The Contribution of Physics to Reduction in Environmental Pollution - Empirical Analysis

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Abstract

This paper studies Environmental pollution which is one of the most crucial global issues today, role of physics in containing various pollutants in our environment air, water, and soil. Environmental pollution is the major source of problems in human health and the sustainable development of society and economy in the world. The presence of environmental pollutants (i.e., heavy metals and persistent organic pollutants etc.) in air, soil, and water is a crucial environmental issue which draws great public concern and scientific attention. Careful and sensitive detection of the pollutants in environmental samples is crucial. Overview of various conventional analytical techniques for environmental analysis and new trends and future directions in the sensitive detection of pollutants in environmental samples is provided. With the description and the effects of environmental pollutants on ecosystems. Then their effects on public health are described. Analytical techniques for environmental analysis, new trends, and future directions are presented in the last section.

In the early part of the 21st century, air pollution claimed the majority of the public's attention in terms of hazards to the environment owing to the roiling debate over what to do about global warming, more broadly called climate change. Nowadays, virtually no honest and informed person disputes the validity of scientific research connecting human activities since the start of the Industrial Revolution in the mid-1800s to warmer average temperatures the world over since that time, with most of the rise occurring more recently. The real debate is not "Is human-caused climate change real?" but "Can anything be done to slow or stop it, and if so, what will this take?". Knowing more about that air pollution is crucial. From the fug of exhaust fumes in traffic-clogged streets to invisible vapours dispersed by industrial plants and gases released from fertiliser applied to fields, Earth’s atmosphere contains a cocktail of added ingredients. Many of these atmospheric extras turn out to be bad for our health. Scientists are just beginning to unravel the chronic impacts, but the early evidence is worrying. Long-term exposure to poor quality air has been linked to everything from low birthweight babies and teenage misbehaviour to arterial disease, respiratory problems and increased risk of dementia.

Key words: atmospheric extras, Industrial Revolution, chronic impacts, air pollution, fertilizer, soil.

Introduction

Changing the scientific path of human societies into the current advanced industrial societies cause that modern technologies with intervention in the applied market, which is proportional to the needs of the industrial society, advance towards the former science and industry substructure. The expansion and movement of air conditioning

industry is directed towards the same way. Therefore, today in health centers, industrial and constructional centers, new approaches are recommended in refining, monitoring, and air conditioning.

As you may well-aware of, some of the former and current industrial equipment of different types of electrostatic air conditioning systems are produced and used with carbon and nano filters. Looking back at the effect of air ionization or electrical discharge of air, we can recommend a strategy in the optimal management in improvement of quality of the macro air conditioning systems in health care centers, industrial centers and urban tunnels. In the process of ionization of gases, by using a high voltage constant current source, accelerated electrons moves away from the electrodes, which during its path toward the opposite pole coronal discharge, it will change the air molecules with emission / absorption of energy into the charged positive / negative ions. Although a small number of electrons produced initially, but then the required electrons will be provided for the next ionization and avalanche ionization. Sequential repetition collisions of these particles makes the plasma environment, and its result and application in the field of modern technologies that is related to agriculture, animal husbandry, poultry farming, industry and the environment is negligible. So in the macro-air ionization, we face a factor in optimization of air conditioning cycle of crowded centers or refining environments from gaseous and non-gaseous (PM10 and PM2.5) pollutants. Determining the main target of ionization, network structures, size and order of the discharger electrodes which suit the required environmental conditions will change and will have a direct impact on changing the efficiency power and refinery output power.

Soil, air and water might be considered the three fundamental environmental needs upon which modern life, or any life, relies most prominently. Clean air is required for optimal respiratory and cardiovascular health, and for a generally pleasant everyday outdoor experience. Clean drinking water is perhaps even more vital as toxins in the water can be deadly in various ways, either building up in the system over time (as with lead or other chemical agents) or causing disease and even death in the short term (as with microbial ailments such as dysentery and cholera). Soil pollution, and the related problem of soil erosion, gets less attention than the other forms of environmental degradation, but soil arguably plays just as critical a role as air and water. It is a vital source of carbon and needed to feed the world's people, a major consideration given that the world's population is expected to grow from 7 billion almost two decades into the 21st century to 9 billion by the year 2050.Soil pollution is an example of how pollution in one form leads to issues in another. The climate change engendered in part by air pollution contributes to increased levels of soil erosion owing to drier conditions. Topsoil losses as a result of erosion cost farmers billions of dollars a year worldwide. The three greatest threats to soil in developed countries are erosion by wind and rain, leading to a loss of water quality and aquatic ecosystems; the compaction of soil, which reduces agricultural productivity and water infiltration; and organic matter decline, which reduces soil quality and affects the supply of nutrients, making it harder for plants to grow. Particle pollution, often called particulate matter (PM) in environmental-science parlance, consists of tiny pieces of solids or liquids floating in the air. These particles include dust, dirt, soot, smoke and droplets of liquid. Primary sources of PM cause particle pollution on their own, whereas secondary sources emit gases that then form particles. Wood stoves and forest

fires are examples of primary sources, while power plants and coal fires are examples of secondary sources. PM can cause eye, lung and throat irritation, trouble breathing, lung cancer and low birth weight. To lessen damage from particulates, spend more time indoors when air quality is bad, especially if you are older, have a chronic respiratory ailment or both. Also, avoid busy roads and highways, where PM density is higher.

Objective:

This paper intends to review Environmental pollution that represents one of the biggest risks to the survival of humankind. And how physics can help mitigate the menace

Ill effects of pollution

Pollution can travel far, sometimes hitching a ride on a storm, or surfing the breeze to cross an ocean. At Auchencorth during high pollution episodes the winds are often easterly, with a larger than usual fraction of pollutants coming from Western Europe. “Air pollution is not limited by boundaries and transport between countries is driven by meteorology,”. “We need to tackle emissions collaboratively across nations since this is a global problem.” Averaged across the year, however, the dominant source of particulate pollution originates from UK emissions.The successful implementation of permitting programs, monitoring programs and water-quality standards were prerequisites for the implementation of these management programs. The final three years were dedicated to the continued implementation of additional monitoring and evaluation systems and pollution control through the use of emerging as well as existing technologies.Ground-level ("bad") ozone is created by chemical reactions between nitrogen oxides and volatile organic compounds in the presence of sunlight. Emissions from industrial plants and electricity providers, vehicle exhaust, gasoline vapors and chemical solvents are some of the major sources of ground-level ozone's constituents. This ozone can cause health problems in people who already have lung diseases, such as asthma, and can harm vegetation as well.

Regulations established by the government aim to reduce pollutants that generate "bad" ozone. These include vehicle and transportation standards as well as rules concerning regional haze and visibility.

On an individual and family scale, it is possible to make use of some of the same principles. Home water-testing kits are available to assess your drinking water, whether it comes from a public reservoir or a well. Be sure to report anomalies in the area of metals and ions such as chlorine. Be careful to not waste water through frivolous means, such as leaving sprinklers running when rain is anticipated or has very recently fallen. A smaller burden on municipal treatment and sewage-disposal systems is vital for ensuring the availability of clean water – an indispensable element of good health – for everyone.

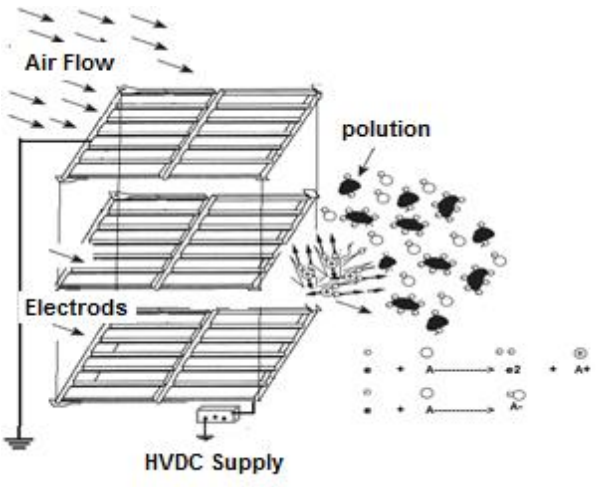
Containing: Air pollution strategy

With increasing population and increasing need for greater coverage by the respiratory air volume by air conditioning systems, the main challenge in this area is the design of air conditioning systems which with no doubt makes the role of modern technology in macro-air ionization in industrial air conditioning systems and underground tunnels more prominent In general because of breathing and the entry of pollutants into the environment, the harmful and positive ions density will increase. For this reason, it is necessary to design a system that can reduce the density of positive ions. So the positive ions should be neutralized and reduced in way that by increasing the negative ions density and by taking advantage of the modern technology of air ionization, this process becomes effective. Therefore, the scientific approach and mechanism of producing anion in the closed environments is considered a part of the discussion of new technologies in air-conditioning industry. In large-scale, industrial air conditioning systems that are based on modern technologies, and functional structure of producing anion and ionizing the environment is directly related to the corona discharge physical issues which will be possible through the high voltage switching source. Designed switching source is divided into two main sections: driver and high voltage. In the driver section, the required power through defined circuit by city electricity is ready to convert and transit to the high-voltage section. And, in order to manage the risks of high voltage of this device and for safety of the device, the required circuit is installed on the driver section. The end of the transition process of electrical current is the output driver signal with specific characteristics, which is used as the next section supplies, high-voltage power. In the high voltage section, the voltage taken from the driver section by using special tools and special design together in series will turn into the desired voltage output. The result of this two-part is production of high-voltage electric along with low electrical current. Using previous technology in electrical discharge, particular equations will be used to present a suitable voltage-current of ionization and coefficient parameters of the coronal field is presented by the equation below if d≫r0:

$$U_0 = E_c m_v \delta^2 r_0 \left(1 + \frac{0.03}{\sqrt{\delta r_0}}\right) ln\left(\frac{2d}{r_0}\right) \quad (1)$$

U_0 -is potential difference of the beginning of the electrical discharge, -E_c is Critical potential gradient of air and is equal to $3 \cdot 10^6 (\frac{V}{m})$, where m_v -is Parameter to determine the effect of electrode surface impurities, and its value for the smooth and monotonic electrode is equal one, which in the practical situation depending on the type of wire varies in the range of 0.85 to 0.98. And by the geometric parameters, distance and diameter of the electrodes is determined (The effect of geometric shape in different mechanisms of ionization with any polarity). δ -is gas index parameter, which is dependent on the pressure and temperature between the electrodes and in the standard conditions is equal to $\delta = 1$.Therefore, the ionization of air with high voltage power source will design by different techniques such as power voltage with single-electrode discharge or a multi-electrode discharge (Figure 1) and it varies based on the desired location of the electrodes discharge parameters and shape of the electrodes. It should be noted that the use of a composite electrode networks with a voltage between 30 and 80 kV (if required above)

next to or under a high-powered fan air blower in the direction of central air conditioning ducts in industrial environments, hospitals and infrastructure to reduce pollution and enhance the health of breathing



Air Ionization equipment.

In corona discharge electrodes, by establishing a high voltage in the discharger at the cathode, strong electrostatic will be created and the strong coulomb force on the free electrons near the discharger surface causes electrons to be accelerated towards the opposite electrode, and move away from discharger electrodes and thereby participate in the process of air ionization. When the higher voltage is applied and electric field intensity increase, the speed of electrons movement becomes faster. In the high voltage, accelerated electrons collide with air molecules such as non-killers O_2 and N_2 which will be created in the electromagnetic field, have enough energies to separate the capacity layer electrons of molecules and convert it into cation. According to the following equation:

$$AB + e \rightarrow A^- + B$$

$$O_2 + e \rightarrow O^- + O$$

The electrons collide with air molecules, producing the sequential secondary electrons will continue and many electrons will be produced and the process is known as electron avalanche which particles flow towards the positive electrode. Because of being heavy, the produced cation moves slower towards the opposite electrode. So on the way to attract electrons in the space between the electrodes will be converted back into a neutral molecule. And, re-enter to the cycle of ionization . Emission of electrons in a neutral space between the electrodes provides a situation for anion production. Negative charged region will be created in the path of oncoming emission through the pores and channels of air conditioner with direct effect, because of falling cation particles. On the sampling results, we review the impact of artificial ionization of the air in different phases of the haze dust of the particles PM10, and the nitrogen monoxide which its results is included in Tables (1 and 2): *The variation in circumstances and the discharger of air pollutants is located about 60-65 kilometers away from the pollutant)* Setting the artificial injection source in the effective potential and continuous output at least 12.10

ions in per cubic centimeter, makes dust and gas pollutants reduction by a factor of the coefficient effect of falling significant.

All various of pollutant concentration

Day	Initial concentration ($^{\mu g}/_{m^3}$)	Secondary concentration ($^{\mu g}/_{m^3}$)	Percentage change in concentration
1	584	420	28.08
2	606	310	48.84
3	806	310	61.54
4	842	700	16.68
5	852	240	71.83
6	891	560	37.15
7	989	340	65.62
8	1116	410	63.26
9	1145	590	48.47

Concentration of industrial pollutants (NO).

Day	**Initial concentration (ppb)**	**Secondary concentration (ppb)**	**Percentage change in concentration**
	NO	**NO**	**NO**
1	17.4	16.6	6.6
2	24.2	17.4	28.1
3	18.3	16.7	8.7
4	17.5	16.7	4.6
5	19.4	16.3	16.0
6	20.2	19.4	4.0
7	23.2	18.3	21.1
8	24.0	15.8	34.2

9	17.6	16.0	9.1

Macro Ionization Systems in the Hospitals

One of the known properties of air ionization systems is its bactericidal and anti-microbial effects. Although the definite mechanism of this effect is unknown, but several studies have shown that it exists. Antimicrobial effects of air ionization specially negative ionization are specified on some common types of bacteria, including Salmonella, Pseudomonas. What makes this technology has been not widely used as an antimicrobial is because of its uncertainty of mechanism's effect and doubts about its more general effect and being Biocidal. This means that the mechanism which causes loss of germs will cause the death of living cells in general and have side effects for human. However, it seems not to be a problem to apply this method in areas where it is not likely having impact on human like hospital air conditioning exists and isolation rooms. Those who believe that negative ionization is harmless to humans, will not recommend the use of this technology in the input air where infections cause serious problems, such as ICU, burn and emergency departments. It is clear that the systems which need to reduce airborne infections will benefit most from this technology.

Water pollution has a number of causes, such as release of contaminated effluents from various industries, sewage containing domestic wastes and pesticides from agricultural lands, the release of superheated water, and the release of waste and oil from refineries. The industrial water pollutants, such as mercury, cadmium, chromium, and lead, are poisonous. They are also capable of entering the food chain and causing diseases in the human body. Mercury is known to cause a disease called Minimata. Organochlorine pesticides (OCPs), such as dichlorodiphenyl-trichloroethane (DDT), in agricultural wastes are nondegradable and can be released into the food chains. Some industrial effluents can also cause changes in color, odor, and taste of the natural water. The contamination of water also leads to the spread of waterborne diseases, such as cholera and amoebiasis.

Nature of Particle pollution, nanomaterial pollutants

Soil pollution, also known as soil contamination, is defined as the presence of hazardous chemicals such as heavy metals, radioactive metals, nanomaterial pollutants, and toxic solvents in soil. These pollutants can easily penetrate soil affecting the organisms that live in soil. However, the effect of the presence of pollutants in soil or the lithosphere on both terrestrial animals and ecosystems is much more considerable as these substances accumulate in food chains. Fossil fuels may also lead to the pollution of soil and water. Some sources of fossil fuel–based soil pollution involve petrochemical plants, refineries, and motor vehicles. The indiscriminate use of various agricultural chemicals, such as herbicides and pesticides, and the improper disposal of industrial wastes are other causes of soil pollution.Air pollution can be defined as the presence of any liquid, solid, or gas compounds in the atmosphere at such concentration values that can directly or indirectly affect humans, animals, and/or plants. Air pollution is caused by certain domestic and industrial and activities.17–19 For example, the

increasing use of fossil fuels in industry, mining, transportation, and construction of buildings are crucial factors, which have led to air pollution. One of the major types of air pollutants is suspended materials such as dust, smoke, and fumes. Gas pollutants such as carbon monoxide, nitrogen oxides, and sulfur dioxide are the other type of air pollutants.

Conclusion

Security, health and health care in urban centers, enclosed public places, factories, hospitals, etc. is one of the fundamental social rights for a country's population. So, expansion of the underground public places metropolis such as subways, long tunnels in the city, underpasses pedestrians, increasing closed silos and many industrial centers as well as the increasing complexity of processes affecting the air pollution in large cities, will increase the need for healthy air conditioning systems in the cities and in the human community centers. The use and application of modern technologies in the increase of healthy and low-risk air conditioning equipment is necessary today. For this reason, using past achievements and integration of new technologies in air purification structure will improve the health of the public closed centers air and we can achieve the goals of protecting the health, safety and welfare of population effectively. Therefore, in this paper, we suggest the use of artificial ionization technology (aura electrical discharge) as a strategy to improve the situation in order to reduce unhealthy air pollutants, or in some cases having more breathing air for health care and industrial facilities.

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