

EDITORIAL

HEALTH IMPACT OF AIR POLLUTION

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Pakistan's urban air pollution is among the most severe in the world. In November 2024, Lahore-Pakistan became the most polluted city in the world. The toxic smog has left citizens struggling to breathe, and over 15,000 people have been hospitalized. There are numerous causes of pollution across the major cities of Pakistan; pollution put out by vehicles and factories, and the stubble burning taking place in the winter months. A combination of legislative, technological and social behavioural changes is to be made to solve this problem. Air pollution is injurious to human health. Wearing masks, developing urban forests, building parks and fountains in cities can mitigate air pollution. Where there is a lack of free areas for landscaping, an 'Algae Bioreactor' can be used. An algae bioreactor is a machine that utilises microalgae to capture carbon dioxide through photosynthesis and wastewater to produce biomass and oxygen. Types and amounts of indoor air pollutants differ from those found outdoors. Indoor air may contain a variety of contaminants, including particulate matter, tobacco smoke, radon, biological contaminants and many chemicals. Eliminating smoking indoors, using products with low Volatile Organic Compounds (VOC) emissions, reducing Radon levels, using exhaust fans, and cleaning air filters of air conditioners can reduce indoor air pollution. Air purifiers can be used to clean indoor air. Small units of Algae Bioreactors can also be used to decrease air pollution indoors.

Keywords: Indoor air pollution, Outdoor air pollution, Smog, Liquid tree, Air purifiers

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The World Bank estimates that Pakistan's annual burden of disease due to outdoor air pollution accounts for 22,000 premature adult deaths and 163,432 DALYS lost, while that for indoor pollution accounts for 40 million cases of acute respiratory infections and 28,000 deaths per year. The WHO Global Health Observatory estimates that about 30 deaths per 100,000 are attributable to indoor air pollution; while about 25 deaths per 100,000 are attributable to outdoor air pollution.¹ Indoor air pollution is much more dangerous than the outdoor air pollution.

Outdoor (Ambient) Air Pollution

Pakistan's urban air pollution is among the most severe in the world, and it significantly damages human health and the economy. The World Bank's document in 2014 warned Pakistan that "Current trends, including industrialization and urbanization, suggest that air quality will worsen unless targeted interventions are adopted. The harm caused by air pollution in Pakistan's urban areas is the highest in the South Asian Region."² Within ten years of this warning, in November 2024, Lahore has become the most polluted city in the world with its AQI soaring to 1165, more than 120 times the levels recommended by the World Health Organization (WHO). The toxic smog has left citizens struggling to breathe, and over 15,000 people have been hospitalized due to respiratory issues.³

Smog is indeed one of the most dangerous forms of air pollution that poses significant threats to human health, the environment, and the economy. The term 'smog' was first coined in the 1900s to describe the combination of smoke and fog that blanketed urban

areas. Smog is a visible, fog-like mixture of pollutants in cold air that forms when emissions from vehicles, industries, burning of crop remnants and other sources react with sunlight and atmospheric chemicals.⁴

There are numerous causes of pollution across the major cities of Pakistan, with some of them being more of a year-round constant, such as the pollution put out by vehicles and factories, and others being seasonal such as the stubble burning taking place in the winter months, compounded by the cold air. Fine particulate matter arises from the burning of fuels inside car engines, such as carbon and nitrogen dioxide (NO₂) and sulphur dioxide (SO₂), are released in high quantities. Fumes from burnt plastics produce chemicals such as dioxins, furans, polycyclic aromatic hydrocarbons, polychlorinated biphenyl, as well as dangerous metals such as lead, mercury and cadmium. Health issues that arise from breathing polluted air are numerous, e.g., a number of respiratory ailments such as pneumonia, bronchitis, emphysema and aggravated asthma attacks, ischemic heart disease, increased risk of stroke, heart attack, arrhythmias, liver and kidney damage, and death.⁵

Pakistan has a long way to go in order to remove itself from the top spot of most polluted countries worldwide. A combination of legislative, technological and social behavioural changes is to be made to solve this problem. Wearing mask should be mandatory to prevent harm of breathing polluted air. Growing trees in urban areas (urban forests), building parks and fountains in cities can mitigate air pollution. Trees and green areas represent natural air purification system in urban areas, but where there is a lack of free areas for landscaping, or in emergency situations an

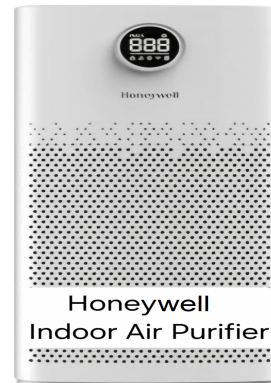
'Algae Bioreactor' can be used. An algae bioreactor is a machine that utilises carbon dioxide (CO₂) through photosynthesis and wastewater to produce biomass and oxygen. For example, 'LIQUID 3' is an efficient and innovative solution for reducing greenhouse gas emissions and improving air quality in cities. Liquid 3 is often called a 'liquid tree'. The microalgae in 'LIQUID 3' replace two 10-year-old trees or 200 square meters of lawn. The basic principle is the same because both Liquid 3 and trees and grass perform photosynthesis and bind carbon dioxide. The advantage of microalgae is that they are 10 to 50 times more efficient than trees in capturing carbon dioxide. A Liquid 3 requires only 6.25 square meters space. It is not to replace forests, but to fill those urban pockets where there is no space for planting trees. In certain conditions of great pollution, trees cannot survive, while algae do not mind that pollution.⁶

Indoor Air Pollution

Indoor air pollution costs more lives and causes more morbidity compared to outdoor pollution. In urban areas, humans spend more times indoor, whether that is home, office, shopping mall or restaurants and are exposed to indoor air pollutants. Exposure is a function of pollutants levels and the time spent in contact with the pollutants. Indoor atmosphere is essentially an extension of outdoor atmosphere. When outdoor air has excess pollution, it will pollute the indoor air through ventilation. The indoor air composition, in terms of its main constituents (O₂ and N₂), is essentially the same as in outdoors, but the types and amounts of indoor air pollutants differ from those found outdoors. Indoor air may contain a variety of contaminants, including particulate matter, tobacco smoke, radon, biological contaminants (e.g., mould, bacteria, fungi, dust mites, spores, and pollen) and more than 400 organic and inorganic compounds with associated health effects. Indoor air pollutants may concentrate 10 times their concentration outside. Sources of indoor pollutants are indoor activities, cooking, cleaning, and rats, mice and cockroaches.⁷

Indoor air pollution can be managed by reducing sources of pollution, having proper ventilation and by using some sort of air cleaning system. Eliminating smoking indoor, using products with low

Volatile Organic Compounds (VOC) emissions, reducing Radon levels, increasing ventilation, using exhaust fans, and cleaning air filters of air conditioners can reduce indoor air pollution. Indoor air can be cleaned and its oxygen level increased by having indoor plants like money plant, moonshine snake plant, majesty palm, sansevieria, aloe vera etc. Various types of air purifiers are available which can be used to clean indoor air. Small units of Algae Bioreactors can also be used to decrease carbon dioxide level and to decrease air pollution indoors.



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