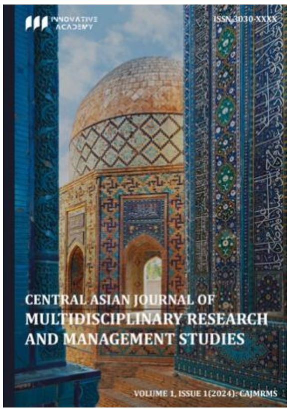

COMPOSITE ADHESIVE MIXTURES BASED ON CEMENT: PROPERTIES, APPLICATIONS, AND ADVANCEMENTS

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ABSTRACT

Composite adhesive mixtures based on cement have gained widespread use in construction and other industrial applications due to their superior bonding properties, durability, and versatility. This thesis aims to explore the formulation, mechanical properties, and potential applications of cement-based adhesive mixtures. By examining the components, such as polymer additives, fillers, and reinforcements, this research delves into how these composites perform under various environmental conditions and stresses. Additionally, the study evaluates the advancements in the development of these mixtures, focusing on their potential to enhance sustainability in modern construction practices.

Introduction

The use of adhesive systems in construction has evolved significantly with the advent of composite technologies. Cement, a traditional binding material, has been further enhanced through the incorporation of polymers and other chemical additives, creating composite adhesive mixtures that exhibit improved mechanical performance, durability, and environmental resistance. This thesis explores the fundamental properties, formulation techniques, and advancements in cement-based adhesive composites, shedding light on their growing role in sustainable construction practices.

Research Objectives

The primary objective of this research is to investigate the properties and applications of composite adhesive mixtures based on cement. Specifically, it aims to:

Understand the role of polymer additives and fillers in cement-based adhesives.

Evaluate the performance of these mixtures under various environmental conditions.

Explore new developments in adhesive technology that enhance sustainability.

Significance of the Study

Cement-based adhesives form an essential component in a variety of construction applications, including tile bonding, concrete repair, and industrial flooring. By enhancing their composition, engineers and researchers can develop more effective solutions to modern construction challenges, such as reducing waste and improving the durability of materials.

Historical Context of Cement-Based Adhesives.

The traditional use of cement as a binding material dates back centuries, with its application in various types of construction. However, the development of composite adhesive mixtures based on cement is a relatively recent innovation, driven by the need for stronger, more flexible, and environmentally resilient materials.

Polymer-Modified Cement Mixtures

The introduction of polymers into cement mixtures has led to the creation of polymer-modified cement (PMC), which has enhanced flexibility, adhesion, and resistance to cracking. Several types of polymers, including latex and acrylics, have been studied for their ability to improve cementitious systems. Research shows that the addition of polymers to cement mixtures significantly enhances their bonding strength and durability, especially in environments with fluctuating temperatures and moisture levels.

Recent Advances in Composite Adhesives

Modern advancements in composite adhesive mixtures have focused on optimizing material properties through the addition of fibers, nano-reinforcements, and other fillers. These additives not only improve the mechanical performance of the mixture but also contribute to reducing the overall environmental impact of construction projects by incorporating sustainable materials and practices.

Methodology

Materials and Formulation

The composite adhesive mixtures studied in this research are based on ordinary Portland cement (OPC) combined with polymer additives, including latex, acrylic polymers, and fiber reinforcements. A range of fillers, such as silica, were introduced to enhance specific properties like adhesion and compressive strength.

Testing Protocols

The cement-based adhesive mixtures were subjected to a series of tests, including compressive strength, tensile bonding, shrinkage, and environmental resistance tests (e.g., freeze-thaw cycles, water absorption, and chemical exposure). These tests were designed to assess the mechanical properties and durability of the mixtures under both normal and extreme conditions.

Data Analysis

The data collected from the testing phase were analyzed using statistical tools to determine the correlation between mixture composition and performance. A comparative analysis between different polymer additives and their effects on the adhesive properties was also conducted.

Results and Discussion

Mechanical Properties of Cement-Based Composite Adhesives

The results indicate that the inclusion of polymer additives in cement-based adhesives significantly enhances their mechanical properties, including tensile bonding strength, flexibility, and resistance to environmental stresses. Mixtures with higher polymer content demonstrated better performance in terms of bonding strength and durability, making them ideal for applications in areas prone to high moisture or temperature fluctuations.

Environmental Performance

The modified cement mixtures showed improved performance under extreme environmental conditions. Freeze-thaw resistance was notably higher in polymer-modified mixtures, with a significant reduction in cracking compared to traditional cement-based adhesives. This makes polymer-modified cement adhesives a superior choice for outdoor applications or regions with severe weather conditions.

Implications for Sustainable Construction

Cement production is known to have a large carbon footprint, but advancements in composite adhesive mixtures can help mitigate this. By incorporating recycled materials and optimizing the use of polymers, these adhesives can reduce the need for frequent repairs and replacements, thus contributing to more sustainable construction practices.

Conclusion

This thesis demonstrates that composite adhesive mixtures based on cement, particularly those modified with polymers, offer superior performance in terms of mechanical properties, durability, and environmental resistance. These materials present a promising solution for the construction industry, particularly in areas where traditional cementitious systems may fail. Future research should focus on developing even more sustainable formulations by incorporating bio-based polymers and minimizing the use of energy-intensive materials like cement.

Future Directions

Potential areas for further research include the exploration of bio-based additives, nano-reinforcements, and the development of formulations that reduce the carbon footprint of cement production. Additionally, further studies on long-term durability and lifecycle analysis will be crucial for promoting the widespread adoption of these mixtures.

REFERENCES

1. Курбанов, З. Х., & Талипов, Н. Х. (2024). ОБЛИЦОВОЧНЫЙ ПЛИТОЧНЫЙ КЛЕЙ НА ОСНОВЕ ЦЕМЕНТА НИЗКОЙ ВОДОПОТРЕБНОСТИ.

2. Бердиев, О. Б., Курбанов, З. Х., & Абдурахманов, А. (2023). ИССЛЕДОВАНИЕ ЭНЕРГОЭФФЕКТИВНОСТИ ТРЕБУЕМОЙ ТЕПЛОПРОВОДНОСТИ ПО НОРМАТИВНЫМ ДОКУМЕНТАМ НА ПРИМЕРЕ ГОРОДА ДЖИЗАК (РЕСПУБЛИКИ УЗБЕКИСТАН): ИССЛЕДОВАНИЕ ЭНЕРГОЭФФЕКТИВНОСТИ ТРЕБУЕМОЙ ТЕПЛОПРОВОДНОСТИ ПО НОРМАТИВНЫМ ДОКУМЕНТАМ НА ПРИМЕРЕ ГОРОДА ДЖИЗАК (РЕСПУБЛИКИ УЗБЕКИСТАН).

3. Бердиев, О. Б., Болотов, Т. Т., Мамиров, А. Х., & Курбанов, З. Х. (2023). БЫСТРОТВЕРДЕЮЩЕЙ СУЛЬФАТСОДЕРЖАЩЕЙ ДОБАВКИ ДЛЯ САМОВЫРАВНИВАЮЩИХСЯ ПОЛОВ: БЫСТРОТВЕРДЕЮЩЕЙ СУЛЬФАТСОДЕРЖАЩЕЙ ДОБАВКИ ДЛЯ САМОВЫРАВНИВАЮЩИХСЯ ПОЛОВ.

4. Бердиев, О., Талипов, Н., Курбонов, З., & Болотов, Т. (2023). Development of a formulation for dry cement-adhesive dry building mixtures for ceramic slabs using the addition of spent alumina catalysts. *Scientific Collection «InterConf»*, (180), 407-414.

5. Kurbanov, Z., & Artiqqulov, D. (2023). DETERMINATION OF THE CONTENT OF DRY CONSTRUCTION MIXED ON THE BASIS OF LOCAL MARBLE WASTE POWDER. *Центральноазиатский журнал образования и инноваций*, *2*(9), 104-106.

6. Hamidulloevich, K. Z. (2023). DETERMINATION OF THE CONTENT OF DRY CONSTRUCTION MIXED ON THE BASIS OF LOCAL MARBLE WASTE POWDER. *Journal of Academic Research and Trends in Educational Sciences*, 273-275.

7. Kurbanov, Z., & Artiqqulov, D. (2023). OPPORTUNITIES TO GET LIGHT SUPPLIES BASED ON COAL WASTE. *Центральноазиатский журнал образования и инноваций*, *2*(9), 100-103.

8. Курбанов, З., & Ортиккулов, Д. (2023). ВЫСОКОПРОЧНЫЙ ГИПСОВЫЙ ВЯЖУЩИЙ НА ОСНОВЕ СУЛЬФАТСОДЕРЖАЩЕГО ОТХОДА. *Models and methods in modern science*, *2*(2), 5-12.

9. Талипов, Н., Курбанов, З., & Артыккулов, Д. (2023). ЭФФЕКТИВНЫЕ СУХИЕ СМЕСИ С ПОЛИМЕРНЫМИ ДОБАВКАМИ. *Центральноазиатский журнал образования и инноваций*, *2*(5), 43-48.

10. Шоқосимов, И. К., & Курбанов, З. Х. (2021). ТЕХНОЛОГИЯ ПРОИЗВОДСТВА ЗЕМЛЯНЫХ РАБОТ С ПРИМЕНЕНИЕМ ГЕОСЕТОК.

11. Rahmonqul O'g'li, M. J. (2023). KUL-SHLAKLI ARALASHMASIDAN QURILISH MATERIALLARINI ISHLAB CHIQARISHDA QO'LLASH. *Journal of Academic Research and Trends in Educational Sciences*, 269-271.

12. Қурбонов, З., Эшқулов, Н., & Ортиққулов, Д. (2023). ҚУРУҚ ҚУРИЛИШ ҚОРИШМАЛАРИНИНГ АСОСИЙ ТАРКИБИЙ ҚИСМЛАРИ. *Центральноазиатский журнал образования и инноваций*, *2*(5), 61-66.