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Seminar Report On

TOPIC

Role of Architectural Elements in Air Purification

Towards partial fulfilments of under

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ABSTRACT

With the continued growth of the global economy, environmental degradation, particularly from industrial activities, has become increasingly apparent. As society seeks both material comfort and an improved quality of life, ensuring clean air has emerged as a vital concern. In response, air purifiers have been developed to improve indoor air quality. These devices have rapidly gained public interest, leading manufacturers to innovate continuously to meet a wide range of user needs and remain competitive. This study provides a comprehensive analysis of air purifiers, focusing on their design, dimensions, materials, and manufacturing processes. It also explores the critical connection between design choices, material selection, and production techniques.

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CHAPTER ONE
INTRODUCTION

Pollution is a serious issue that affects the entire world. Cities are made up of many parts, and the way they expand and change directly impacts on our health, the environment, the economy, and even how our surroundings look and feel. Both existing buildings and new ones being built can influence how we connect with nature and may help improve the air we breathe.

To fight pollution, we need smarter city planning, a stronger focus on eco-friendly practices, and strict environmental rules at all levels. Planting more trees and greenery, selecting safer building materials, and using paint and finishes that contain fewer harmful chemicals (called VOCs) are just a few ways we can help reduce pollution. But these solutions will only be effective if we take pollution seriously and act quickly to deal with it.

➢ *Causes of Air Pollution the Various Causes of Air*

- *Pollution Are:*

Air pollution happens for many reasons. Some of the main causes include:

Using fuels like petrol, diesel, coal, and wood in factories, vehicles, airplanes, trains, power plants, farms, and even kitchens release harmful substances such as soot, carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides, and sulfur oxides.

✓ *Metal Processing:*

When metals are processed, they produce dust and harmful gases. These fumes can contain dangerous chemicals like fluorides, sulfides, and heavy metals such as lead, chromium, nickel, arsenic, mercury, and others.

✓ *Chemical Industries:*

Factories that make things like pesticides, fertilizers, weed killers, and fungicides release chemicals that pollute the air.

✓ *Cosmetics and Certain Industries:*

Products like cosmetics, as well as industries such as textiles, wheat flour mills, and asbestos-related work, also add to air pollution.

✓ *Construction and Craft Work:*

Activities like welding, crushing stones, and cutting or polishing gems release fine particles and dust into the air.

✓ *Household and Cleaning Products:*

Some air pollution also comes from natural or daily sources, such as using petroleum-based products in dry cleaning, paints, sprays, and varnishes that contain harmful chemicals.

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CHAPTER TWO
BACKGROUND

There are many plans aimed at reducing our exposure to both biological and non-biological pollutants. One of the most effective methods has been the development of air filters, which have become a key part of controlling our environment. According to the World Health Organization – often called the "promoter of health" – air pollution causes over six million deaths each year and is a major contributor to allergies.

Although we spend most of our lives indoors, that doesn't mean we're protected from pollution. In fact, indoor air can be up to five times more polluted than the air outside. This is due to a mix of airborne particles like mold, chemicals from cleaning products, and dust mites that are commonly found in our homes.

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CHAPTER THREE
WHY IS IT NEED?

It is necessary for fresh/clean air at such places.

It is also important to use some building elements which will help with air purification naturally.

Table 1 The normal air (clean, dry) is composed of different gases as follows:

Oxygen	20.93%
Co2	_ 0.03%
Nitrogen	78.10%
Argon	0.94%

Air plays a crucial role in maintaining Earth's balance by helping recycle key elements like carbon, which mainly comes from burning fossil fuels and decomposing dead organisms. However, with rapid urbanization, population growth in cities has surged, leading to severe air pollution that threatens both human health and the environment. India is facing a serious air pollution crisis, with many of its cities ranked among the most polluted in the world. Fine particles in the air can have serious health impacts, contributing to conditions such as asthma, chronic obstructive pulmonary disease (COPD), allergies, and even sleep disorders like insomnia. In some cases, poor air quality can result in long-term health issues. Air purifiers play a vital role in improving indoor air quality by removing harmful particles, unpleasant odors, and allergens, helping people breathe easier and live healthier. This review focuses on the causes of air pollution, the importance of using air purifiers, and how these devices function.

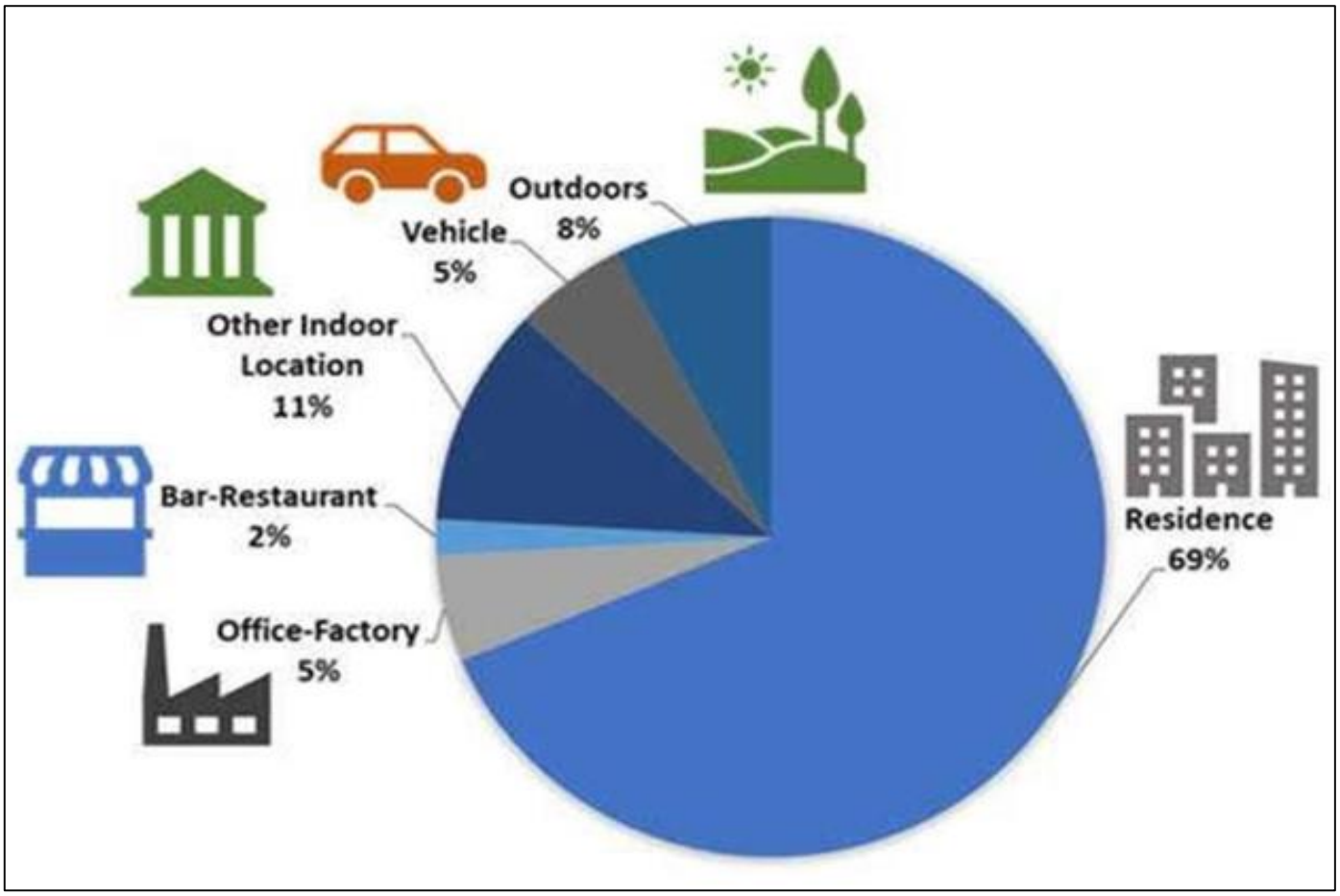

Fig 1 Percentage of Time Spent in Various Locations, Including Residence, Outdoors, and Other Indoor Spaces.

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CHAPTER FOUR
NEED

After the COVID-19 pandemic, making sure the air inside homes and buildings is clean has become more important than ever. People are now more aware of how clean indoor air affects health, and this will likely influence how buildings are designed and built in the future.

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CHAPTER FIVE
AIM

To study air pollution affecting factors in architecture.

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CHAPTER SIX
OBJECTIVES

- *To Take a Step Forward and Help to Meet Present Demand of the Country*
- *To Purify the General Quality of Air in the Vicinity.*
- *To Make Building Orientation with Air Purification System with its own Design and Element.*
- *To Develop Awareness about the Pollution Adaptive Methodologies of construction. To Study General Overview of Air Pollution and its Various Aspects*

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CHAPTER SEVEN
SCOPE

- *To Study about the Different Air Purification Elements which can be use in Buildings.*
- *To Understand the Limitations and Outcomes of these Techniques.*

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CHAPTER EIGHT
LIMITATION

- *It will be Limited only for Building Elements.*
- *Limitation comes with Different Climatic Conditions.*
- *It will mainly Focus on Façade Design to Save Buildings from Air Pollution*

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CHAPTER NINE
METHODOLOGY

- *Define the Research Problem*
- *Conduct a Literature Review*
- *Formulate Research Questions and Hypothesis*
- *Select Research Methods*
- *Case Study*
- *Analyses Data*
- *Conclusion*
- *Reference*

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CHAPTER TEN
CASE STUDY 1

➢ *Location: Delhi, Connaught Place.*

- *Background:*

In 2019, the Supreme Court instructed the Central Pollution Control Board (CPCB) and the Delhi government to create a plan for installing smog towers to help reduce air pollution.

Following this, IIT-Bombay submitted a proposal to the CPCB for setting up these towers.

In January 2020, the Supreme Court ordered those two smog towers be installed as a trial by April.

The first of these towers were set up at Connaught Place, and the second one is almost finished in Anand Vihar, East Delhi, with the CPCB overseeing its construction.

Fig 2 Smog Tower

➢ *About:*

Smog towers are tall structures that function like giant air purifiers.

They contain several layers of filters that clean the air by removing harmful pollutants as it moves through the system. The largest smog tower in the world is in China.

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CHAPTER ELEVEN
CASE STUDY 2

The facade is made of two layers of special concrete bricks that pull air into a space between them.

Inside this space, filters are installed to clean out heavy pollutants from the air.

After filtration, the purified air enters the building using either passive or active ventilation. One innovative example is Breath brick, created by Carmen Trudell. It works like the skin of an animal, filtering air before it enters the building.

This system can remove around **30% of fine particles** and **70% of larger particles** from the air. The facade features a cyclone filter that separates and collects heavy particles in a detachable bin at the bottom.

It also includes insulation and a smart surface design to guide airflow and support the building's structure.

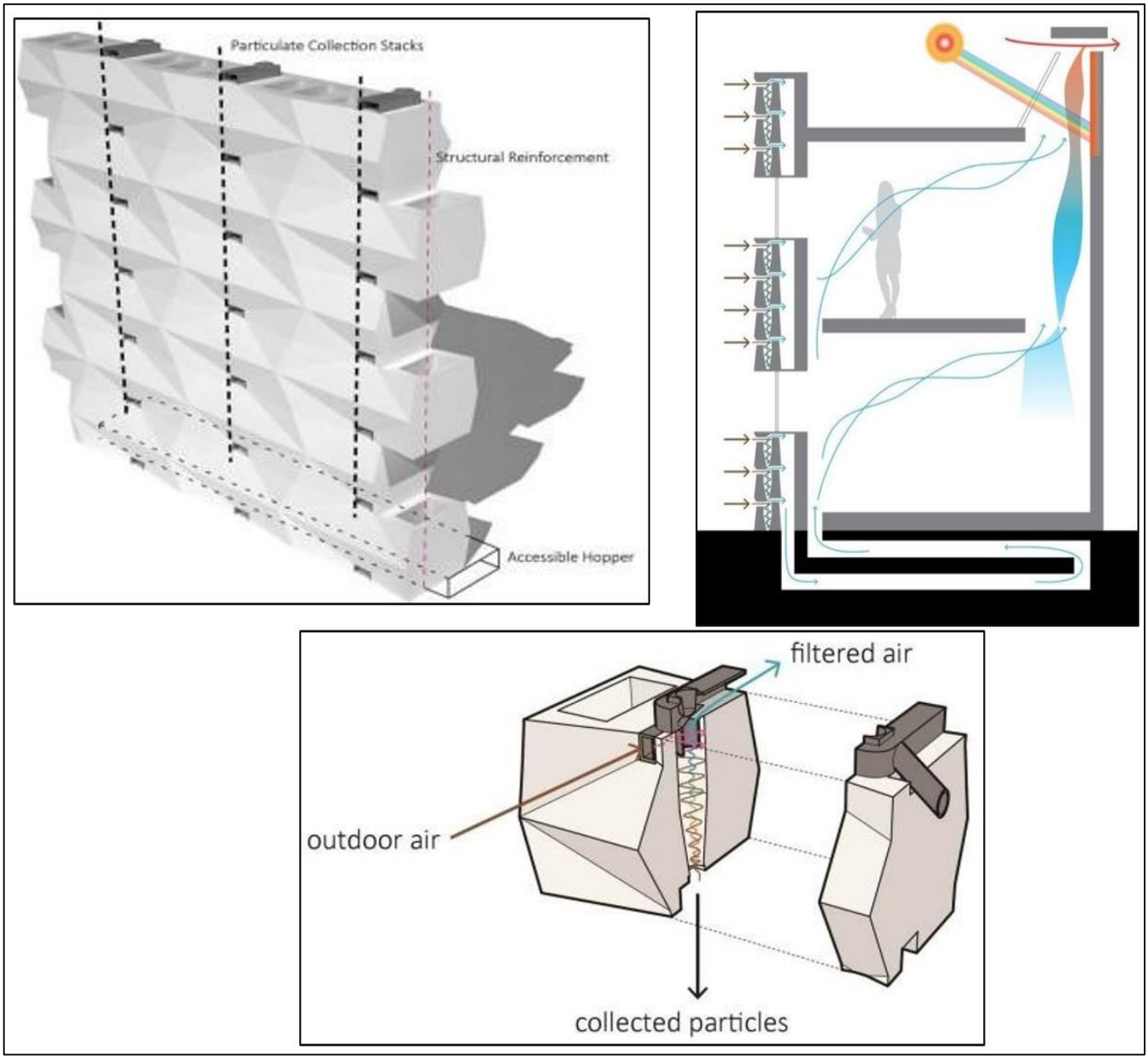

Fig 3 Air Filtration and Ventilation Systems Using Breathe Brick and Double-Wall Assemblies or more descriptively

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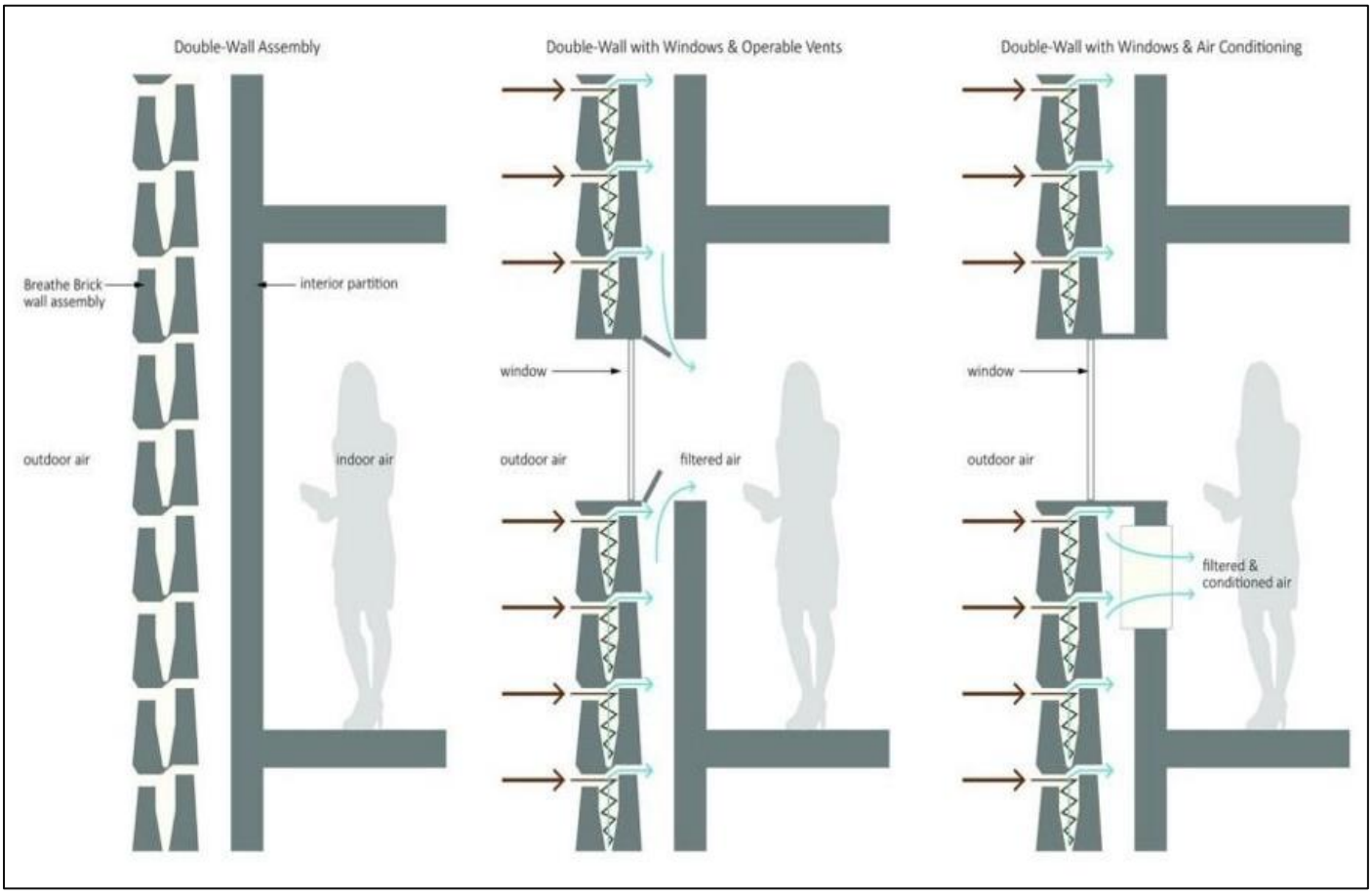

Fig 4 Illustration of Passive and Assisted Ventilation Techniques Incorporating Breathe Brick Units, Double-Wall Systems, and Air Filtration Mechanisms for Improved Indoor Air Quality

➢ Passive Methods for Air Purification

- *Effect of Indoor Plants*

Indoor plants help improve air quality by absorbing harmful gases through their leaves and roots. They are effective in removing pollutants like benzene, found in plastics, fabrics, pesticides, and cigarette smoke, and formaldehyde, which is present in products like cosmetics, dish soap, fabric softeners, and carpet cleaners.

The key process involves beneficial microorganisms in the plant soil that help break down and neutralize these pollutants. Some of the most effective plants for removing indoor air pollutants include Japanese royal ferns, spider plants, Boston ferns, purple waffle plants, English ivy, areca palms, golden pothos, aloe vera, snake plants, and peace lilies.

Name of the plant	Family	Growth habit
Dypsis lutescens	Araceae	Erect, small
Orchid (*Dendrobium*)	Orchidaceae	Small plant
Aloe vera	Xanthorrhoeaceae	Small plant
Spathiophyllum	Areceae	Small palm
Chlorophytum comosum	Liliaceae	Medium plant
Nephrolepis obliterata	Lomariopsidaceae	Small plant
Hedera helix	Araliaceae	Vigorous climber

Fig 5 Botanical Classification and Growth Habits of Selected Indoor Plants for Air Quality and Aesthetic Use

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Indoor plants can clean the air by taking in harmful gases through their leaves and roots. Common indoor pollutants like benzene and formaldehyde, which come from things like plastics, cleaners, and smoke, can be reduced with the help of plants. The soil around the plant also has tiny microbes that help break down these pollutants. Some of the best plants for this purpose include spider plants, ferns, English ivy, aloe vera, snake plants, and peace lilies.

- *Material Analysist*

When choosing materials for air purifiers, we look at two main parts — the outer casing and the inner filter. Different materials are used in each, depending on their function. For building facades, titanium dioxide fins can be added as they help clean the air by breaking down pollutants.

- *Use Place*

Air purifiers are especially important in certain environments. For example, in hospitals— where many people come and go and the risk of spreading infections is high—using medical-grade air purifiers can help disinfect the air and improve safety alongside regular cleaning. In newly renovated homes, harmful chemicals like formaldehyde and benzene are often present. These are known by the World Health Organization to cause serious health issues, including cancer and respiratory problems. Installing air purifiers in such spaces can help remove these toxins faster and reduce health risks.

- *Material Strtergies can be Use In Façade Design to Save From Air Pollution in Buildings*

- An Ornate Double Skin that Filters Air Pollution

A unique double-layered facade has been designed to filter both air pollution and sunlight entering buildings. Created by the Berlin-based firm Elegant Embellishments, these special prosolve tiles can be arranged to form an entire exterior wall.

These tiles help purify the air by turning harmful nitrogen oxides into harmless compounds like calcium nitrate, water, and carbon dioxide.

This is achieved through a coating of titanium dioxide, which uses UV rays to trigger the reaction. Since titanium dioxide acts as a catalyst, it doesn't wear out and can keep purifying the air indefinitely.

The system not only cleans the air inside buildings but also improves air quality in the surrounding environment.

These tiles can be arranged in different shapes to fit architectural styles and help reduce heat from the sun. Notable installations include the Manuel Gea Gonzalez Hospital in Mexico and the Italian Pavilion at Expo 2015 in Milan.

- *Bio-Digital Curtain Filters Air While Creating Bioplastic*

The Bio-Digital Curtain, called 'Photosynthetic,' is a special membrane made from bioplastic and filled with living algae.

This system helps clean the air by using photosynthesis to turn carbon dioxide (CO_2) into oxygen. At night, the algae give off a natural glow, which can be used for decoration or lighting building facades. Impressively, each unit of this curtain can absorb up to 1 kilogram of CO_2 daily.

The algae also produce biomass as a by-product, which can be collected and turned into bioplastics including the membrane itself. Designed by the London-based firm ecologic Studio, this innovation addresses the challenges of climate change.

City air is pushed into the base of the curtain, causing bubbles to rise through the algae. As the CO_2 moves up, it is captured and transformed into oxygen and biomass, while the modules glow at night and act as mini air-purifying reactors.

- *Bioreactor Façade*

The Bioreactor Façade is an innovative smart material designed to perform several functions at once, such as cleaning the air, generating oxygen, and producing green energy.

It contains algae that uses sunlight to convert carbon dioxide into oxygen, helping reduce pollution. This system also filters sunlight entering the building, which lowers indoor heat in summer while letting in more light during colder seasons.

The sunlight absorbed by the facade is used to heat water for the building's heating system. Additionally, the algae produce biomass, which can be harvested and turned into renewable energy.

By relying on photosynthesis, the facade helps control indoor temperature, reduces reliance on fossil fuels, and promotes sustainable energy use in buildings.

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CHAPTER TWELVE
CONCLUSION

- This kind of building facade can improve air for human beings as well as fit in every type of building.
- Fresh and pure air is must for everyone specially patients in hospitals.so this will be most usable.
- It can be fitted in facade design while doing construction, no need for any external element to purify the air.
- It will be effective research topic considering today's problem of extreme pollution increasing in every city day by day

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