

# **Suppressing Air Pollution in Metropolitan City by Solar Chimney Using Helio-aero- gravity Principle**



**By**

**Sumaira Yaseen**

**I.D : 13002139010**

**Supervisor**

**Prof. M. A. K. Lodhi**

**Department of Physics**

**School of Science**

**University of Management and Technology C-II, Johar Town**

**Lahore – 54770, Pakistan**

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By

**Sumaira Yaseen**

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**UNIVERSITY OF MANAGEMENT AND TECHNOLOGY**

**C-II, JOHAR TOWN LAHORE – 54770, PAKISTAN**

## **RESEARCH COMPLETION CERTIFICATE**

Certified that the research work contained in this thesis titled, **“Suppressing Air Pollution in Metropolitan City by Solar Chimney Using Helio-aero- gravity Principle”** has been carried out and completed by **Sumaira Yaseen, ID: 13002139010**. The quantum and the quality of the work contained in this thesis is adequate for the award of Degree of MS/M.Phil.

---

**Prof. M. A. K. Lodhi**

Professor of Physics

University of Management and  
Technology, Lahore

---

**External Examiner**

---

**Dr. Ehsan Ellahi Khawaja**

**Chairperson,**

Department of physics

UMT, Lahore.

---

**Dr. Muhammad Azhar Iqbal**

**Dean**

School of Sciences,

UMT, Lahore.

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I **Sumaira yaseen d/o Muhammad Yaseen** ID: 13002139010, Session 2013-2015 hereby declare that the matter printed in the thesis titled “**Suppressing Air Pollution in Metropolitan City by Solar Chimney Using Helio-aero- gravity Principle**” is my own work and has not been printed, published and submitted as research work, thesis or publication in any form in any University, Research institution etc. in Pakistan or Abroad.

Dated: \_\_\_\_\_

\_\_\_\_\_  
(Sumaira Yaseen)

## DEDICATION

Dedicated to

My Parents and Teachers

## ACKNOWLEDGEMENTS

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## List of Abbreviations

<b>Symbol</b>	<b>Abbreviation</b>	<b>Symbol</b>	<b>Abbreviation</b>
AC	Air conditioners	K <sub>2</sub> CO <sub>3</sub>	Potassium Carbonate
Ar	Argon	K.E	Kinetic and Kinematic Energy
As	Arsenic	<i>k<sub>v</sub></i>	Empirical constant
Ca (OH) <sub>2</sub>	Calcium Hydroxide	MEA	Monoethanolamine
Cm	Centimeter	NaOH	Sodium Hydroxide
CDGL	City District Government of Lahore	NO	Nitrogen Oxide
CFC	Chlorofluorocarbons	η	Power coefficient
CFD	Computational fluid dynamics		
CHASNUPP	Chasma Nuclear Power Plant	NH <sub>3</sub>	Ammonia
C <sub>6</sub> H <sub>6</sub>	Benzene	O <sub>2</sub>	Oxygen
C <sub>7</sub> H <sub>8</sub>	Toluene	P	Pressure
C <sub>8</sub> H <sub>10</sub>	Xylene	PM	Particulate Matter
CFPP	Coal Fired Power Plant	ρ	Density of air
CO <sub>2</sub>	Carbon Dioxide	SAEPP	Solar Aero-Electric Power Plant
Cd	Cadmium	SC	Solar Chimney
Cr	Chromium	SC	Supreme Court
CNG	Compressed Natural Gas	SCPP	Solar Chimney Power Plant
CNS	Central Nervous System	SCS	Solar Chimney System
DG	Director General	SPD	Static Pressure Distributions
EPD	Environmental protection department	SO <sub>2</sub>	Sulpher Dioxide
ET	Environment Tribunal	SPD	Static Pressure Distribution
Fg	Centrifugal Force	STPP	Solar Tower Power Plant
GT	Grand Trunk	T.E	Thermal Energy

Hg	Mercury	Tl	Thallium
IRC	Integrated Reforming Combined	TPP	Thermal power plant
KANUPP	Karachi Nuclear Power Plant	Zn	Zinc

## Abstract

Air pollution can be purified using solar chimney in a metropolitan city. Reduction of carbon dioxide (CO<sub>2</sub>) and sulfur dioxide (SO<sub>2</sub>) from the atmosphere play an important role in these purifications. In this study a chimney is proposed to be constructed in the heart of the town, where the most polluted air needs to be cleaned. The water is sprayed on the top of the chimney that makes the air cool and denser. The cooled denser air descends to the bottom of the chimney where air turbines are placed. This air starts the turbine to produce electricity. The air is then passed through the filters which capture the particulate. To remove the undesirable gases the appropriate chemical reagents are placed at the bottom. Various routes of capturing CO<sub>2</sub> and SO<sub>2</sub> from the air are discussed physically and thermodynamically feasible. It is explained how large scale collection of these gases can be made using different reagents such as (NaOH, KOH, K<sub>2</sub>CO<sub>3</sub> and Ca (OH)<sub>2</sub>) as possible sorbent. The cost estimate and energy producers are briefly discussed. Other quantities involved during this process as gas uptake, liquid flow rate, air flow rate, air pressure drops are discussed. This technique, in particular, is applied to Lahore to clean its air. For that purpose the environmental data for Lahore metropolitan area has been collected and analyzed. By using solar chimney approximately 30% air pollution can be reduced in Lahore city.

## Chapter No. 1

### 1. Introduction

#### 1.1 Air Pollution

Polluted air, that contains highly toxic gases, is a major issue that needs to be addressed in these days. Air pollution is causing environmental problems for the whole mankind. Countless factors (industrialization and motorization) contribute in amassing air pollution. Today, the atmosphere over major cities around the world is mostly polluted due to smoke of automobile as shown in Fig.1. The death ratio due to automobiles pollution has been growing drastically in the metropolitan cities. With time the polluted air has severe issue on health and climate.



Figure 1 Automobiles generating pollution enhancing temperature

The significant pollutants like oxides of carbon (CO, CO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), black smoke and nitrogen dioxide (NO<sub>2</sub>) are performing central role for air pollution.