

Aslan Khalilov

PhD (Art Study)

*Azerbaijan State University of Culture and Arts
(Azerbaijan)*

aslan_ashiq@mail.ru

PROBLEMS AND PROSPECTS OF THE APPLICATION OF ECOLOGICAL BUILDING MATERIALS IN MODERN AZERBAIJANI ARCHITECTURE

Abstract. The article examines the role of ecological building materials in contemporary architectural and construction practice, as well as their main characteristics and application possibilities. Against the background of global environmental challenges, the importance of these materials is substantiated in terms of increasing energy efficiency, reducing carbon emissions, and creating a healthier living environment. The main types of ecological materials – natural, recycled, and energy-efficient are presented in a generalized manner.

In modern Azerbaijani architecture, examples of this approach are observed in such structures as the Heydar Aliyev Center, SOCAR Tower, and the Flame Towers. At the same time, a number of challenges are identified, including high costs, limited local production, and the недостаточность нормативной базы. As a result, the study emphasizes the importance of developing local production, training qualified specialists, and applying modern technologies to expand the use of ecological materials.

Key words: ecological building materials, sustainable architecture, energy efficiency, green building, modern Azerbaijani architecture.

Introduction. In the modern era, problems such as global climate change, the depletion of energy resources, and environmental pollution have made it necessary to develop new approaches in the fields of architecture and construction. As a result of the acceleration of industrialization and urbanization processes, the construction sector has become one of the fields that

plays a significant role in the formation of global energy consumption and carbon emissions. According to the results of various international studies, a considerable share of global energy consumption and carbon emissions released into the atmosphere is directly related to building construction and their operation. For this reason, the application of ecological approaches in architectural and construction practice has gained particular relevance in the contemporary period.

The interpretation of the main material. In modern architectural theory, ecological approaches have been shaped under the influence of global environmental problems. In this context, the concept of ecological architecture is based on the principles of efficient use of natural resources, energy conservation, and environmental protection. This approach, accepted as a “green” or sustainable architecture model, covers all stages from design to operation, and its main goal is to create a healthy and comfortable living environment while minimizing negative impacts on the environment.

The selection of construction materials plays an important role in this process. The application of ecological materials makes it possible to increase energy efficiency, improve thermal and sound insulation, and enhance the quality of the indoor environment. “The thermal conductivity coefficient of construction materials depends on many factors, primarily on the structure of the materials, their porosity, the nature of the pores, average density, moisture content, etc.” [3, p.16]. The use of natural and recycled materials contributes to more rational use of resources and the reduction of carbon emissions.

In global architectural practice, this approach has already become widespread, and especially in European countries, green building standards and energy-efficient technologies have become an integral part of architectural practice. Interest in this direction is also increasing in modern Azerbaijani architecture. The “Baku White City” project, as well as such objects as the Heydar Aliyev Center, SOCAR Tower, and the Flame Towers, are examples of the application of modern technologies and ecological approaches.

At the same time, large complexes such as the National Gymnastics Arena and the Baku Olympic Stadium demonstrate the broad possibilities of innovative materials and structural solutions. Thus, the application of ecological construction materials in modern Azerbaijani architecture is relevant both scientifically and practically and can make a significant contribution to the formation of a sustainable architectural environment.

Ecological construction materials are of particular importance in modern architectural and construction practice. These materials are characterized by minimal environmental impact throughout all stages from production to disposal, efficient use of natural resources, reduced energy consumption, and safety for human health.

Usually produced from renewable or recycled raw materials, these materials contribute to increasing energy efficiency in the construction sector, reducing carbon emissions, and creating a healthier living environment. One of their important features is their high thermal and sound insulation capacity, which allows for reduced energy losses in buildings and improved indoor environmental quality.

There are specific examples of the application of this approach in modern Azerbaijani architecture. The use of the “BREEAM Assessment” system in the administrative building of the State Oil Fund, the application of energy-saving technologies and solar panels, as well as panoramic glass panels converting solar energy into electricity at the Baku Aquatics Palace demonstrate the practical possibilities of ecological materials and engineering solutions.

The classification of ecological construction materials in modern architectural and construction practice is of great theoretical and practical importance. These materials are characterized by their minimal environmental impact, increased energy efficiency, and safety for human health. Their classification is based on origin, production technology, and functional characteristics, which allows for the purposeful selection of materials.

One of the main groups is natural-origin materials. Examples such as wood, bamboo, cork, cotton, and straw-based insulation materials, obtained from renewable resources, provide high thermal and sound insulation while creating a healthy microclimate. Natural stone, ceramics, and clay-based materials, distinguished by their durability and resilience, are widely used in architectural structures.

“Good thermal insulation creates conditions for a comfortable microclimate in a space. Thermal insulation has great economic significance, which is directly reflected in heating costs. Thanks to good insulation, the consumption of heating energy is minimized. This helps to preserve the environment. Extremely good thermal insulation ensures a high surface temperature in external walls. This leads to greater thermal comfort. The closer the indoor temperature is to the surface temperature, the less cold penetrates inside” [3, pp. 182–183].

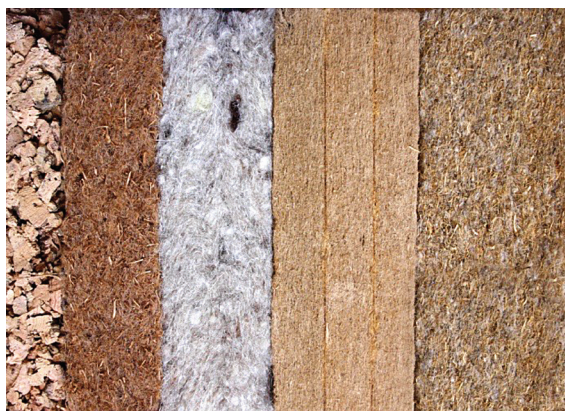


Fig. 1. Natural thermal insulation materials for a healthier and more environmentally friendly home

Another important group consists of recycled materials. Cellulose insulation, recycled metals and plastics, as well as composite materials obtained from construction waste ensure efficient use of resources and contribute to

waste reduction. This approach is closely related to the principles of the circular economy.

Energy-efficient materials aim to reduce the energy consumption of buildings. Modern façade systems, glass technologies, and insulation materials reduce heat losses and enable energy savings. The Flame Towers, SOCAR Tower, and other modern buildings are examples of the application of these materials.

At the same time, innovative materials such as bio-composites, low-carbon cement, and composite façade systems are becoming widespread in modern architecture. EPS, one of the synthetic materials, is widely used due to its lightness and insulation properties, although its environmental impact should be assessed comprehensively.

Thus, the development of construction materials has gradually shifted from natural materials to technological and synthetic materials, while ecological architecture, as a new stage of this development, has aimed to combine the advantages of traditional and modern materials to form a sustainable architectural environment.

Today, the application of ecological construction materials in architecture and construction is considered one of the key directions of sustainable development. However, the widespread implementation of these materials is accompanied by a number of economic, technological, and organizational challenges. These problems, to a certain extent, limit the broader adoption of ecological materials in the construction sector.

One of the main difficulties in the application of ecological construction materials in Azerbaijani architecture is their high initial cost. Many ecologi-

cal construction materials are imported from foreign countries, and therefore their price is higher compared to traditional construction materials. This makes their application in construction projects economically challenging. In particular, high-tech façade systems and energy-efficient structural solutions are mostly applied in large-scale projects, but their widespread use in mass residential construction is still limited.

Another important problem is the insufficient development of the local production base. The small number of enterprises engaged in the production of ecological construction materials in Azerbaijan hinders their widespread application. For this reason, the use of traditional materials often prevails in the construction sector, although the demand for energy-efficient and innovative materials in modern architectural projects is steadily increasing.

One of the problems related to the application of ecological construction materials is also the limited number of specialized professionals in this field. The insufficient dissemination of knowledge among architects and engineers about ecological construction technologies and the characteristics of these materials makes their broad use in the design process difficult. Such knowledge is especially important in modern and complex architectural projects.

The incomplete formation of the regulatory and legal framework also creates certain problems. The lack of sufficient regulatory documents related to the implementation of ecological standards and energy efficiency criteria in the construction sector hinders the widespread use of these materials. However, the implementation of green building standards is considered an important tool for improving the ecological quality of architectural projects.

Thus, the application of ecological construction materials in modern Azerbaijani architecture faces a number of economic, technological, and regulatory challenges. Overcoming these problems is of great importance for the formation of a sustainable architectural environment.

Today, the application of ecological construction materials acts as one of the main directions of sustainable development strategies. These materials are of great importance in terms of increasing energy efficiency, reducing carbon emissions, and protecting the environment, and there are broad opportunities for their application in Azerbaijani architecture.

In recent years, large-scale urban development projects and modern architectural complexes implemented in the country have created favorable condi-

tions in this direction. In particular, the “Baku White City” project attracts attention as a successful example of the application of an ecological approach. The use of energy-efficient façade systems, innovative insulation materials, and modern engineering technologies in contemporary buildings is becoming increasingly widespread.

The prospects for the application of ecological materials are primarily related to energy saving. Modern insulation and alternative energy technologies reduce heat and energy losses in buildings, minimizing operating costs. Solar energy panels applied at the Baku Aquatics Palace are an example of a successful technological solution in this field.

At the same time, expanding the use of recycled materials is of great importance in terms of efficient resource use and waste reduction. Bio-composite materials based on innovative technologies, low-carbon cement, and modern façade systems create both structural and ecological advantages in architecture.

Azerbaijan’s rich natural resources open broad opportunities for the production of ecological materials based on local raw materials. This can reduce dependence on imports and make materials more accessible.

Thus, the application of modern technologies, the spread of energy-efficient approaches, and the use of local resources will make an important contribution to the wider application of ecological construction materials and the formation of a sustainable architectural environment in the future.

Conclusion. The conducted research shows that the application of ecological construction materials in modern architectural and construction practice plays an important role in the implementation of sustainable development principles. These materials are of particular importance in terms of increasing energy efficiency, reducing carbon emissions, and creating a healthier living environment. There are already certain examples of the application of this approach in modern Azerbaijani architecture.

At the same time, the application of ecological materials is accompanied by problems such as high cost, limited local production, shortage of specialists, and insufficiency of the regulatory framework. In order to overcome these difficulties, it is essential to develop local production, implement modern technologies, and strengthen the training of qualified personnel.

Thus, the expansion of the application of ecological construction materials can make a significant contribution to the formation of a more sustainable and environmentally safe architectural environment in the future.

REFERENCES:

1. Ağazadə R., İbrahimli Y. Azərbaycan memarlığı inkişaf yollarında. -Bakı, 2012.
2. Fətullayev-Fiqarov Ş. Bakının memarlıq ensiklopediyası. – Bakı, 2013.
3. Məmmədov V. Üzlük materiallar. – Bakı, 2014.
4. Nağıyev N., Hüseynov F. Azərbaycan Respublikasının müasir memarlıq tarixi. V cild. – Bakı, 2013.

Aslan Xəlilov (*Azərbaycan*)

MÜASİR AZƏRBAYCAN MEMARLIĞINDA EKOLOJİ TİKİNTİ MATERIALLARININ TƏTBİQİ PROBLEMLƏRİ VƏ PERSPEKTİVLƏRİ

Məqalədə müasir memarlıq və tikinti təcrübəsində ekoloji tikinti materiallarının rolu, onların əsas xüsusiyyətləri və tətbiq imkanları araşdırılır. Qlobal ekoloji problemlər fonunda bu materialların enerji səmərəliliyinin artırılması, karbon emissiyalarının azaldılması və daha sağlam yaşayış mühitinin formalaşdırılması baxımından əhəmiyyəti əsaslandırılır. Ekoloji materialların təbii, təkrar emal olunmuş və enerji səmərəli növləri ümumiləşdirilmiş şəkildə təqdim olunur.

Müasir Azərbaycan memarlığında Heydər Əliyev Mərkəzi, SOCAR Tower və Alov Qüllələri kimi obyektlərdə bu yanaşmanın tətbiq nümunələri qeyd edilir. Bununla yanaşı, yüksək maliyyə, yerli istehsalın məhdudluğu və normativ bazanın yetərsizliyi kimi problemlər göstərilir. Nəticədə ekoloji materialların tətbiqinin genişləndirilməsi üçün yerli istehsalın inkişafı, mütəxəssis hazırlığı və müasir texnologiyaların tətbiqinin vacibliyi vurğulanır.

Açar sözlər: ekoloji tikinti materialları, davamlı memarlıq, enerji səmərəliliyi, yaşıllıq, müasir Azərbaycan memarlığı.

Аслан Халилов (*Азербайджан*)

ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ ПРИМЕНЕНИЯ ЭКОЛОГИЧЕСКИХ СТРОИТЕЛЬНЫХ МАТЕРИАЛОВ В СОВРЕМЕННОЙ АЗЕРБАЙДЖАНСКОЙ АРХИТЕКТУРЕ

В статье рассматривается роль экологических строительных материалов в современной архитектурно-строительной практике, а также их основные характеристики и возможности применения. На фоне

глобальных экологических проблем обосновывается значение данных материалов с точки зрения повышения энергоэффективности, снижения выбросов углерода и формирования более здоровой среды обитания. Основные виды экологических материалов – природные, переработанные и энергоэффективные представлены в обобщённом виде.

В современной азербайджанской архитектуре примеры применения данного подхода прослеживаются в таких объектах, как Центр Гейдара Алиева, SOCAR Tower и «Пламенные башни». Наряду с этим выявляются основные проблемы, включая высокую стоимость, ограниченность местного производства и недостаточность нормативной базы. В результате подчёркивается необходимость развития местного производства, подготовки квалифицированных специалистов и внедрения современных технологий для расширения применения экологических материалов.

Ключевые слова: экологические строительные материалы, устойчивая архитектура, энергоэффективность, «зелёное» строительство, современная архитектура Азербайджана.