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

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IN

PHYSICS

By

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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.

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I **Sumaira yaseen d**/o Muhammad **Yaseen** ID: 13002139**10,** 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

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This research is a result of the Blessings showered and endowed by Almighty Allah, most Beneficent and Merciful for which I offer my gratitude to Allah. May the Holy Prophet Muhammad (PBUH) be praised who enabled us to recognize our creator.

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Author

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Symbol	Abbreviation	Symbol	Abbreviation
AC	Air conditioners	K_2CO_3	Potassium Carbonate
Ar	Argon	K.E	Kinetic and Kinematic Energy
As	Arsenic	k_v	Empirical constant
Ca $(OH)_2$	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_3	Ammonia
C_6H_6	Benzene	O_2	Oxygen
C_7H_8	Toluene	P	Pressure
C_8H_{10}	Xylene	PM	Particulate Matter
CFPP	Coal Fired Power Plant	ρ	Density of air
CO_2	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_2	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_2) and sulfur dioxide (SO_2) 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_2 and SO_2 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_2CO_3 and Ca $(OH)_2$) 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_2), sulfur dioxide (SO_2), black smoke and nitrogen dioxide (NO_2) are performing central role for air pollution.