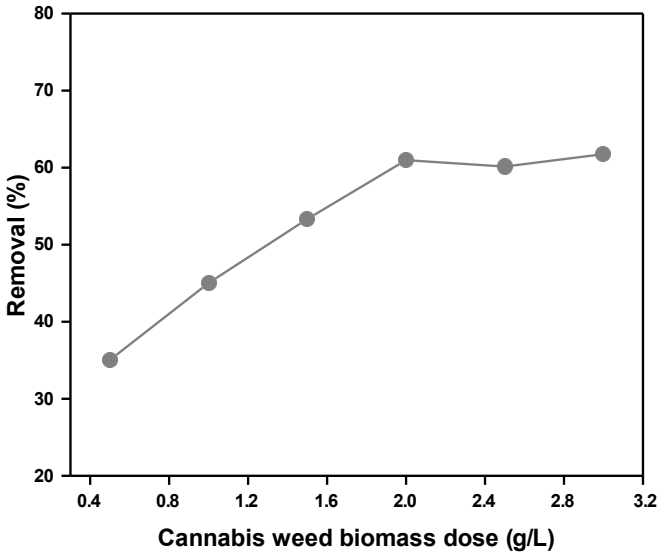

Figure 4. Effect of cannabis weed biomass dose on RO16 removal.

Effect of Initial Dye Concentration

As shown in Figure 5, the efficiency of CWB to eliminate RO16 at various initial concentration levels (25 to 150 mg/L) was investigated. It was discovered that increasing the dye concentration from 25 to 150 mg/L decreased the percentage of RO16 removed by CWB from 60% to 20.1% respectively. The increased availability of vacant binding sites on the surface of CWB led to a higher dye uptake per unit mass of adsorbent. The declining dye concentration can be attributed to the increased competition and conglomeration at the adsorbent surface, which provides resistance to mass transfer, caused by a greater number of dye molecules in aqueous phase.

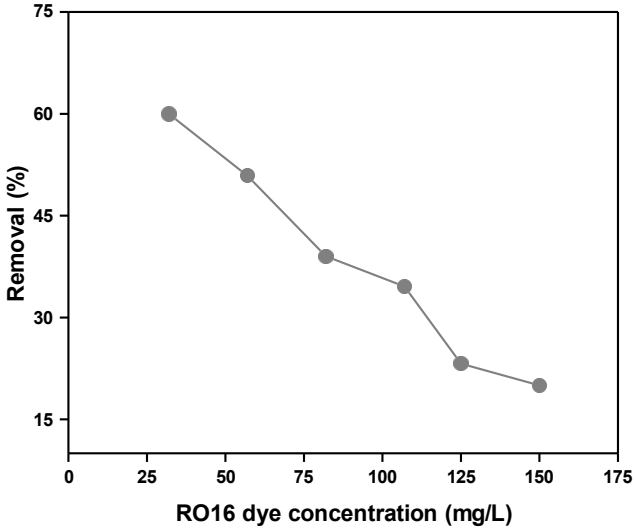

Figure 5. Effect of concentration on RO16 dye removal by cannabis weed biochar dose.

Effect of pH

In order to achieve efficient adsorption, RO16, an anionic dye, exhibits a pronounced attraction towards surfaces that are positively charged (Li et al., 2023). As shown in Figure 6, the dye adsorption peaked at 60.44% at pH 2 and dropped to 35.02% at pH 12, which is quite alkaline. The decline in concentration can be ascribed to the repulsive electrostatic interaction that likely occurs

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between hydroxyl ions and anionic dye groups, which are probably in liquid phase. Carboxylic adsorption may also occur due to the protonated functional groups present on the surface of CWB at higher pH (Averheim et al., 2024).

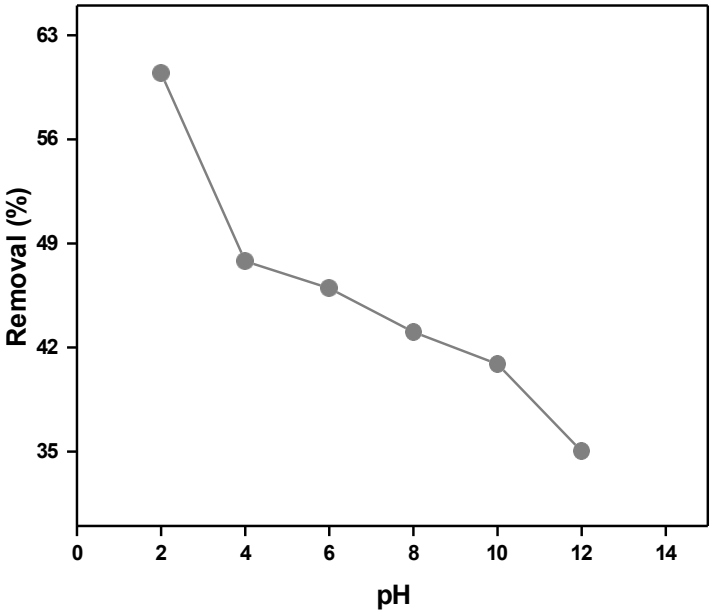

Figure 6. Effect of solution pH on RO16 removal by cannabis weed biochar

Adsorption Modelling

Mechanism and rate of adsorption was investigated by using different isotherm model and kinetic models.

Isotherm models

Based on the R^2 values presented in Table 2 and illustrated in Figure 7a, the Langmuir isotherm was identified as the most appropriate. Adsorbate monolayer formation, a layer of adsorbate with a single molecule thickness, over a predetermined number of adsorption sites is theoretically explained by the Langmuir isotherm. At equilibrium, the maximal adsorption capacity of 33.45 mg/g is achieved without any mutual contact between the adsorbate molecules. Once the adsorbate molecule fills an empty site, it is prevented from further attachment due to the establishment of a chemical bond (Langmuir 1918).

Since the adsorption process occurs in a uniform and singular layer, it significantly enhances the effectiveness of dye removal due to its higher adsorption efficiency (Mubashar Hussain Gardazi, Ali, Rehman, Ashfaq, & Bilal, 2017).

Furthermore, the free energy available for CWB (0.61) is linked to the constant Ka in the adsorption mechanism. Based on the value of dimensionless constant (where the separation factor = 0.07), the RO16 dye adsorption onto CWB is likely a favorable adsorption process (Rehman et al., 2018).

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Table 2 Adsorption parameters for the removal of RO16 dye by cannabis weed biomass

Isotherms	Parameters	Values
Langmuir	q_{exp}	30.00
	q_{max}	33.45
	R_L	0.07
	K_a	0.08
	R^2	0.9957
Temkin	AT	1.37
	B=RT/bT	7.50
	*ln*AT	0.32
	R^2	0.9546
D-R	q_{DR} (mol/g)	28.14
	β $(mol/J)^2$	9×10^{-6}
	E (kJ/mol)	333.33
	R^2	0.9347
Freundlich	K_f	6.89
	N	2.97
	R^2	0.9046

Temkin isotherm indicates that lateral interaction between adsorbate molecules influences the adsorption process. The interaction lowers the heat of adsorption in the adsorbent's surrounding layers of adsorbate molecules.

The model is characterized by a uniform distribution of peak binding energies. A linear drop in the heat of adsorption will occur in the molecular layer of adsorbates around the adsorbent if low and high concentration thresholds are disregarded. For the RO16 dye adsorption onto CWB, the Figure 7b and Table 2 illustrate the graph curve and values of Temkin model constants derived from a linear fit.

The sorption heat in the adsorption system is reflected in the rate constant Bt; which is determined to be 1.36 kJ/mol, indicating that the lower RO16 facilitated an equitable distribution of lower bonding energies. As a result, the CWB surface sites experienced an increase in RO16 absorption on the CWB.

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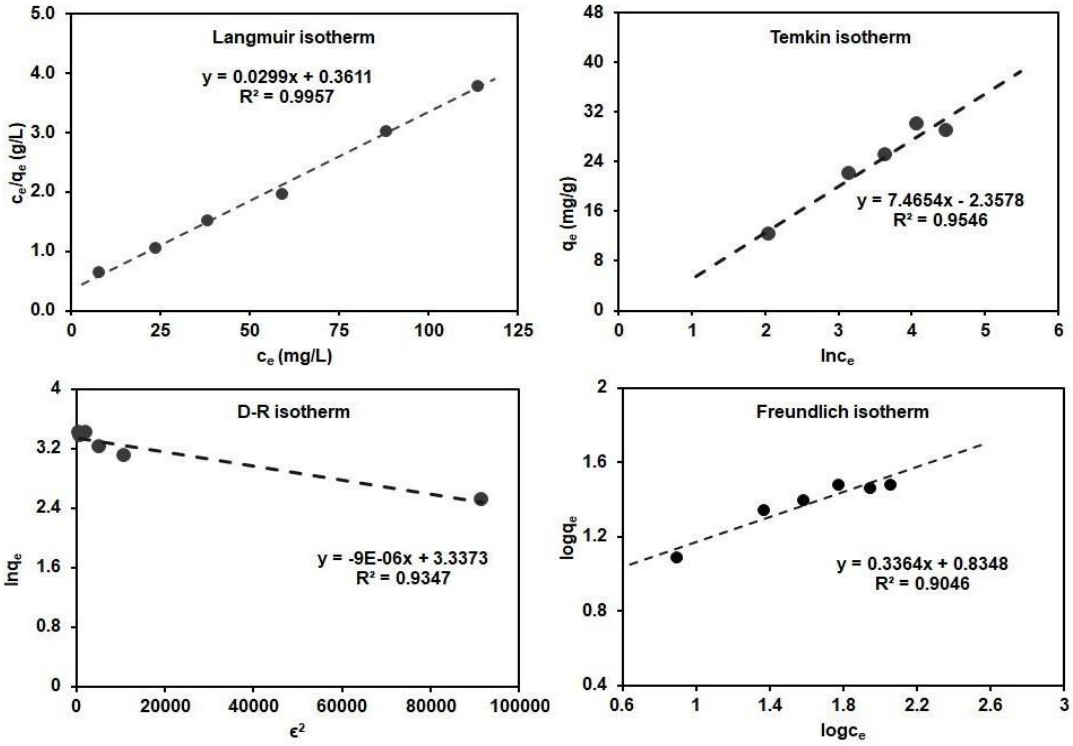

Figure 7 Isotherm models from experimental adsorption capacities of CWB for RO16 dye at variable initial concentrations

Moreover, a lower R^2 value for the q_{exp} compared to Langmuir isotherms in the adsorption system suggests that the model does not accurately represent the experimental data (Foo & Hameed, 2010). Table 2 and Figure 7 presents the D-R isotherm model fitness for RO16 on CWB. Chemisorption's primary driving force has been linked to a high value of E (>8 kJ/mol). The Langmuir chemisorption, in which chemical bonding dominated the potential adsorption mechanism, is consistent with this phenomena (Rehman et al., 2018).

The Freundlich isotherm postulates that contaminants will adsorb on the adsorbent's heterogeneous surface. The adsorption process's feasibility and intensity are determined by the parameters KF and n, which stand for relative adsorption capacity (6.89 dm^3/g) and heterogeneity factor (2.97) in Table 2. These constants were determined by looking at the plot of qe against Ce. In comparison to other models, the Freundlich model (Fig. 7d) showed a poor fit (R^2 = 0.904) to the equilibrium data. As a result, the adsorption demonstrated the CWB's monolayer coverage and uniform distribution of active sites (Mubashar Hussain Gardazi et al., 2017).

Kinetic models

Table 3 offers a summary of the parameters for several kinetic models, including the Elovich, intra-particle diffusion, and pseudo-second-order models. According to the pseudo-second order model, chemisorption involving valence forces through electron sharing or exchange between sorbent and adsorbate which could be the rate-limiting step. As summarized in Table 3 K_2 (g/mg/min) represents the pseudo-second order rate constant. The initial adsorption rate (h) and rate constant (K_2) were calculated by analyzing the intercept and slope of the plot t/qt vs. t. When compared to the intra-particle diffusion and elovich kinetic model, the R^2 values (0.879) showed that the adsorption of RO16 onto CWB less followed the pseudo-second order model, suggesting that this model was a poor fit for the experimental data (Bilal et al., 2013; Rehman et al., 2023).

The R^2 values demonstrate that the Elovich model provides a more accurate fit to the experimental data compared to the pseudo-second-order model. Greater R^2 values (0.887) indicate stronger concordance between the model and empirical observations. The alpha values imply a

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higher number of active sites that are easily accessible on the CWB surface, as well as favorable conditions for adsorption. At increasing concentrations of adsorbate, the increased alpha value inhibits diffusion processes at higher concentrations of RO16.

Table 3 Kinetic parameter for RO16 adsorption onto CWB

Kinetic models	Equations	Parameters	Values
PSO	$\frac{t}{q_t} = \frac{1}{k_2 q^2_e} + \frac{t}{q_t}$	$q_{e\ cal}$	34.36
		K_2	0.0012
		h2	1.47
		R^2	0.9511
IPD	$q_t = k_p t^{1/2} + C$	C_i	2.27
		K_{diff}	2.21
		R^2	0.9859
Elovich	$q_t = \frac{1}{\beta}\ln(\alpha\beta) + \frac{1}{\beta} lnt$	A	0.06
		B	0.21
		R^2	0.8875

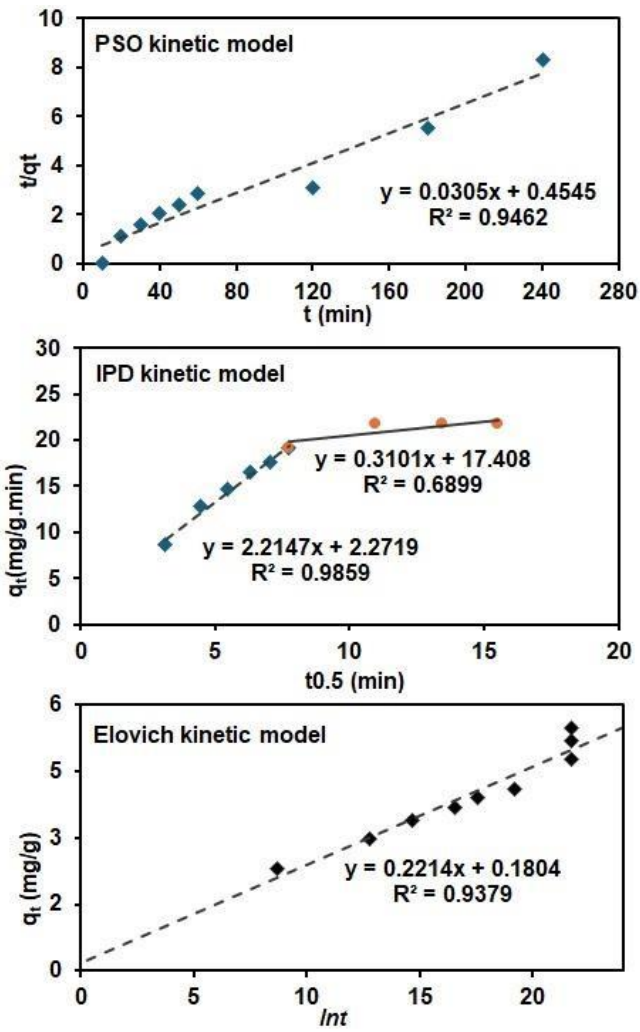

Figure 8. PSO, IPD and Elovich kinetic plot of RO16 removal by Cannabis weed biochar

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The adsorption of aqueous pollutants in porous adsorbents is significantly influenced by intraparticle diffusion. To optimize the process parameters and understand the mass-transfer mechanisms, it is crucial to identify the rate-controlling step using intraparticle diffusion models. The linearization of the curve qt= ($t^{0.5}$) yields the initial intra-particle diffusion rate. The relationship between the plot of qt against $t^{0.5}$ may exhibit multi-linearity, as shown by (Hu, Ma, He, Liu, & Pei, 2024). This suggests that there are multiple steps involved in the adsorption processes. The initial phase is characterized by external surface adsorption, often known as the immediate adsorption stage. The second phase involves the progressive adsorption stage, when the diffusion within the particle is regulated by the rate. The third phase represents the ultimate state of balance, where the diffusion within the particles begins to decrease as a result of the exceedingly low concentration of solute in the solution (Dharmarathna & Priyantha, 2024). The validity of the intra-particle diffusion models was assessed using linear equation analysis Table 3) of log (q_e-q_t) versus t, (t/q_t) vs t, and q_t vs $t^{1/2}$. The connection that best describes the kinetic data is the one that elucidates the mechanism of dye adsorption in the solid phase (Zhu et al., 2023).

SEM and EDX Analysis

Figure 9 displays scanning electron microscope (SEM) images of the CWB surface at high magnification, both before (a) and after (b,c) the adsorption of RO16. The effective adsorption of RO16 is probably seen due to the even distribution of pores in CWB, which facilitates the process of dye adsorption. Following adsorption, the RO16 dye in the aqueous solution most likely filled the visible pores. The elemental composition of the CWB was primarily made up of C (63.68%), O (31.88%), Ca (2.40%) and K (0.93%) by weight prior to RO16 absorption. The confirmation of RO16's presence on CWB was established through changes in elemental composition following adsorption of RO16. The sample consisted of C (67.48%), O (27.38%), Ca (3.28%) and K (0.32%).

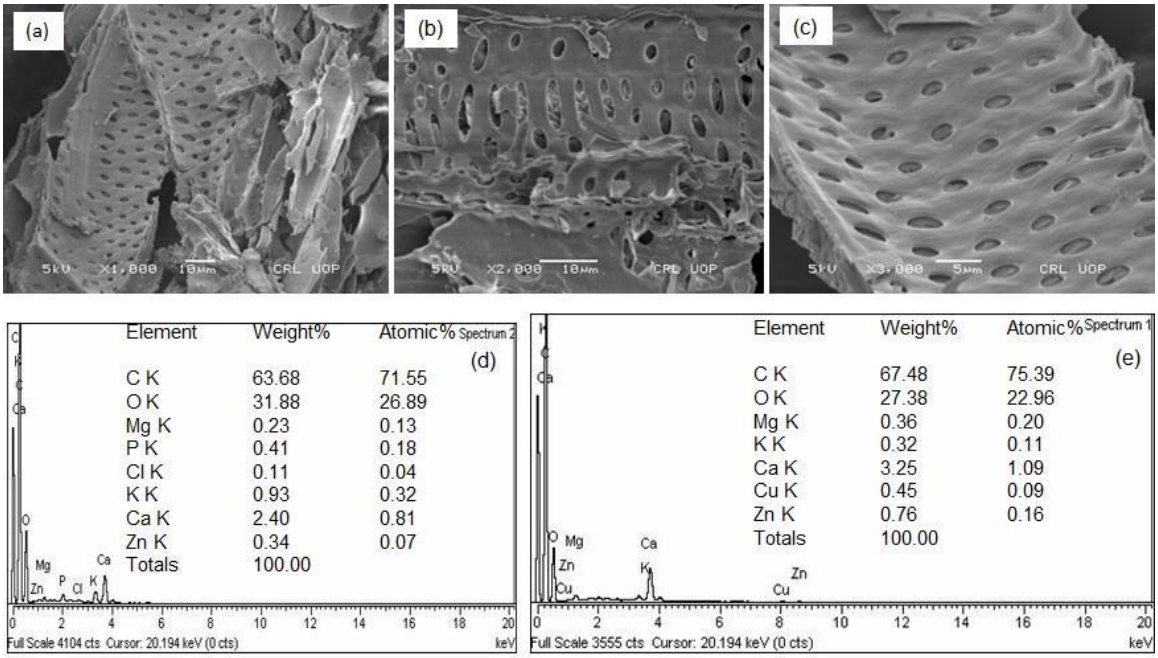

Figure 9. SEM micrographs of CWB before (a) and after (b,c) RO16 adsorption with corresponding EDX spectra (d) CWB before, (e) CWB after RO16 adsorption.

Conclusion

We illustrated RO16 adsorption onto the biochar of CWB in the aqueous solution. The adsorption process was found exothermic, as indicated by the negative values of ΔH. This suggests that higher temperatures do not favor the adsorption process, rather CWB adsorbent loose energy and system shift towards stability. The negative ΔG values across temperatures indicate that the adsorption process is spontaneous, which underlines the feasibility of using CWB for RO16

removal in practical applications. Furthermore, the Langmuir isotherm model fits the adsorption data well, indicating monolayer adsorption of RO16 on homogeneous sites within the CWB. The maximum adsorption capacity was found to be 33.45 mg/g, highlighting the effectiveness of CWB in adsorbing RO16. We also found that the adsorption efficiency of CWB is largely influenced by initial dye concentration, adsorbent dosage, and solution pH. Maximum dye removal was achieved at lower dye concentrations and higher adsorbent dosages, indicating that the availability of adsorption sites plays a crucial role. The adsorption is also highly pH-dependent, with higher removal efficiency at lower pH values due to favorable electrostatic interactions between the anionic dye and the protonated surface of CWB. In conclusion, CWB exhibits considerable potential as a low-cost, efficient, and sustainable adsorbent for the removal of RO16 dye from aqueous solutions.

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STUDY OF FUNGAL DISEASES OF PEAR PLANT IN GANJA DASHKASAN REGION AND MEASURES TO COMBAT IT

Abstract

The article provides information about fungal diseases that affect pear plants and methods of combating the disease. It has been established that fungal diseases occur in all regions of Azerbaijan. Information is provided on fungal diseases that affect pear plants and methods of combating the disease. It has been established that fungal diseases occur in all regions of Azerbaijan.

Effective use of climatic resources in agricultural production is one of the important tasks of solving the food problem. To implement it, it is necessary to study in depth the characteristics of the territories and identify potential opportunities that ensure more efficient and rapid development of agriculture.

Depending on environmental conditions, the incubation period of the pathogen lasts 3-8 days. All life processes of plants, including the object of study, the pear plant, their variety, quality and quantity of products, are associated with the amount of solar radiation and lighting conditions. A lack of potassium in the soil also increases the development of the disease

Keywords: *pear plant, pathogen, spore stage. fungal diseases*

Introduction

As we know the agricultural field is a traditional production area in Azerbaijan, as the same case has been in the world since ancient times. One of the main directions of the economic policy of the state is to increase the agricultural products in the country and to improve the supply of food of the population at the expense of local production. It should be noted that many diseases and pests cause damage to crops. That's why, one of the most important areas of the modern plant-growing system is the plant pest, disease and weed-fighting system. Climate fluctuations, cataclysmic disturbances, ecological imbalances occasional out-of-control, and a greater number of abiotic and biotic stress factors have been shown to accelerate in recent years. On one side of the world, rain pours during the summer, it snows, rivers break, wildfires break on the other, and the daily average air temperature does not fall below 40-450C. Across the nation, there is famine in Africa in other countries, food is scarce in many countries in Asia, and thousands of hectares of agricultural fields are either burned or flooded since the high science of America and Europe is sometimes unable to handle the whims of nature. With all these problems gone, thousands of microorganisms are constantly attacking agricultural fields to provide their nutrients. The persistence of some local varieties is not equal to that of diseases and pests, some varieties are superior in productivity and product quality, and these varieties cannot be kept away at all times (Bayramova, Mammadov, 2010: 204).

In spite of all this, the damage to plant diseases is too great. Sometimes these numbers are hard to imagine. Today, food security is in the first place in the world and our country. Today's student and tomorrow's expert, who is directly involved in the safe food supply of Azerbaijani human beings, should not forget all this, but should not abandon their efforts in the study of

phytopathology, both biological and agricultural science. Similar symptoms produced by different disease sufferers, sometimes resulting in an improper diagnosis of the pathogen, also diminish the effectiveness of measures to fight the outcome. It is known from ancient times that there is a lot of medicine for diseases (Mammadov, Bayramova, Siriyeva, 2014:58).

In this regard, the methods of combating plant diseases are also very diverse. Helping plants purchase environmentally friendly products is one of the most pressing issues of the day, reducing the development of various diseases caused by a complex of agrotechnical measures that stimulate their normal growth and development. However, by applying biological, physical-mechanical, and chemical, quarantine measures on scientific grounds, integrating struggle into the overall system can ensure high biological efficiency. According to our research, fungal diseases are one of the common diseases in regions. It is found in more fruit trees of the region (plums, quince, apples, pears and fields (Mardakan, Shuvalan, Buzovna, Bilgah, Sabunchu, Surakhani, Zigh, Pirshagi, Zagulba, Hovsan, Digah, Binagadi, Khirdalan, Bina, Balakhani, Mehdiabad, etc.) (Mammadov 2004: 32).

In general, Azerbaijan is a mountainous country. Therefore, it is of great scientific and practical importance to study the spatial distribution of natural factors, quantitative relations of individual elements of climate, distribution of agro-climatic indicators depending on height, inlet relief conditions, and exposition of slopes (Jafarov, 2009: 328).

The fruit plants in this group belong to the Gulch *(Rosaceae)* family, the apple *(Maloideae)* subfamily, and individual genus.

The flower shoots are complex, the fruit is not real, and they are located on perennial and one-yeared hilltops of the fruit stalks. In some apple varieties (mainly small fruit ranette type *varieties*), the flower shoot is also found on the growth of a fruit branch. It has a high stripping and cog recovery capacity. Most representatives are insect-pollinated.

Seeded fruit crops are widely cultivated in our republic and have large areas. Of this group, those promising commodity crop production in our country are apples, pears, quince, mussels, and partial feeders (Rajabli, 1966: 229).

Pear – Seeded fruit plants stand second in area and crop production.

Fruits have been cultivated since ancient times because they are high quality and nutritious. Fruits contain a percentage of 5-15.7 sugars, 0.1-0.99 acids, 0.06-0.12 pubic substances, 0.18-0.44 ash elements, and various vitamins (A, B, B1, C, and PP).

The fruit is fresh and processed. According to international statistics, about 8 million tons of pears are produced worldwide. Italy is in I place (1.2 million t), the Czech Republic is in II (1.0 million t), USA is in III place (0.7 million t) for production.

Pear's CIS farmland amounted to more than 250,000 hectares. They are primarily cultivated in the southern regions of the country. The North boundary in these areas crosses St. Petersburg, Yaroslavl-Gorki, Ufa-Orenburg.

Pear is successfully cultivated in most districts of our republic. It is a highly productive plant. Ornamental gardens have 120-130 centner per hectare, and intensive gardens 300-500 centner or more.

Apples are the most common breed within fruit crops in our country. German farmland accounts for up to 50% of total fruit crops in our republic.

The rich chemical content, the ability to store fruit for a long time, high yields, and the ability to cultivate in different soil-climate conditions have led to extensive cultivation of this plant. Apples stand in the first place, according to crop area and total crop production. According to the data, more than 20 million tons of apples are produced worldwide. Pear plants are mainly cultivated in the mountainous parts of the Guba-Khachmaz and Ganja- Dashkasan regions of our republic.

The fruit is fresh and processed. Sort, grove, and crop from age 2-10 depending on cultivation conditions, producing a highly profitable plant for 20-100 years.

There are up to three hundred different varieties and kinds of apples in Azerbaijan. Sixty of these are necessary for industry. The advantage of buying other juicy fruits is that they can be stored

and used all year round. The growing season of the apple is as follows: summer (July, August), autumn (September, October), and winter (November to February). The same variety of apples may vary in maturity depending on climatic conditions. Depending on the type and variety of apples, the color, taste, and aroma are different.

The apple contains sugar up to 5-24%, about 1.3% acids (apples, lemons, cashews), pectin and vaccines, vitamins B and C, carotene, potassium, sodium, and iron salts from minerals. Iron salt in apples is of great healing importance. The main part of sugar in the apple is glucose and fructose, which are very useful for the cardiovascular system.

In addition to using apples naturally, several valuable canned products – compote, jam, povidlo, juice, pulp, etc. are prepared. These products have a great deal of therapeutic value. The apple and various preservative products made from it have a very good healing effect on heart weakness, bloating, chronic gastrointestinal diseases, as well as low vitamin content.

It is a highly productive plant. Potential performance reaches 1,500-2,000 centner per hectare.

Demand for external ambient conditions. Pear is a heat-relieving plant compared to apple. Trees can sustain 25…30° frost. Flowers are severely damaged in 2…3°, fruits in 2…4°, cranberries 5…6° frost. The light is in high demand. Humidity demand varies depending on the grove. Low humidity over a loud grove indicates a high demand, over humidity is for a short height (quince). It can be cultivated in different soil types. For good height and high yields, deep, fertile soil is more suitable.

All agrotechnical measures must be taken in a timely and correct manner to produce high-quality crops from pear trees. It is also essential that plant protection measures are properly implemented to combat disease and pests. Sometimes these diseases are not noticed until just before harvest, during harvest, or after fruit is stored. Agricultural crops, planted at optimal times, grow 25 to 30 days earlier than in Ganja. Because the distance of these places is near and the latitude north is the same, the researcher explains why this difference is due to the high annual active temperature totals.

In order to maintain quality and usability, strict compliance with the product storage regime (temperature, moisture, relative humidity, etc.) should be strictly observed. Because of the damaged and fully grown fruit, the acidic environment and carbohydrates are primarily caused by the development of mold fungus. It should be noted that these fungi survive the winter and can damage a pear tree in the next season.

The most common and severely damaging fungal diseases in pears are black cancer, dew, and fruit rot. Pathogens of listed fungal diseases mainly develop in spring and summer. Pathogens develop intensively and infect new plants, especially when the weather is unstable (mainly in rainy weather). The higher amounts of rain than normal air conditions in the summer months and the excess air temperature cause the emergence of many diseases such as brewing syndrome, black cancer, rust, septoriosis, dew, bacterial cancer, burning in trees, etc. in orchards (Mammadova, Garayev, 2000: 63).

The amount of hours the sun shines is important for the normal growth and development of plants. This is especially interesting against the wintry stages of the disease (Samedov, Khalilov, 1964: 402).

During the winter months, mostly in February, the majority of hours when the sun is shining brightly are caused by faster winterization. In this regard, the average number of hours of sun glare in the Ganja-Dashksan region is 2200-2400. The number of such hours in the mountainous and other mountainous regions (Gadabay) is relatively small.

The continuation of solar lighting in the region during the year is 2381 hours, 45% during the day and even 13% in December, 53% in January, 45% in February, 56% in March (Ermakov, 1987: 430).

Diseases are most prevalent in apples and pears. The apple brew syndrome is caused by Venturia inaegualis, and the pear brew by Venturia purina mushrooms.

Each type of fungus can produce disease in only one plant. In this regard, the fungus damages all organs, not just the fruit. The peculiarity of the disease begins by first forming a brown coating on the leaves, and then drying and shedding these leaves. Infected sensations of the plant occur in the fruit when the top of the jar turns a pale -tinty color, leaving completely unknown spots on the ribs, and the appearance of dislike is obtained in the fruit and cracks occur in the infected parts (Dorojkina, Beloshapkina, 2015: 55).

When such fruits are stored, they get staining and solubility occurs in the fruit. The disease is produced by increasing both by non-gender way and the way of ascospores .The conidies in this disease are mainly on spring and summer brew stains. The incubation period of this disease takes 8-20 days (Minkevich, 1996: 21).

At the same time, if the fruits are damaged, they are mainly caused by mittels. At this time, the damaged fruits have round neat stains on them. According to this disease, stains of bubbles may also develop and spread during the storage period of the fruit. When stored in the warehouse, the disease is carried out in other healthy fruits.These fruits are unsuitable for sale, but at the same time, the quality of the commodity decreases (Rahimov, 1988: 232).

To overcome these problems, it is recommended to fight in a comprehensive way. It is recommended to carry out pruning in the garden, at the same time to destroy infected plant remains, to carry out "ABC" or "Volk-92" Winter spraying, and to carry out spraying of insecticides containing "Imidacloprid". At the same time, the period of formation of bud in trees against their disease 1% Bordeaux solution, 0.5% Monica Bordeaux is recommended to be sprayed every 10-12 days (Peresypkin, Kirik, 1991: 206).

If the amount of precipitation is high, it is recommended to spray with a Bordeaux solution of 1% against diseases in the trees during the budding period.

Conclusion

The pear plant is known to have 13 major fungal diseases worldwide. The fungus infects the leaves, shoots, and fruits of the apple tree, causing white, pollen-like growth on the surface of the plant tissue.

Dust infusion can lead to reduced growth and yield on apple trees, as well as decreased fruit quality. Fighting against disease can be achieved through cultural practices like pruning and sanitation, as well as the use of fungicides.

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ECONOMIC IMPORTANCE OF CITRUS PLANTS

Abstract

The article discusses various directions of activity in the agricultural field, including the fact that fruit growing is the most important occupation of the population in the development of agriculture. Fruit growing is considered one of the ancient fields. Many types of Diaspididae harm citrus and fruit plants, ornamental plants, and more. Thus, it causes their leaves to dry out, fruit to fall out, and even the plant to perish. Cushions with California beetle *(Diaspidiotus perniciosus* Comst.), comma-shaped beetle *(Lepidosaphes ulmi L.*), Lemon beetle (Pscudococcus*citri Risso*.), etc. are more dangerous pests for plants. Diaspididaes do more damage in warm subtropical and tropical countries. While the vast majority of diaspididaes are pests, a small number are good. Dactylopius *cacti common in Mexico,* Kermes vermilion on the Mediterranean coast*, Margarodes polonicus in Poland*, Porphyrophora hameli in Transcaucasia, etc. are of great importance to industry.

Keywords: *pest, fruit, breed, fight, agriculture*

Introduction

The quantity and quality of fruit harvested in fruit growing are some of the key indicators that determine the development of this area. Unfortunately, there is still hope for more nature in fruit growing in our country. Even though the quality of fruit is high, it loses out to the competition in terms of appearance. At the same time, processing facilities are not very interested in local fruits because they are not very profitable for the industry. (Abbasov, 2010: 592).

Reliable food supply of the population in the Republic of Azerbaijan forms one of the main directions of the economic policy of the state. 2008-2022 State programs on the reliable food supply of the population in the Republic of Azerbaijan state that reliable food supply is the main condition of economic stability and social development of each country.

Fruit growing has become the most important activity of the population, being one of the historically formed agricultural fields in Azerbaijan. It is considered one of the ancient fields of fruitgrowing (Newspaper of Economy, 2008).

Citrus belongs to the family of the rue (Rutaceae Juss.), a subfamily of pomegranates or rednecks (Aurantioideae Engl.). Other well-known Soviet citrusologist scientists such as Rockosburg, Guker, Brandis, Engler, Swingl, Tanaka A.I.Luss were engaged in the classification of the pomegranate subfamily of some species after Linney. According to W.Swing, the pomegranate subfamily unites 33 gender and 203 species. More importantly, the genus citrus (Citrus L.) (Mustafayeva, 2004: 31).

Geraniums (lat. Coccinea), and citrus whitefly (Dialeurodes citri) are found in all orchards of Azerbaijan. The larvae move until they choose a permanent place, after which they have a sedentary lifestyle. Their bodies are covered by the pelvis. Geraniums sometimes grow so large that they cover the branches in shells. They absorb the tree's juice and produce red spots on the fruit. Fruit orchards are home to many types of geraniums. The most common of these is a purple comma-shaped Pscudococcus citri and Diaspidiotus perniciosus. In terms of its damage and spread, Diaspidiotus perniciosus occupies a more important place. Its body is yellow and covered with a round sink, damaging more than 150 species of plants. It accumulates on the branches, leaves, and fruits of the damaging fruit and ornamental plants, absorbs their juices, and eventually dries up damaged branches and leaves. It gives rise to two generations a year in the Lenkaran region (Gasimov, Babayev, 2004: 87).

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Citrus whitefly is one of the main pests of more than 50 species of citrus plants in the world. Found in the early 60s, the pest inflicts damage in various regions of the republic, particularly in southern regions of citrus fruit growing. Citrus whitefly of farm importance harms many fruit growing areas, but also mainly citrus plants. The plants are lemon, orange, persimmon, fig, European ash, squash, ivy (Hedera helix), jasmine, Laurus nobilis, wild privet, magnolia, common oleander, coriander, common coriander, plum, common pomegranate, pear, etc. Citrus whitefly in fruiting causes damage to the plant mainly in the flowering fruiting solution after baring, causing damage during the development of the organism i.e. after more crops have been absorbed (Mustafayeva, 2006:354).

Whiteflies dilute the plant's juice and damage it. Damage caused by the pest to the plant, in particular, fruit crops, results in crop loss. Thus, 20%of larvae of the species damage fruit plant leaves, 5-10% of productivity, 50%of damage is caused by a 50-55% decrease in yield, and 75% of leaves are practically completely lost.

Thus, the polyphagia of the Citrus whitefly, which is the quarantine object, spread 1-3 generations per year. It depends on climatic conditions, its ability to cause severe damage to citrus plants, fruit, and ornamental plants, its frequency of spread and its high productivity make it a dangerous pest. In view of the fact that it is also a new invasive species in Azerbaijan, measures should be applied to completely destroy all its fires without regard to their number if discovered (Mustafayeva, 2015:81).

Comma-shaped beetle mainly damages apples, pears, quinces, hawthorns, and partly plums, apricots, peaches and other plants. The female of diaspidiotus perniciosus has a comma-shaped pelvis on the lumbar side formed from a waxed substance. Extraction of larvae from eggs that spend winter under the female's pelvis occurs after the trees bloom. In general, larvae take up to a month to hatch. Some of the young larvae initially adhere to stems and branches, while others adhere to fruits and leaves. Soon afterward, these larvae bark the tree and cover the pelvis after moving. In early September, the maid puts 100-120 eggs in a ball under her pelvis, and she herself dies after some time. The trees are weakened and their leaves fall, and when this condition persists for several years, the damaged trees are often trapped (Aghayev, 2004: 303). Citrus fruits of agricultural importance are more valuable for their high dietical and aromatic properties than for their chemical content. At the same time, storage time and stable preservation of the product content, which is rich in essential nutrients with a strong vitamin, further maintain the medical importance of such kinds of plants.

Comma-shaped Coccinea.

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The recent inclement weather-with frequent rainfall and scorching sun has created a variety of pests and diseases in agriculture, specifically fruit growing and vineyard growing. İt causes the increase of sucker pests in fruit orchards, which disrupt the photosynthesis process in plants and create obstacles to the normal development of plants. Thus, rainy weather causes the growth of different types of meanings, mammals, ticks, dactylopiidaes in fruit orchards.

The species of this genus is believed to be formed in different subtrotropical and tropical regions, while the cultivation of citrus is not yet clarified and is not found anywhere in the wild. Thus, sweet orange is believed to have originated in south- east Asia, mandarin orange in the Philippines, citron, lemon, as well as orange in India, where pompelmus originated in the Zond Islands (Arutyunova, 1938: 35).

It is believed that citrus was culturally cultivated between five and eight thousand years ago.

In the cultivation of citrus in Azerbaijan during the first century B.C. Feofrast and Strabo reported, and more information about these plants is found in the X-XI centuries.

The Citrus was most likely brought in by Arab travelers and merchants, or by Indian firemen who worshiped the fire (Borkhsenius, 1950: 226).

Changes in climatic conditions have led to the restriction of the area of citrus in the territory of our republic and their survival in more suitable climatic conditions (the Black Sea and Caspian Sea coastal regions of the Caucasus) in small or large quantities (Biradar, Jagginavar, 2005).

The issue of the effective use of climate resources in agricultural production is one of the important tasks set in place to solve the food problem. Implementing it requires an in-depth study of the characteristics of the areas, uncovering potential opportunities that make agriculture more efficient and faster to grow. Depending on environmental conditions, disease incubation time lasts 3-8 days. Lack of potassium in the soil also strengthens disease progression.

In general, Azerbaijan is a mountainous country. Therefore, it is of great scientific and practical importance to study the distribution of natural factors depending on space-time distribution, quantitative relations of individual elements of climate, height of agro-climatic indicators, inlet relief conditions, and exposure of slopes.

The proper study of increasing the population's food security has recently been adopted. The measures taken to implement the state programs and produce exportable products in the agricultural sector are customary in our republic and play a great role in the development of all the agricultural sectors. In this regard, regions and districts have created a very great basis for the juggling of the employment work of the population and to ensure that the level of poverty does not fall.

It should be noted that the cultivation of citrus fruit crops in agriculture is necessary for the development of citrus crops in the country's Lankaran-Astara southern region because the temperature and natural climatic conditions of the country properly exist in the traditions of such areas in the interest of economic efficiency and high potential of the exported product (Mustafayeva, 2014:98).

Much of the loss of rural crop worldwide is caused by the activity of insect and pest organisms. It is advisable to fight pests and organisms and apply more efficient chemical preparations against them (Valitov, Valitov Reactive, 2013).

Building the knowledge and skills of rural farm crops to understand the fundamentals of methods for chemical treatment and management of pesticides against the spread of diseases and pests.

Conclusion

How many species of pests have been found in citrus orchards in the Lankaran-Astara economic southern regio. Citrus whitefly, Ceroplastes japanicus Green, Psedococcus Gahana Greeth, Chrysomphalus distyospermi Morg. have been determined.

More fruit trees were confined to Citrus whiteflies, and the percentage of damage to plants was found to be an average of 16%. Studies showed that the secretion of leaves with the common pest of Citrus whitefly was 15.0%.

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As such, it accounts for 0.14% of citrus production in the world and 0.6%of production in Asian countries.

Citrus production in other countries is slightly more than 35,000 tons. This world accounts for 0.14% of citrus production and 0.6% of production in Asian countries. This is a major reason why the climate is inconvenient to cultivate citrus ones. However, with the cultivation of citrus in covered areas, recent work has shown that there are extensive and inexhaustible opportunities in southern regions to increase citrus production.The cultivation of citrus in covered areas and the enhancement of these areas is a matter of their ecological requirements. In open conditions in our country, only mandarin cultivation can be considered economically viable. The remaining breeds are often harmed by the inconvenient effects of foreign environmental scarring. Conducted studies have shown that the efficiency of citrus in several regions and covered areas has been determined with extensive experiments.

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NATURAL AND RECREATION RESERVE POTENTIAL OF DUZDAG

Abstract

The article talks about the Duzdag salt reserve in the territory of the Nakhchivan Autonomous Republic, the geology of the area where the deposit is located, the history of production, the economic-geographical importance of the salt reserve, as well as therapeutic recreation.

Salt reserves in the Duzdag field in the Babek region are estimated at 1 billion tons. A branch of the Duzdag massif is located in the southwest of Jahri village, southeast of Gulshanabad village.

The use of salt reserves in the Duzdag massif has an ancient history. For the first time, scientific research on the salt deposit was found in an article by G. Voskaboynikov in 1830. Q. Abix (1857), Q.Q. Chulukidze (1869), K.N. Paffengols (1930), K. Nikitin (1882), S. Zelinski, P. Nadezhdin, and other researchers reported about the deposit. At the same time, V. Muradov wrote a monograph on the production and sale of salt.

According to the information received from the enterprise, 4189.4 tonnes of rock salt and 1995.5 tonnes of ground salt were produced in the first 10 months of the current year. 1467.3 tonnes of produced rock salt and 2164.9 tonnes of ground salt were sold. According to calculations, if only the salt reserve of the Duzdag mine is used to meet the demand for salt, the reserve of this deposit will reach approximately 150 years.

The height of Duzdag above sea level, the existing weather conditions in the mines, temperature, humidity, atmospheric pressure, and the percentage of oxygen and bacteriological composition make the treatment of patients suffering from asthma and allergies here ideal.

At the end of the article, there is information about the impact of the opening of the "Zangazur Corridor" on the economic life of Nakhchivan.

Keywords: *Nakhchivan AR, rock salt reserves, Duzdag, therapeutic recreation, Zangezur Corridor*

Introduction

The territory of Nakhchivan AR, with an area of 5502.75 km2, is rich in mineral resources, including rock salt resources. This wealth has never been used effectively.

Due to the occupation of 20% of the territory of the Republic of Azerbaijan, the territory of Nakhchivan MR has been put under blockade. This has severely affected the economic life of the Nakhchivan Autonomous Republic. The 44-day Patriotic War ended the 30-year occupation and ensured the integrity of the country's territory. In this regard, the solution to the important local, regional, and intercontinental Zangezur Corridor problem has become one of the most important issues. Thus, solving the problem of the Zangezur corridor will increase the use of natural resources in Nakhchivan, including salt resources, and will have a great impact on the economic life of the autonomous republic, including the increase in the volume of foreign trade and the development of tourism. From this point of view, the article is dedicated to an actual issue.

Natural reserve potential. Nakhchivan Autonomous Republic is rich in underground resources as well as surface resources. This wealth in the autonomous republic of ore, non-ore, construction materials, etc. opens wide opportunities for the application of a number of resources in various fields of the national economy. Among the non-ore mineral resources of Nakhchivan MR, rock salt resources occupy an important place. The rock salt reserves of the area are located in the foothills

and plains. In the territory of Nakhchivan AR, salt reserves are more common in the western part of the territory.

Rock salt reserves are spread around Duzdag, Nehram village, Sust Tazakend in Kangarli district, Pusyan village in Sharur district, etc. The reserves of Duzdag and Sust fields are 97 million tonnes, and the reserve of the Nehram deposit is 1.5–2 billion, more than a tonne (Mins, 1972: 257). The Duzdag massif, which is the area with the largest concentration of rock salt resources, is almost devoid of underground and surface water. The only surface river in the massif is Shorsuchay. This river is a dry river; there is water only during the rainy season. However, the river is a brackish river because it passes through saline soils. During the hot season, the river dries up, and a thick layer of salt remains in the river valley. As a result of academician A.G. Guluyev's research, kahriz remains were also identified in the northern part of the deposit.

In order to obtain more extensive information about the geological structure of the area, a large-scale geological map of the Nakhchivan depression was drawn up in 1949–1951. It was determined that the area of the Nakhchivan depression is composed of Upper Miocene and IV-period rocks. Upper Miocene sediments consist of two main layers: the first layer consists of Lower and Middle Sarmatian sediments, and the second layer consists of Upper Sarmatian sediments. Lower and Middle Sarmatian layers in the Duzdag mining zone consist of reddish-brown, brown-brown, brown-grey, grey, green-grey, yellow-grey clays, sandstones, sedimentary rocks mixed with clay and lime, marls, limestones, siltstones, and volcanic sands.

The Duzdag syncline stretches along the southeastern slope of the Duzdag plateau, stretching in the direction of 90–800 northeast from the territory of the Dash-Başı railway station (Rusanov, 1987: 196). Then, from where the last crease ends in the east, this arrow turns in the northwest direction and extends to the village of Gulshanabad. Along the southeastern and eastern slopes of Plato, it extends to the village of Jahri. In the southwestern part of Jahri village, it is due to the effect of this wing that bitter-salty water comes out of water wells dug 20–25 metres deep (Azizbekov, 1961: 502).

The Duzdag syncline approaches the Boyukduz antisyncline in the northwest. It runs almost parallel from southwest to northeast. The antisyncline is clearly visible at the northern end of the Duzdag plateau. This part is covered with post-Pliocene sedimentary rocks, passes under the western slope of the plateau, and extends to Boyukduz. The Boyukduz part is covered with sedimentary rocks from the IV period. The joint excavations of Azerbaijani and French archaeologists have proven that the beginning of stone salt production in the field dates back to BC. It dates back to the 3rd millennium, which means that the Duzdag field is the oldest salt mine in the world.

The history of using the Duzdag rock salt deposit is much older. So, the salt deposits here have caused salt settlement. For the first time, G. Voskaboynikov collected information about this deposit known to people, and in 1830, detailed information about the deposit was given in the article "Notes on the Nakhchivan stone salt deposit." In the following years, G. Abix (1857), G. G. Chulukidze (1869), K. N. Paffengols (1930), and others wrote about the mines researchers reported. The history of the use of salt here goes back to ancient times due to stone tools. The territory was widely used during the Shah Abbas period. Oven-like holes were opened on the bed, and salt was extracted here. In later periods, the salt reserve was used by the method of freezing (Nakhchivan Autonomous Soviet Socialist Republic-75, 1975: 358).

Date of salt extraction. Salt is one of the most important components for the lives of humans and living beings. People living in all places, especially in countries with hot climate conditions, sweat more when moving or working, and at this time, salt, which is constantly used in various physiological processes in the body, is excreted from the body together with sweat. If this loss is not replaced, serious health consequences can occur. For this reason, people have used salt since ancient times. The reserve of this salt is estimated to be about 1 billion metric tonnes, and it has a history of extraction dating back two millennia.

Therefore, in order to meet the demand for salt, salt rocks formed as a result of natural processes were used in different places, and as a result, salt mines were formed. One of them is the salt mines located 12 kilometers northwest of the city of Nakhchivan. Here, salt deposits extend to Jahri and the former village of Sust in the north. One of the legends about Prophet Noah among the population of the region says that Prophet Noah, who settled in Nakhchivan after the Great Flood, taught the people a number of crafts, including salt extraction. Based on those narratives, K. Nikitin, the inspector teacher of the Nakhchivan city school, wrote in 1882 that Noah was the first worker in the Nakhchivan salt mines.

In the 70s of the 19th century, Beyer, who worked as the head of mines in Duzdag, found several stone axes and adzes, followed by I.Polyakov in 1879, who discovered several stone axes around the salt mines. Analysing those finds, I. Polyakov came to the idea that these axes were used to break and crush salt and noted that they were tools belonging to the people of the first metal age, perhaps even more ancient times. S. Zelinski, P. Nadejdin, and I. Chopin also gave interesting information about Nakhchivan Salt Mountain. I. Jafarzade, the first Azerbaijani archaeologist who studied the stone tools found in Duzdag; M. Huseynov, an outstanding expert on the Stone Age; and economist-scientist M. Valiyev (Baharli), are of the opinion that salt was extracted here in the Stone Age.

In 1967, a mine used by ancient people was discovered as a result of an avalanche in Duzdag. In 1976, when an explosion was carried out to extract salt, another mine was discovered here. Both the first and second mines, which have a very interesting structure, have material and cultural samples, as well as archaeological materials discovered during the research conducted in Duzdag since 2007, including stone hammers, hearth traces, ceramic products, remains of deer antlers, etc., which confirm that people used these salt mines in the VI-II millennia BC. In 2008, the employees of the French National Centre for Scientific Research, conducting joint research with local archaeologists in the Nakhchivan salt mines, obtained very successful results by analysing the material and cultural samples obtained as a result of the research. Based on these results, it was determined that the Nakhchivan salt mines are one of the first salt mines in the world. About this, the international scientific community was informed about the discovery of the world's oldest salt mine in Azerbaijan in articles published in France. Apparently, the obtained results confirm that Duzdag is the oldest salt mine in the world (Hasanov, 2018: 246).

It should be noted that the salt supplied in Duzdag, in excess of the needs of the population of Nakhchivan and other nearby settlements, was taken from here to neighbouring countries for the purpose of exchange. Before the Silk Road, the Salt Road extended from the territory of Nakhchivan to the countries of the Middle East. The people of Jahri village in Babek district, which has played an important role in extracting salt from Duzdag since ancient times, still call the road from Jahri to the ancient salt mines "Duzdag road." Nakhchivan salt was one of the cargoes of trade caravans passing through Nakhchivan to the east and west. Because salt was exported to the neighbouring countries of the South Caucasus and the Middle East in addition to meeting the needs of the local population (Babayev, 1999: 226).

History of salt production. Salt extraction and production in Duzdag, which began in ancient times, continued intensively during the Middle Ages. The sources contain information about the production of excellent salt in Duzdag in the 10th and 14th centuries and the export of a certain part of the finished product to a number of countries. Vidadi Muradov wrote a monograph on the production and sale of salt. He notes in this monograph that at the end of the 19th century and the beginning of the 20th century, a new stage began in the production of salt in Nakhchivan. The reason is that the iltizam system existed until the mentioned period. Based on the sources, the scientist says that the exploitation of Nakhchivan salt mines was concentrated in the hands of the state. Taking into account the increase in demand for salt, the government started the operation of two more mines near the villages of Sust and Jannat at that time. The government, which could not cope with the demand on its own, was forced to involve individual entrepreneurs in this work. Thus, since 1907, the company "Kalbalikhanov brothers and K" started to operate Sust mines. However,

its activities were restricted. The appeals of Haji Khudadat Khan, the head of the "Kalbalikhanov brothers and K" company, to the tsar's government to allow the production of salt from Sust mines to 200,000 pounds were rejected for a long time, and it was allowed only after a few years. After the tsarist government lifted the ban on local companies, the volume of salt production increased significantly. In 1911, the volume of salt produced by the "Kalbalikhanov brothers and K" company from the Sust mines was 304,261 pounds. Research conducted in this field shows that salt production in Nakhchivan reached its highest level in 1911–1913. According to estimates, 600–800 thousand pounds of salt were produced from salt mines per year. However, it was not possible to fully meet the demand for salt. It is enough to note that in 1912, 9,000 tonnes of salt produced in the salt mines operating in Nakhchivan were 4.2 times less than the demand for salt in the South Caucasus. However, the outbreak of the First World War in 1914 did not allow for maintaining this level. During the time of the Soviet Union, salt production in Nakhchivan stood out due to the use of new opportunities in the industry compared to previous times. However, after the restoration of our independence, our people became the real owners of this underground wealth. In recent times, the establishment of "Nakhchivan Salt Production" Limited Liability Company and the provision of the enterprise with new technological equipment have allowed salt production in the autonomous republic to enter a new stage. The new production areas put into use are the first modern production areas established in the history of the exploitation of salt deposits in Nakhchivan. Today, there are four salt processing areas equipped with new technological equipment in the salt mine. "Nakhchivan Salt Production" Limited Liability Company, which has a daily production capacity of 40–45 tonnes of rock salt and 20–25 tonnes of ground salt, produces 18 types of salt, and these products are used in the household, animal husbandry, and chemical industry. The products are sold under the trademark "Duzdag." According to the information we received from the enterprise, 5391 tonnes of rock salt and 2206 tonnes of ground salt were produced here last year (7) 2340 tonnes of rock salt and 2129 tonnes of ground salt were sold by the enterprise (8). In the first 10 months of the current year, 4189.4 tonnes of rock salt and 1995.5 tonnes of ground salt were produced. 1467.3 tonnes of produced rock salt and 2164.9 tonnes of ground salt were sold.

The importance of salt flats for therapeutic recreation. The protection of human health is one of the most important human tasks. In this regard, sanatorium and resort treatment using natural resources has been one of the most effective methods since ancient times. In modern times, the fact that medical tourism, which is a widespread type of tourism, is rapidly developing and has a volume of approximately 14 percent worldwide, shows that it is of great importance.

Speleotherapy, the treatment of asthma by natural methods in a salt cave, which is suffered by many people in the world, is an important achievement of modern medicine. However, the geographic location of Nakhchivan Salt Mine, the volume of salt reserves, and the quality of the applied treatment are different. In general, Duzdag's altitude above sea level, current weather conditions in the mines, temperature, humidity, atmospheric pressure, and the percentage of oxygen and bacteriological composition make it possible for the treatment of patients suffering from asthma and allergies to give ideal results here (Geography of the Nakhchivan Autonomous Republic, Volume II, Economic and Social Geography, 2018: 383). Thus, the fact that people can directly enter the salt mine, which stretches up to 300 meters without any phobia, the constant temperature of the air here at 18–20 degrees throughout the year, and the extremely minimal level of toxic gases are the main factors that increase the effect of salt treatment.

With the increase in the number of people on the planet and the aggravation of weather and climate conditions in many places, the spread of asthma increases interest in this type of treatment. Thus, in the current annual report of the Global Asthma Network, which is headquartered in New Zealand and has representation in 135 countries, it is reported that approximately 339 million people worldwide suffer from asthma, and about 1,000 people die from this disease every day. Therefore, the treatment of asthma based on the stone salt caves in Nakhchivan, which occupies an important place among the natural resources of our country, is very remarkable for its medical-biological and humanitarian importance.

Looking at the history of treatment and recreation in Duzdag, the Duzdag Physiotherapy Centre has been operating for 42 years. Thus, the role of this treatment centre can be noted as a strategic issue in the implementation of measures necessary for the country's national economy during the political activity of the great leader Heydar Aliyev, which still belongs to the former Union period. It is a fact that this centre, distinguished by its economic and social nature, has been operating since 1979 as an expression of the diversification of the health and tourism prospects of our country, and this was possible at the initial stage as a 50-bed hospital in the base of the Nakhchivan salt mine. Of course, the effective organization of the service in this area also conditioned the connection of the processes calculated for the regulation of the demand formed in the later stages. For this purpose, in 1983, the number of beds for the treatment of diseases was increased to 100. However, Duzdag Physiotherapy Centre, whose construction was completed in 2008, attracts attention with its 450 beds, patients, and medical staff working here.

Undoubtedly, the modern infrastructure created in recent times—the nearby five-star Duzdag hotel, regular bus services from Nakhchivan, catering and gift sales offered at the entrance of the mine, and most importantly, the care of the medical staff for patients, both for those who come for treatment and those who accompany them—creates such opportunities. The cities of Baku and Sumgait, as well as Guba, Gusar, Gabala, Shamkir, Goranboy, Barda, and Yevlakh, as well as the citizens of Lankaran and Masalli who use the services of the centre, are Turkey, Ukraine, Iran, Russia, Tajikistan, Georgia, Kazakhstan, Germany, Great Britain, Holland, and Austrian tourists also agree with the miraculous healing potential of Duzdag (Let's get to know Nakhchivan: Collection of articles, 2017: 356). Treatment courses lasting up to 12 days for children and 18 days for adults lead to the recovery of patients without the use of drugs (11).

As it is clear from the above, modern conditions have been created for patients suffering from respiratory tract diseases at the Duzdag Physiotherapy Center. On May 16, 2019, the "Duzdag" Physiotherapy Centre's 40th Anniversary" Decree was one of the most important steps taken in the direction of the development of medical tourism (12). In addition to the economic and social importance of the decree, its advantages in the development of public cultural areas are also very great. Among the essential issues of Duzdag are:

-The importance of salt flats and salt has become the object of scientific research by scientists.

- Wide use of Nakhchivan salt in industry, household, nature, and medicine;
- Highlighting its medical importance;
- Taking into account the increasing importance of the role of Duzdag in the development of medical tourism in the autonomous republic, other necessary factors are included (13).

Conclusion

Rock salt reserves in the territory of the Autonomous Republic were assessed by experts by categories, and their exact reserves and chemical composition were given. However, there has been no assessment of the years it will reach according to the per capita volume and production volume. The reserve of the Duzdag field alone is estimated at 1 billion tonnes. 10.6 metric tonnes of rock salt fall per person in Azerbaijan, and more than 234,150 metric tonnes in Nakhchivan AR. When conducting an economic assessment based on the volume of production, it should be noted that, according to experts' calculations, 700,000 tonnes of rock salt are required annually in our republic to meet the demand of the fields. In this regard, if the Duzdag stone salt reserve is used alone, the reserve of this deposit will reach 150 years.

There is a great need for the construction of production facilities and chemical plants in the area for the use of Dashduz (rock salt) resources. The realization of the "Zangezur Corridor" will create conditions for the natural resources of Nakhchivan to go to world-scale trade markets and production enterprises, and at the same time, the Duzdag therapeutic recreation area will increase in world importance. Keeping this in mind, measures should be taken now to meet future demands.

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EMPLOYMENT STRUCTURE OF THE POPULATION IN SHARUR DISTRICT AND FACTORS AFFECTING IT

Abstract

It has been determined on the basis of the analysis of official statistical data, the changes in the employment structure in the Sharur administrative district during the last 10 years (2009-2019), and the factors influencing the formation of the population's employment in the article.

In the Sharur administrative district, the number dynamics, gender and age composition of the population, settlement of the able-bodied population in villages and cities, changes of the economically active population over the years, as well as the distribution of the population by economic activities have been analyzed. The reasons why the economically active population works more in various fields of agriculture were analyzed, and negative and positive factors affecting the structure of employment in the region were noted. Statistical data are shown and compared with tables and charts. The differences in the working population according to employment status were analyzed according to the statistical data of 2009 and 2019. The changes in the wage-earning and self-employed population over the years, the gender composition, and the settlement of the population working in these fields were recorded and compared on the basis of the data recorded in the tables.

Keywords: *employment, working age population, economically active population, gender and age composition of the population, urban and rural population*

Introduction

Sharur district is located in the west of Nakhchivan Autonomous Republic, its area is 815.18 km2. (14.8% of the territory of Nakhchivan AR). The administrative center is the city of Sharur. The administrative structure includes 1 city, 64 rural settlements, 1 urban administrative territorial district, and 51 rural administrative territorial districts (statistical data of Nakhchivan AR as of January 1, 2023; 11). The Sharur region borders with the Islamic Republic of Iran from the south and Armenia from the north. It is surrounded by Kangarli district from the east and Sadarak district from the west (12). According to the statistics of January 1, 2023, the population of the Sharur region was 112,292 people. 7.4 thousand people (6.6%) of the population live in urban areas, and 104.9 thousand people (93.4%) live in rural areas. 24.1% of the population of Nakhivan AR, 4.5% of the urban population, and 34.9% of the rural population belong to the Sharur administrative district. 55879 people, i.e. 24.02% of the population are men, and 56413 people, i.e. 24.2% are women. The density in the district is 137 people per km^2. Most of the territory of Sharur district is made up of plains, which made it ahead of other districts of Nakhchivan AR in terms of population density (10).

Research. When studying the employment structure of the population in the administrative region of Sharur, it is important to study the main factors affecting the formation of employment, including the number of the population, the average age limit, age-gender composition, labor reserves, economic fields where the working-age population is engaged, economically active and inactive population (Geography of the Republic of Azerbaijan, volume II Economic, social and political geography, 2015: 73).

One of the factors influencing the employment structure of the population is determining the gender and age composition of the population. Therefore, the age and gender composition of the population in the Sharur region was studied and the results are reflected in Table 1.

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As can be seen from the table, the population of the Sharur region increased by 14.8% in 2019 compared to 2009, including the male population by 15.3% and the female population by 14.2%. An increase in the age-gender composition of the working-age population in the Sharur administrative region was also observed in 2009 and 2019. So, while in 2009, 69,027 people were of working age, in 2019, 14,790 people increased to 83,217 people. (Population Census of the Republic of Azerbaijan 2009, Volume I, 2010: 248) This shows an increase of 21.4% in the working-age population within 10 years. Among the working-age population, the male population increased by 7,420 (21.4%) and the female population by 7,370 (21.5%) to 42,143 and 41,674 respectively in 2019. During the 10 years of the study, the population below working age decreased by 0.5%, i.e. by 124 people, to 25,884 people. On the contrary, the population over working age increased by 5.9%, that is, by 427 people, reaching 7674 people. The average age of the population increased by 4.4 years to 32.6 during 2009-2019.

In general, since a high growth rate was observed in the total number of the population, the absolute increase in the number of the working-age population was also high.

Table 1.
Distribution of the population of Sharur administrative region by age and gender groups (Based on population census data, in people and %).

Age	2009					2019				
	Both genders	Including				Both genders	Including			
		Male		Female			Male		Female	
		Person	%	Person	%		Person	%	Person	%
Total:	102282	50586	49,5	51696	50,5	117375	58319	49,7	59056	50,3
Including										
Below working age	26008	13618	52.4	12390	47,6	25884	13502	52,2	12382	47,8
At working age	69027	34723	50.3	34304	49,7	83817	42143	50,3	41674	49,7
Above working age	7247	2245	31	5002	69	7674	2674	34,9	5000	65,1
The average age	29,2	28,1		30,3		32,6	31,5			

Note: Compiled by the author based on statistical data of 2009-2019.

One of the factors influencing the employment structure is the location of the district population in urban and rural settlements. Table 2 and Table 3 show the changes in the settlement of the working-age population in urban and rural areas in Sharur administrative region in the period 2009-2019. From the statistics given in Table 2, it can be seen that in 2019, compared to 2009, the urban population among the working-age population increased by 14.3%, that is, by 695 people, from 4853 to 5548 people. Despite this, the urban population decreased from 7% to 6.6% in relation to the total working-age population during this period. In the 10-year period, increases were also observed in the gender distribution of the urban population of working age. Thus, the male population increased by 15.8%, i.e. 377 people, to 2768 people, and the female population increased by 318 people, i.e. 12.9%, to 2780 people. In relation to the working age population, men increased by 0.6%, while women decreased by 0.6% (Tahirova, 2016: 59).

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Table 2.
The number of working-age population of city population in Sharur administrative district, by number and percentage.

By years	Working age population		Including					
			Urban population					
	Person	%	Total		Male		Female	
			Person	%	Person	%	Person	%
2009	69027	67,5	4853	7	2391	49,3	2462	50,7
2019	83817	71,4	5548	6,6	2768	49,9	2780	50,1

Note: Compiled by the author based on statistical data of 2009-2019.

Table 3 analyzes the statistical data of the working-age population of the rural population. Based on the given data, it can be determined that a continuous increase in the number of the rural population was observed during the years 2009-2019. Thus, the village population, which was 64,174 people in 2009, increased by 22%, i.e. 14,095 people, and reached 78,269 people in 2019. As can be seen from the table, among the working-age rural population of Sharur administrative region, the male population in 2019 compared to 2009 was 7043 people (21.8%), and the female population increased by 7052 people (22.1%) and reached 39375, respectively. and reached 38894 people. It can be observed that the male population increased by 0.1% and the female population decreased by 0.1% in relation to the total number of the working-age population (Census of population of Nakhchivan Autonomous Republic 2019,volume I, 2022: 23).

Table 3.
The number of working-age population in the Sharur administrative region by rural population, by number and percentage.

By years	Peaople at the age of able to work		Including					
			village population					
	Person	%	Total		Male		Female	
			Person	%	Person	%	Person	%
2009	69027	67,5	64174	93	32332	50,4	31842	49,6
2019	83817	71,4	78269	93,4	39375	50,3	38894	49,7

Note: Compiled by the author based on statistical data of 2009-2019.

In the 10-year period after 2009, when analyzing the number dynamics of the population of working age in Sharur administrative district, despite the socio-economic difficulties, it can be observed that the urban and rural population, as well as the general population, are constantly increasing.

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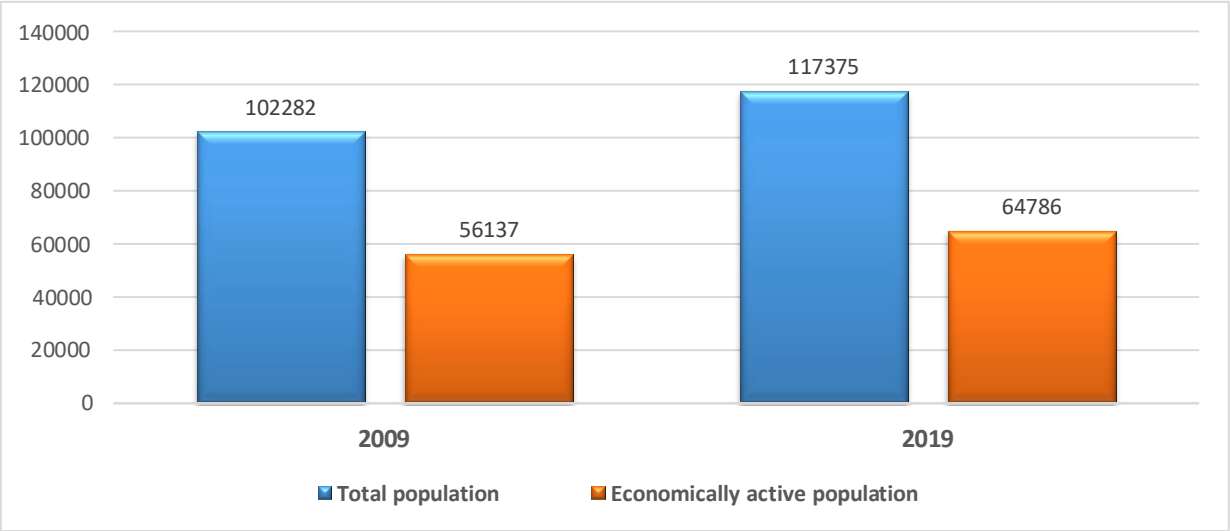
Diagram 1.
Economically active population of Sharur administrative region (15 years old and over)



Note: Compiled by the author based on statistical data of 2009-2019.

Diagram 1 shows the number of total population and economically active population in Sharur administrative district by year. The concept of economically active population is widely used in world statistics. It shows the number, composition and level of employment of the employed population. It is clear from the diagram that during the ten years of our research, an increase was observed in both the population and the number of economically active population. So, while the economically active population was 56,137 people in 2009, it was 8,649 people in 2019, that is, 64,786 people increased by 15.4% (Census of population of Nakhchivan Autonomous Republic 2019, volume III, 2022:26). At the same time, compared to the total population of the administrative region, the economically active population increased from 54.9% to 55.2%. It is clear from this information that during these years, the economically active population has grown at a higher rate than the general population (total population growth was 14.8%).

In Table 4, statistical data are analyzed according to the gender and age composition of the economically active population, as well as their settlement in rural and urban areas. When comparing men and women, it is possible to determine that the ratio among the working population is equalized in both research years. Thus, in 2009 there were 28,124 men and 28,013 women, including only 111 people, i.e. 0.4%, and at the same time in 2019, there were 32,707 men and 32,079 women, including 628 people, i.e. 1, A difference of 9% was observed. In both years, men dominate over women among the economically active population. If we pay attention to the employment status of the working population, it can be seen that men prevail in the category of wage earners, and women prevail in the category of self-employment. The reason for this is that many factors affect women's work, including religious factors, women doing more housework, the difficulties they face in getting higher education, family status, the location of business enterprises in urban areas, long working hours, etc.

When we compare the urban and rural population according to the employment status of the working population, we see that in 2009, 7.1% of the employed population, and 6.6% in 2019, were urban population, respectively 92.9% and 93.4% were rural population. Regarding the employment status of the urban and rural population, the urban population working for wages decreased by 1,967 people (55.7%) to 1,563 people, and the rural population working in the same field decreased by 1,859 people (9.5%) to 17,801 people. In addition, the urban population working in the field of self-employment increased 6.2 times during 10 years and from 441 people to 2737 people, and the rural population increased 1.3 times from 32504 people to 42672 people (Population census of the Republic of Azerbaijan 2009, volume XIV, 2010:160).

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Table 4.
Employment status of the working population

2009					2019			
By region	Working population	Including			Working population	Including		
		Salaried	Self employment	Other		Salaried	Self employment	Other
Total	56137	23190	32945	2	64786	19364	45409	13
Male	28124	14735	13387	2	32707	13038	19663	6
Female	28013	8455	19558	0	32079	6326	25746	7
Urban population	3972	3530	441	1	4302	1563	2737	2
Rural population	52165	19660	32504	1	60484	17801	42672	11
At working age	55466	22905	32559	2	63984	19095	44876	13
Above working age	671	285	386	0	802	269	533	0

Note: Compiled by the author based on statistical data of 2009-2019.

Table 4 also analyzes the age composition of the employed population. Based on the statistics of 2009 and 2019, it can be determined that in both years, 98.8% of the employed population was of working age. In 2009, 22,905 people, i.e., 41.3% of the working-age population were employed, 32,559 people, i.e., 58.7%, were self-employed. In 2019, 19,095 people, i.e., 29.8% of the working-age population are employed, and 44,876 people, or 70.2%, are self-employed. (Census of population of Nakhchivan Autonomous Republic 2019, volume II, 2022: 323). Among the population over working age, the employed population increased by 131 people (19.5%) to 802 people, the wage-earning population decreased by 16 people (5.6%) to 269 people, and the self-employed population increased by 147 people (38.1 %) increased to 533 people. It is clear from the table that in the age distribution of the employed population, from 2009 to 2019, a constant growth rate was observed in the number of the self-employed population compared to the salaried population.

Diagram 2 shows the number of the employed population in different areas of economic activity. Compared to 2009, in 2019, the number of people working in general economic activities increased by 8,649 people or 15.4%. If in 2009 there were 27,493 people working in agriculture, forestry and hunting, in 2019, 13,747 people or 50% increased to 41,240 people, and 434 people or 27.7% were working in public administration, defense and social security. increased to 2345 people. (Population census of the Republic of Azerbaijan 2009, Volume XIII, 2010:16). Except for agriculture, forestry and hunting, public administration, defense and social security, the situation has changed in all the remaining economic activity areas, and reductions in the number of people working in all areas have been observed. Thus, in 2019, according to the official statistics of 2009, there are 2,248 people (35.8%) working in various fields of industry, 206 people (3.4%) working in construction, and 1,618 people (23.8%) working in trade and transport, communication and information workers decreased by 511 (73.3%), education and science workers decreased by 622 people (16.8%), health and social services to the population by 890 people (54.3%).

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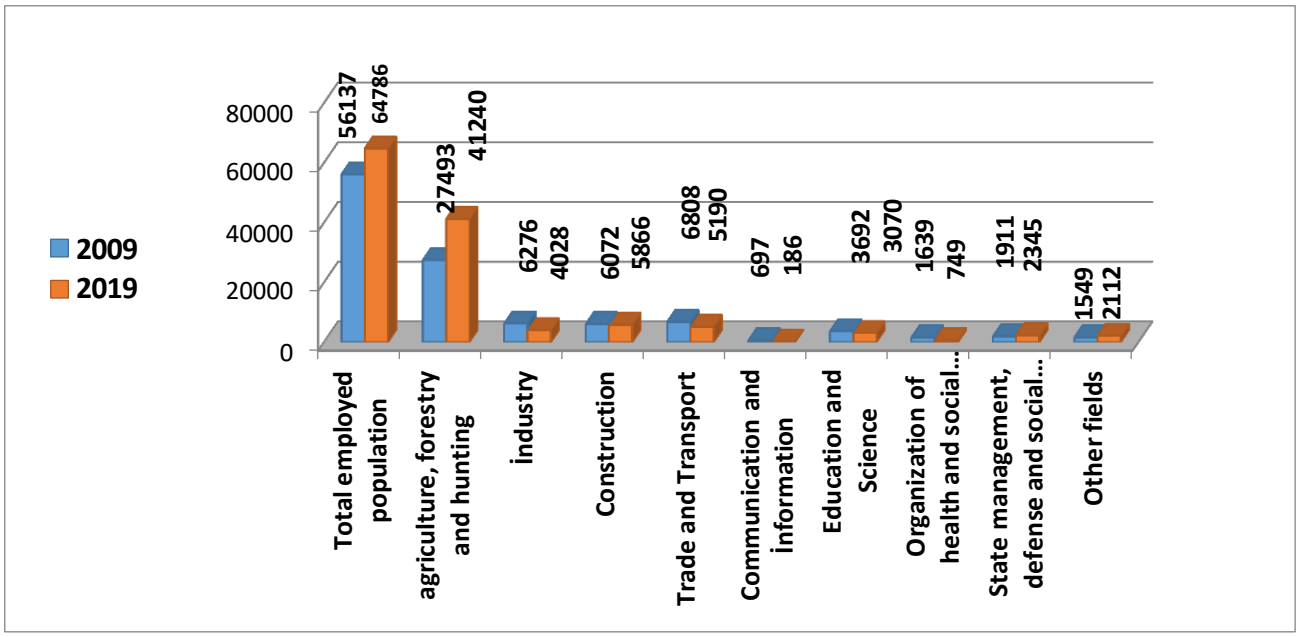
Diagram 2.
Distribution of the employed population by economic activities



Note: Compiled by the author based on statistical data of 2009-2019.

It can be seen from the diagram that in both years we compare, the largest number of workers in terms of economic activities is in the field of agriculture, forestry and hunting, and in the field of transport and trade. The greater individual activity of the population working in these fields causes them to be ahead in terms of population compared to other fields of economic activity.

During the analysis, the decrease in the specific weight of those working in industrial fields and its growth at a lower rate compared to other fields indicate that these fields are not paid attention to, few measures are taken, and new enterprises are not involved in the development of labor and science-intensive fields.

Economic, social, geographical, demographic, psychological and political factors can have a significant impact on the employment of the population. In addition, the formation of the employment structure of the population is influenced by geographical conditions, the location of the population in altitude zones, the possibilities of using natural resources in the area, the specialized areas of agriculture and industry, the organization of enterprises based on their processing, historical-geographical development characteristics and the traditions of the population. (Geography of Nakhchivan Autonomous Republic, volume II Economic and social geography, 2018: 138). There are many factors affecting the employment structure of the population in Sharur administrative region. These include economic factors such as population growth, age-gender structure, standard of living, migration, health care development, areas of economic activity, etc., as well as physical factors such as terrain, climate, land cover. The territory of Sharur administrative district is favorable for the development of agriculture. So, most of the region is located in the plains. The rich composition of the soil, the development of agriculture under irrigation conditions and the taking of high productivity provide conditions for the better development of various areas of agriculture compared to other areas of economic activity. Also, Arpachay, which flows through the region, is one of the factors affecting the structure of the economy here. 60% of cultivated fields in Sharur administrative district are irrigated with Arpachay water (Geography of Nakhchivan Autonomous Republic, volume II Economic and social geography, 2018: 186).

Along with positive factors, there are also negative factors affecting the structure of employment. For example, as we mentioned above, most of the population work in various fields of agriculture. The drying of the climate has a negative effect on the development of the economy in

the administrative region of Sharur. Thus, the fact that agricultural fields require more irrigation, lack of irrigation water especially in the summer period when agriculture is more developed, as well as the lack of warehouses for storing the harvested products, and the low purchasing power of the population belong to these factors. Also, the lack of industrial enterprises, the fact that a part of the population goes to Nakhchivan city and other areas to work has a significant impact on the structure of employment in Sharur administrative district.

Conclusion

The following conclusions were obtained while analyzing the employment structure of the population in Sharur region and the factors affecting it.

1. In the age structure of the population, the working-age population increased by 21.4% and reached 83,217 people in 2019. In the gender structure of the able-bodied population, an increase of 21.4% in the number of males and 21.5% in the number of females was observed.

2. Among the working population, urban population increased by 14.3%, including men by 15.8% and women by 12.9%. There was a 22% change in the number of the rural population among the working-age population. In particular, the male rural population increased by 21.8%, while the female population increased by 22.1%.

3. While in 2009, 41.3% of the working-age population was employed, 58.7% was self-employed, in 2019, this indicator changed, and 29.8% of the working-age population was employed. 70.2% were self-employed.

4. The employed population increased by 15.4% in 2019 compared to 2009. In particular, among the population working in various fields of economic activity, those working in the field of agriculture, forestry and hunting were significantly ahead of other fields in both years.

5. Decreases were observed in the number of people working in all economic activities, except for agriculture, forestry and hunting, public administration, defense and social security.

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