

“To Study On Pollution Absorbing Brick By Using ZnO”

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Abstract - Pollution Absorbing Brick using Zinc Oxide (ZnO) is an innovative construction material developed to address both structural and environmental challenges in modern construction. The incorporation of ZnO, a photocatalytic material, into the brick matrix significantly enhances the functional properties of conventional bricks by enabling them to reduce air pollution. Unlike traditional bricks, these modified bricks actively participate in environmental purification by degrading harmful pollutants such as nitrogen oxides (NO_x) and organic contaminants when exposed to sunlight.

The results indicate that the inclusion of ZnO slightly influences the physical properties of the bricks while considerably improving their pollution absorbing capacity. An optimum percentage of ZnO was identified to achieve a balance between structural performance and environmental effectiveness.

Thus, pollution absorbing bricks using ZnO present a promising solution for modern construction by enhancing air quality, durability, and overall environmental performance.

The study also examines the potential application of these bricks in urban areas with high pollution levels, highlighting their suitability for facades, pavements, and exterior walls. The findings demonstrate that ZnO-based pollution absorbing bricks offer a sustainable, eco-friendly, and cost-effective alternative to conventional construction materials.

1. INTRODUCTION :

Brick is one of the most commonly used and essential construction materials in the world. From ancient times to modern infrastructure development, bricks have been widely used for constructing residential buildings, commercial structures, pavements and boundary walls. They are preferred because of their strength, durability, fire resistance, thermal insulation and economical cost. However, conventional bricks are designed only for structural purposes and do not contribute towards solving environmental problems such as air pollution. In the present scenario, air pollution has become one of the most serious environmental challenges globally. Rapid urbanization, industrial growth, increasing number of vehicles and continuous construction activities have significantly increased the concentration of harmful gases in the atmosphere. Major pollutants include nitrogen

oxides (NO_x), sulphur dioxide (SO₂), carbon monoxide (CO), carbon dioxide (CO₂) and volatile organic compounds (VOCs). These pollutants cause severe health issues such as asthma, bronchitis, respiratory infections and cardiovascular diseases. In addition, they contribute to environmental problems like acid rain, smog formation and global warming

Zinc Oxide is a white inorganic compound known for its semiconductor and photocatalytic properties. It is chemically stable, non-toxic, corrosion resistant and environmentally safe. Due to these characteristics, ZnO is widely used in various industrial applications such as paints, coatings, ceramics, rubber products and pharmaceuticals. In recent years, researchers have explored its environmental applications, particularly in air purification.

The concept of pollution absorbing bricks supports sustainable development and green building practices. Instead of depending entirely on external air purification systems, buildings themselves can contribute to improving environmental quality. These bricks can be effectively used in areas with high traffic density, highways, industrial zones, tunnels and urban regions where pollution levels are high.

Thus, the development of pollution absorbing bricks using ZnO integrates structural engineering with environmental protection. It offers a promising approach towards cleaner, healthier and more sustainable urban infrastructure.

2. Body of Paper : Material Use

1 Cement: Cement is the primary binding material used in pollution absorbing bricks. When mixed with water, cement undergoes a hydration reaction, forming a hard and strong matrix that binds sand and other materials together. It provides compressive strength, durability, and structural stability to the brick. In pollution absorbing bricks, cement also helps in properly holding the Zinc Oxide particles within the brick surface so that they can effectively react with sunlight and pollutants.



2 Sand: Sand acts as a fine aggregate in the brick mixture. It improves the strength, hardness, and dimensional stability of the brick. Sand also reduces shrinkage and cracking during the drying and curing process. Properly graded sand ensures better bonding with cement, which increases the compressive strength and durability of the brick structure.



3 Zinc Oxide (ZnO): Zinc Oxide is the key pollution absorbing material used in these bricks. It acts as a photocatalyst, meaning it becomes active when exposed to ultraviolet (UV) rays from sunlight. When activated, ZnO produces chemical reactions that break down harmful air pollutants such as nitrogen oxides (NO_x), sulphur oxides (SO_x), and volatile organic compounds (VOCs) into less harmful substances. This process helps purify the surrounding air and provides a self-cleaning effect to the brick surface.



4. Water: Water is essential for the hydration process of cement and proper mixing of all materials. It helps cement particles react chemically to form a strong binding gel known as calcium silicate hydrate (C-S-H). Proper water content ensures workability of the mixture, proper moulding of bricks, and strength development during curing. Insufficient or excessive water can affect the quality and durability of the brick.

5. Activated Charcoal:

Activated charcoal is used in pollution absorbing bricks because it has a large surface area and high adsorption capacity, which helps trap harmful gases, dust, and pollutants from the air. It works together with Zinc Oxide (ZnO) to improve air purification.



6. Fly ash:

Fly ash is a pozzolanic material obtained from thermal power plants. It reacts with cement to form additional C-S-H gel, which increases the strength and durability of the brick. It also improves porosity, helping ZnO and activated charcoal absorb air pollutants more effectively.



3. Objectives:

1. To reduce air pollutants such as NO_x, SO₂ and harmful gases from the surrounding atmosphere.
2. To utilize the photocatalytic property of ZnO for decomposition of pollutants under UV light.
3. To improve air quality around buildings and urban areas.
To increase adsorption capacity by using materials like activated charcoal

4. Problem Statement:

Rapid urbanization → increase in pollution
Harmful gases: NO_x, SO₂, CO, VOCs
Causes: Respiratory diseases, Global warming
Traditional methods are not sufficient.

5.Future Scope:

1. Use in Smart and Green Buildings: Pollution absorbing bricks can be used in environmentally sustainable buildings to improve air quality.
2. Improvement in Photocatalytic Materials: Further research can enhance the pollution absorbing efficiency by optimizing the amount of ZnO used in the brick.
3. Application in Urban Areas: These bricks can be widely used in cities where air pollution is a major environmental issue.
4. Large Scale Production: With improved manufacturing techniques, pollution absorbing bricks can be produced on a larger scale at lower cost.
5. Integration with Sustainable Construction Technologies: Pollution absorbing bricks can become an important component of future sustainable infrastructure development.

6. CONCLUSIONS

Based on the experimental results obtained from the compressive strength and water absorption tests, the pollution absorbing brick prepared using Zinc Oxide (ZnO) shows satisfactory performance in terms of strength, durability, and environmental benefits.

The water absorption test result shows that the pollution absorbing brick has lower water absorption compared to conventional bricks, which improves its durability and resistance to moisture penetration. The addition of Zinc Oxide (ZnO) also provides an environmental advantage as it helps in reducing harmful air pollutants present in the surrounding atmosphere.

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9.Biography:

