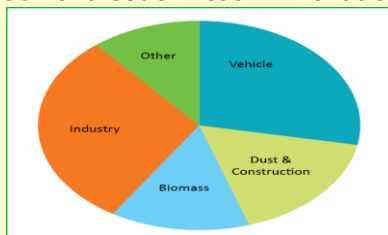


Current Issue: Beat Air Pollution



Sources of Particulate Air Pollution (Ref.: NCAP)

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From Director's Desk



We are very happy to release current issue of our institute's newsletter on the theme 'Beat Air Pollution' to commemorate World Environment Day 2019. Air pollution is one of the major challenges among developed as well as developing countries that is affecting their environmental quality index as well as threatening health of humans and other living beings. The gases, fumes, dust particles and odour released through different industrial activities, vehicular emissions and biological degradation creates smog and acid rain in the atmosphere, causes cancer and respiratory diseases, reduces the ozone layer atmosphere and contributes to global warming. Apart from outdoor air pollution, indoor air pollution is also rising on alarming rate. When countries are aspiring for economic development, air pollution cannot be eliminated completely, but steps can be taken to reduce it. The government has developed, and continues to develop guidelines for air quality and ordinance to reduce emissions in an effort to control air pollution. On an individual level, we can reduce our contribution to the pollution problem by carpooling or using public transportation. Additionally, utilization of energy efficient fuels, appliances and lamps or reducing electricity use will control the pollutants released in the atmosphere. Our institute is actively involved in finding solutions for controlling pollution through R&D activities and has jointly organized 'Airothon' a summit on Air Pollution Control and Management in 2017 and 2018 for Mumbai metropolis with Indian Pollution Control Association. The current issue of the newsletter is another step by us towards air pollution control and management.

Dr. Seema Mishra



Dust Control Study – Delhi

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Abstract: Dust from construction sites, industrial areas, agricultural operations, or roadways might contain pesticides, heavy metals, asbestos, bacteria, fungi, and a variety of other contaminants. Dust particles are very small and easily inhaled. Even short-term exposure to dust can cause respiratory problems and allergic reactions. Dust emissions also contribute to air pollution significantly.

This paper describes a field testing study that was conducted to determine the effectiveness of EPRI's dust suppressant to roads and construction sites. This study was conducted as a part of Central Pollution Control Board research study. The test roads and construction site were located at Delhi. The application of Dust Suppressant followed the conclusion and recommendations.

Introduction: Among all the types of pollution, air pollution is one of the major sources of pollution adding load to the pollutant levels. The increase of motor vehicle Emissions, as well as other anthropogenic sources gives rise to gaseous pollutants and smaller fractions of particulate matter along with carbonaceous and volatile organic compounds. The pollution in winters is mainly attributed to the dust storm due to high wind speeds.

This research was undertaken to demonstrate the effectiveness of dust suppressant at roads and construction sites of Delhi. The main objectives of the study

were:

- To control dust emission through scientific dust suppressant method as controlling dust emission through dust suppressant is more effective
- Monitor current level of dust emission using on-line dust meter (Dust track)
- Apply dust suppressant developed by EPRI on three specific sites for period of three days
- Providing detailed project report about the effectiveness of this project

Study Area: Delhi is the capital of India and its union territory of India. It is surrounded by Gurgaon, Uttar Pradesh, Haryana. It has area of 1,484 km² with population of 1.9 crores. There are various construction and development related projects in progress. They are major sources of air pollution, especially particulate matter. EPRI was to demonstrate control of dust using dust suppressants for these three sites selected. Mainly at these sites, construction activities were in full swing. Some activities were flyover construction, road construction, building construction, etc. Hence, these three sites were chosen and they were:

1. Sarai Kale Khan Road
2. DDA Construction site at Narela
3. Dilshad Garden flyover to proposed Shahid Nagar Metro Station

Methodology: During this study, dust was measured in terms of concentration of particulate matter (PM₁₀, PM_{2.5} and PM_{1.0}) . Before application of dust suppressant,

background concentration was measured at all three test sites for 4 hours in a day.

This dust suppressant has been developed with salts of Magnesium and Calcium along with bio additives. EPRI's dust suppressant is a hygroscopic, deliquescent compound that attracts moisture from the air and resists evaporation. This Dust suppressant binds fine dust particles to keep roads stabilized, to slow the loss of aggregate, and to reduce the need for costly regarding. It has been validated through laboratory studies and field trials under Indian conditions and scenarios. It is mixed with water and applied with 10 % dilution factor. For this study the area considered was 1, 00,000 Sq. m for each site application of 2 times a day for 3 days.

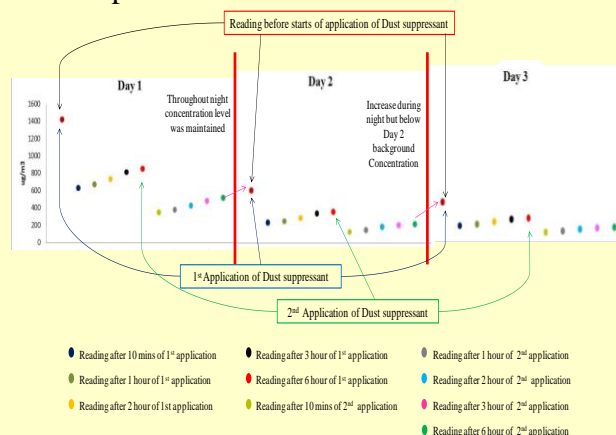
After application of dust suppressant, level of dust in terms of PM_{10} , $PM_{2.5}$ and $PM_{1.0}$ was also measured for duration of 10 mins, 1 hour, 2 hours, 3 hours, 4 hours & 6 hours interval for reduction in level of dust concentration.

Results:

- On all three sites, concentrations of overall PM emission were found to be varying depending upon the various activities
- Overall emission was consisting of construction activities and vehicles
- Vehicular emission was found to be less as compared to emissions from the construction activities
- Overall concentration of PM emission was found to be maximum in morning whereas in evening showed the less emission
- Dust emission included different sources like construction activities, digging, excavation, loading &

unloading of construction material, pedestrian movement and others.

- The wind movement is major factor to dispersion of PM



During study, in all locations, all the activities remained constant; hence no increase in pollution load was observed during night period. Also concentration level decreased from day 1 background level to Day 3 background level (before application readings) and it was also found the reduction level in concentration after application of for duration of 10 mins, 1 hour, 2 hours, 3 hours, 4 hours & 6 hours interval. The overall efficiency of EPRI's dust suppressant was found during study for shown in **Table 1**

Session	Time Period (after spraying dust suppressant)	Overall Efficiency (% reduction)
Morning	10 mins	61.13
	1 hour	54.64
	2 hour	49.28
	3 hour	42.96
	6 hour	37.88
Evening	10 mins	59.39
	1 hour	53.07
	2 hour	45.30
	3 hour	39.99
	6 hour	34.81

Conclusion & Recommendations:

The EPRI's dust suppressant was applied on three different sites. Effectiveness of dust suppressant showed that it can reduce the particulate matter at the site. Hence, dust suppressant can be applied to control particulate matter from re-suspension of road dust and construction activities. The literature showed that water sprinkling was effective for about 2 to 3 hours in terms of controlling dust and mechanical sweepers perform well at picking up heavy material such as coarse particles but are less effective at picking up finer material. Also, mechanical brooms are less effective at penetrating cracks and potholes in pavement, potentially leaving material behind. EPRI's dust suppressant has hygroscopic deliquescent property that attracts moisture from the air and resists re-suspension of dust. EPRI's dust suppressant can suppress the re-suspension of PM level from road for more than 6 hours depending upon site activities; it will last longer over road as compared to water. It is also effective for coarse dust particles. It is observed that during study, no environmental degradation occurs. In addition, it is cost effective as compared to mechanical sweeper. Hence, dust suppressant can be more useful in comparison of water spraying and mechanical sweeping for effective dust control.

In view of the above observations during the study period, the following are suggested/recommended:

- This study was demonstrated with single salt along with bio-additive; but combination of salts could be more

effective and hence that can be taken into consideration while carrying out next phase of research.

- The present study was limited for 3 days and limited sites have been covered in post monsoon season. It is suggested that some more experiments need to be done to evaluate the dust suppressant performance in different seasons.
- There is also need to compare the dust suppressant efficiency and water sprinkling for dust control in next phase of the study.
- A detailed construction management guideline must be prepared for controlling dust at National Level.

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Air Pollution: Causes and Management in Shipping Industry

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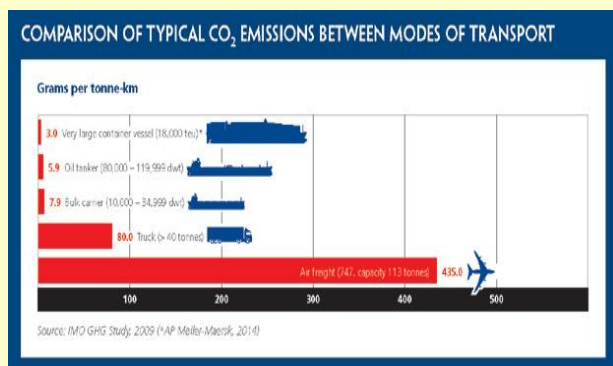
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The Global trade backbone is shipping. History tells us that Nations with good maritime fleet and connectivity were always prosperous and powerful. Shipping has made trade cheap and can move large quantities of commodities over large distances at a relatively fraction of a cost when compared to other conventional transportation methods.

While the population, GDP and the international trade have been on a constant rise, ships had to become bigger and faster. The present generation of vessels is extremely efficient and has the best cargo transportation efficiency.

	Third IMO GHG Study (million tonnes)						ICCT (million tonnes)		
	2007	2008	2009	2010	2011	2012	2013	2014	2015
Global CO ₂ Emissions*	31,959	32,133	31,822	33,661	34,726	34,968	35,672	36,084	36,062
International Shipping	881	916	858	773	853	805	801	813	812
Domestic Shipping	133	139	75	83	110	87	73	78	78
Fishing	86	80	44	58	58	51	36	39	42
Total Shipping	1,100	1,135	977	914	1,021	942	910	930	932
% of global	3.5%	3.5%	3.1%	2.7%	2.9%	2.6%	2.5%	2.6%	2.6%

The ships consume and proportionally emit approximately 3 to 4% of the global fuel emissions. With increasing cargo transportation projected in future, the emissions from ships are likely to increase.



The International Maritime Organization has the responsibility to measure and control the emission through regulations. IMO introduced regulations concerning the Prevention of Air Pollution from Ships in early part of this century and it entered into force on 19th May 2005. It primarily identified the following pollutants and preventive measures under various regulations:-

Ozone Depleting Substances

1. Nitrogen Oxides (NOx)
2. Sulphur Oxide and particulate matter (SOx and PM)
3. Volatile Organic Compounds
4. Incinerator
5. Fuel oil Quality and Availability
6. Green House Gas Emissions. (CO₂)



Figure shows the shipping traffic density and red with highest traffic and hence maximum air pollution. (EPA)

The IMO under its dedicated body MEPC (Marine Environment Protection Committee) lays the limits of the pollutants but does not specify how the pollutant needs to be controlled, the marine industry has the

option of exercising both the primary abatement principle and secondary abatement principle for achieving the desired limits set by regulator. The rules have been introduced for new building and existing ships in a phased manner without disrupting the trade and allowing the technology to be viable and available. The United Nations remains the

driving force behind these rules and the latest being the GHG regulations in shipping. The table below briefly introduces the mitigation technology processes that are presently being used or researched in Maritime domain.

		Primary Principle	Secondary Principle	Remarks
1	Ozone depleting substances	<ul style="list-style-type: none"> • Use Green refrigerants • Phase out CFCs and HCFCs 	Existing CFCs and HFCs recovered and sent for recycling	Globally Controlled by Montreal Protocol
2	Nitrogen Oxides (NO _x)	<ul style="list-style-type: none"> • Engine tuning to generate lower NO_x • Alternate Fuel technology • Fitting of NO_x reduction technologies 	Scrubber	Three stage approach.
3	SO _x and Particulate Matter	<ul style="list-style-type: none"> • Use of Low Sulphur Fuel • Use of Alternate Fuel like LNG 	Scrubber (Open loop type or Closed Loop Type or Hybrid Type)	Stage wise and area wise approach with emphasis on Global Limit at 0.5% S from 2020 and Special area limit to 0.1% S
4	Incinerator	<ul style="list-style-type: none"> • Reduction of Garbage / Waste generation • Approved Incinerators with Combustion parameter controls 		Presently no Scrubbers are fitted on the Incinerator Exhausts
5/ 6	GHG (CO ₂)	<ul style="list-style-type: none"> • Increase fuel efficiency of vessel operation • Low carbon foot print fuels / Carbon Neutral • Alternate fuels (Biodiesel or LNG) • Using the Shore Power when at port. • Alternate technology (Fuel cell / Nuclear) 	Carbon credits or carbon Trading.	IMO has initiated the fuel quality and quantity data collection system (DCS) to map the fuel consumption.



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Vehicular emissions have been identified as a prominent source of air pollution. Carbon monoxide, sulfur oxides, nitrogen oxides, hydrocarbons and particulate matter are the major pollutants arising from automobile exhaust. These emissions have adverse impact on human health ranging from acute to chronic effects such as cough, asthma, bronchitis, pneumonia, COPD, lung cancer and even death in extreme cases. Besides the respiratory system, they may affect eyes, skin and heart. The increasing disease burden is a major cause of concern.

Many methods have been adopted in India for abatement of automobile pollution. These include:

- Imposition of auto emission standards for both petrol as well as diesel based vehicles. Presently, Bharat stage IV standards are enforced and soon these will be upgraded to Bharat Stage VI.
- Enforcement of PUC Certificate
- Ban on Lead addition to petrol
- Use of catalytic converter to exhaust system
- Use of alternate fuel such as CNG and LPG and
- Ethanol blending of petrol.

Despite taking these steps, the pollution due to automobiles is increasing. In view of the recent incidences of Smog in Delhi and the non-attainment of air quality standards in many cities, the government has launched, National Clean Air Program in January

2019. The program aims at reducing the level of particulate pollutants by 20-30 % in the next five years. To control the pollution arising from automobiles, following actions have been proposed:

- The country is expected to adopt Bharat Stage VI norms by 2020 in order to comply with international standards for vehicle emissions.
- Fuel quality is expected to improve by reducing the sulfur content in fuels from existing 50 ppm to 10 ppm in BS VI vehicles.
- National Biofuel Policy has been revised to promote more ethanol blending of petrol and production and use of other clean fuels like biodiesel, CNG, LPG, etc. The government has expanded the scope of raw material for ethanol production by allowing use of various agro waste products.
- Travel by public transport will be promoted and mega projects like metro have been supported with this objective.
- Enforcement of PUC certificates will become stringent by depositing test data to a central database.
- The medium and heavy commercial vehicles contribute 60% of vehicular pollution. In order to control pollution from in-use vehicles, the government proposes to offer tax benefits and discounts to people who junk old vehicles and replace them with new ones.

- Ministry of petroleum and oil and Gas has launched a pilot project aimed at introducing CNG for two wheelers. It has also set up a Hydrogen Corpus Fund of Rs. 100 crores with contribution from major oil companies and oil industry development board for supporting research in various aspects of hydrogen.
- The government has launched National E-mobility program in 2018 to promote electric vehicles. It will create facilities for manufacturing of indigenous electric vehicles and their batteries, charging infrastructure, fleet operators, service providers, etc.
- The government will promote improvement in traffic management to avoid congestion.

- Introduction of CNG in two wheelers.

It is our responsibility now as good citizens of the country to do our bit and support this mission to keep air pollution under control.

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National Air Quality Index (AQI) in India

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Environment Matters



Excerpts from an article by Rahul Datar,
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National Safety Council

Ambient air quality monitoring has been practiced in India at the National as well as State levels since a long time, under the Air (Prevention of Pollution and Control) Act and Rules 1981.

The Central Pollution Control Board (CPCB) has been executing a nation-wide programme of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). The objectives of the NAMP are to determine status and trends of ambient air quality; to ascertain whether the prescribed ambient air quality standards are violated; to identify non-attainment cities; to obtain the knowledge for developing preventive and corrective measures and to understand the natural cleansing process in the environment through pollution dilution, dispersion, wind based movement, dry deposition, precipitation and chemical transformation of pollutants generated.

Air Quality Indices

AQI is a set of readings that transforms the weighted values of individual air quality related parameters (e.g. SO₂, CO, visibility,

etc.) into a single number or set of numbers. There are various ways of aggregating air quality data using a set of rules (for example, an equation) that translate individual parameter values into a more parsimonious form by means of numerical manipulation. The results of this are then categorized using descriptors of levels of air quality and corresponding implications such as, on human health, visibility, other environmental impacts etc.

National Air Quality Index in India

The Ministry of Environment, Forests and Climate Affairs (MoEFCC) through CPCB has established a National Air Quality Index scheme in which there are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI considers eight pollutants (PM₁₀, PM_{2.5}, NO₂, SO₂, CO, O₃, NH₃, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed. Of course, a lot depends on how the air quality is monitored, locations where it is monitored (the land use around them and resulting source bias). Since it is not practically possible to monitor data across multiple locations simultaneously, choice of number of monitoring stations and their locations / spatial distribution play a key

role in deciding the quality and accuracy of the data generated.

The AQI values and corresponding ambient concentrations (health breakpoints) for the identified eight pollutants are as presented below:

AQI Category (Range)	PM ₁₀ 24-hr	PM _{2.5} 24-hr	NO ₂ 24-hr	O ₃ 8-hr	CO 8-hr (mg/m ³)	SO ₂ 24-hr	NH ₃ 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5-1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1-10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430+	250+	400+	748+*	34+	1600+	1800+	3.5+

*One hourly monitoring (for mathematical calculations only)

Figure 2 NAQI Category, Pollutants and Health Breakpoints

Linking the ambient air quality to decision making has been another challenge for the authorities. For instance, if the ambient air quality is poor in certain areas, what options do the citizens have to avoid its harmful impacts? Are enough alternate traffic routes available or does switching to public transport help in such a case? What policies / strategies can Governments use to reduce the impact of adverse air quality? It needs a combination of policies and strategies implemented consistently over a medium to long term to see a positive change. Some interesting examples are given below:

- In Beijing, the government restricts what days you can drive your car if

there are too many consecutive days of high pollution. They shut down factories and prohibit the use of firecrackers and barbecues.

- Paris chooses to make public transportation free on days with high pollution.
- New Delhi has recently experimented with the odd-even numbered vehicles approach. While much of it has been a success, the long-term sustainability of such measures lies in consistency of implementation and cooperation from the citizens.

Conclusion

The CPCB is encouraging people to contribute by maintaining their vehicles properly (e.g. get PUC checks, replace car air filter, maintain right tyre pressure), following lane discipline & speed limits, avoiding prolonged idling and turning off engines while halting at traffic signals. In conclusion, the NAQI and other such indices are limited to 'representing' the air quality data as monitored across locations, in a form that is understandable to the general community. In order to ensure that the air quality objectives of the country are achieved, monitoring effectiveness and accuracy needs to be improved and maintained consistently as well as ways to link NAQI to decision making need to be identified and implemented.



Air Pollution & Prevention: Pros and Cons

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UN has declared Air Pollution as this year's theme for the World Environment Day, celebrations proposed to be held in China. The videos of air pollution in China and people using clean air cylinders for breathing were viral on social media sometime ago. But in recent past China is reducing the air pollution levels rapidly. When issue of air pollution in a country or city is discussed these are based on data collected at a few locations over a few days or may be all days, 24 hrs readings averaged to a day and then averaged to monthly or annual values and the results are extrapolated to the entire area of consideration. But would it be proper to adopt this sampling method in case of air pollution which is very dynamic in nature or one needs to modify it ?

This paper is an attempt to touch upon some of the important issues related to air pollution which are normally not discussed at length.

As readers would know, normal composition of air, it is not annexed. Any visible or invisible particle or gas found in the air that is not part of the original, normal composition is a pollutant. Causes of pollution could be natural like forest fires, pollen, dust storm or unnatural i.e. man-made; for e.g. fuel / fodder burning for various domestic, industrial, transportation, energy production etc. or even agricultural purpose, large scale excavations like mining, construction, open transportation of material, various processes involved in manufacturing, leakages, decomposition of waste material, vehicle emissions and so on.

These pollutants affect human health, vegetation and materials producing acute (short duration) or Chronic (long term) effects depending upon concentration and exposure. They could be affecting human skin, eyes, respiratory system especially lungs, kidneys, nervous system, brain, blood circulation and can sometimes be lethal. Ambient air quality standards and emission norms are specified by CPCB and are monitored by state pollution control boards who have an authority of initiating action against the polluter.

These pollutants can be removed from air in different ways. Particulates can be removed either by wet removal through precipitation, or dry removal through sedimentation, impaction and diffusion while gases can be removed either by wet removal through precipitation or chemical reaction in the atmosphere to produce aerosols and / or absorption on aerosols or absorption or reactions at land and ocean surfaces. Leaves of trees also hold the suspended particulates which can be later removed by sprinkling. But can the air pollution be removed artificially i.e. with human efforts once it has entered the atmosphere or it needs to be prevented before entering into atmosphere ? So many products have come forward for air pollution removal but are with limitations and hence one has to actually prevent the air pollution from happening i.e. source control and not try to reduce it from the atmosphere which is too huge to attend.

Over a period of time, newer and cleaner technologies have come in the market, more and more stringent standards are set for vehicle emission which has led to

improvement in fuel quality as well as engine designs. Euro and Bharat standards are comparable. Diesel vehicles are being substituted by less polluting CNG vehicles. To some extent, use of green fuel like biodiesel, electric cars, and busses is also started. Still megacities face problem of air pollution due to their expansion activities.

When growth of commerce, industry, housing is encouraged, infrastructure development with lot of construction, excavation and transportation activities, leading to substantial increase in suspended particles causing respiratory problems is inevitable, if proper care is not taken. C & D waste management rules have imposed certain restrictions. However, there is no specific provision of recording and maintaining air quality reports at every individual site. The monitoring is done by pollution control board or local body at specific locations and hence the contribution of every individual polluter in this field cannot be assigned to, like those in case of factories. Further, as air quality monitoring unit and project sites will be spatially distant, the real pollution values may not be recorded. The work hours or transportation hours are restricted, so by averaging to 24 hours the effect gets diluted. Seasonal winds also lead to diffusion over area and one ends up in reporting a much lesser value than actual at site. In case of assessing the damage to human beings, animals, plants, nature, biodiversity and environment at large and deciding compensations, the actual on site values need to be considered for which data is not readily available. It is generated only when some complaints arise. There needs to be provision of online reporting of air quality at such locations in the public domain i.e. at the public sites which could be accessible to everyone. Though this sounds costly (approx. cost of automatic weather monitoring station with display @ rupees 70 lakh). A sensor based air quality monitoring system mounted in a small vehicle will also have much smaller cost @ rupees 40 lakh and the results are

adequate for indicative purpose) and difficult task, it would not be in real sense when compared to the costs of various projects that are taken up. But this can certainly fix the responsibility of the polluter in an appropriate way. Project proponents would be more cautious in maintaining ambient air standards and pollution will not increase.

Same is the case with vehicular pollution which are instrumental in increasing PM₁₀, PM_{2.5} and NO_x and ozone which can together cause smog. CNG vehicles are better over diesel and gasoline vehicles for particulate matter and CO₂ and CO emissions, but NO_x values may be higher than those in gasoline vehicles i) at 25%, 50% and 100% throttle operations - Mr. Sarvanan V.S. Dr. Utgikar P.S. and Dr. Sachin Borse (2013) experimental studies, ii) at 3000-3500 rpm performance (Mohamad, T.I., H.H.Geok and others (2010) study on comparison of. The exhaust gas temperature of gasoline operation is higher than that of natural gas operation, while the exhaust valve seat temperature of natural gas is higher (R.Ebrahimi, M. Mercier (2010) experimental study) But what is more alarming is emission of methane in atmosphere due to use of CNG either at the filling stations escaping from nozzles, tail pipe emission. Methane's ability to trap heat in the atmosphere or its global warming potential is 21 times greater than that of carbon di-oxide. (Stephen Tambari and others ISOR-JMCE Jul-Aug 2014). Hence these vehicles could be instrumental in local warming. Though no precise quantified data is available in this matter, complaints of heating of CNG vehicle causing discomfort to drivers and passengers are common. One also needs to confirm whether vehicles which caught fire during last few hot days were only CNG or otherwise. Hence improvement in the nozzle, engines and emission control devices of such vehicles is a must.

In the last decade or so, vehicle prices haven't gone up much, vehicle loans are being offered at rates lesser than education loans, thus inviting more buyers, resulting in tremendous increase in the number of vehicles. No doubt individual vehicle gives travelling convenience and comfort, but it adds to pollution and local warming. The A.C. vehicles dissipate more heat (it is unbearable to stand near a.c. unit of a passenger bus even for couple of minutes) in the atmosphere and now a days almost all 4+ wheelers passenger carriers are becoming A.C. High temperature reduces ones energy and performance level. Further the sufferer is non-user.

Local warming is a predominant phenomenon though not discussed like global warming and one can verify it physically while travelling on a busy road and suddenly entering into non traffic bye lane. Unfortunately, vehicle emission norms do not have temperature criteria- may be because European countries are cold countries. For them, emission temperature is not an issue. There has not been a systematic study to assign contribution of individual vehicle in quantifiable units to local warming. But countries like us need to restrict the emission temperature at tail pipe as well as A.C. exhausts. If made mandatory, manufacturers will definitely come up with necessary changes in the vehicle. This will definitely bring down temperatures of crowded city roads.

Noise is also part of ambient air and strict norms restricting noise at construction sites,

factories, vehicle horns need to be monitored stringently. We do not always have foggy situation, vehicles do not travel at 100+ speed except on highways and in any case certainly not in cities. So horns are meant for travellers in the nearby distances whether pedestrians or vehicular. Naturally one does not need horns generating noise of high db. Except for railways, horns generating noise more than 60 to 70 db (which is fairly audible to a safe distance) should not be permitted. Police is the implementing authority for Noise Pollution.

One should consider the pain undergone by a common person who travels home in a public or personal transport after office hours or vice versa, through a busy road having an infrastructure development activity. He faces traffic jams, loses time, inhales polluted air, feels the heat and by the time reaches home or office has substantially lost energy to work further. Technically no creativity is left over. Therefore there is nationwide necessity to come up with strict implementation of measures to control air pollution on city roads where as on today it is difficult to ascertain contribution of individual polluter but collective hazard is visible by considering above suggestions. Rather continuous air quality monitoring units linked with GIS at strategic locations can also serve as a guide to traffic authorities who can decide which roads to be assigned for transportation and where the traffic needs diversion and which roads to be used for diversion.

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SIES INDIAN INSTITUTE OF ENVIRONMENT MANAGEMENT

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Eligibility: B. Sc. / B.E. degree or equivalent

Duration: Two year- Full Time

COURSE HIGHLIGHTS

- Highly experienced faculty and high faculty/ student ratio
- State of the art well equipped laboratory for practical's
- Industry centered curriculum with emphasis to develop sustainability professionals
- Interdisciplinary approach
- Innovative pedagogy
- Focus on innovation through project activities and industrial training
- Linkages with various stakeholders like industry, NGOs, consultancy and government departments
- Focus on improving individual skills
- Specialized library
- Placement assistance provided

LEARNING OUTCOMES

After successful completion of this course, the students

- Will have a deep understanding of the pertinent environmental issues and challenges
- Will have knowledge and skills to tackle various environmental problems in industries
- Will be able to work effectively as a member of an interdisciplinary team involving scientists, engineers, managers and administrators
- Will be able to integrate technical knowledge and sustainability parameters to facilitate industrial sustainability and development of sustainable communities



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Odour Removal from Hazardous Waste Water by Electrolytic Process

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Odour is sensory perception in the inhaled air. Air quality is affected not only due to conventional air pollutants but also due to unpleasant odours. The usual effect of bad odours is nuisance, but in more serious cases, it may lead to feelings of nausea and head ache and to other symptoms that appear to be related to stress. Odour pollution has distinctly different characteristics and is undoubtedly the most complex of all air pollution problems.

In order to develop and implement effective control programme on odour pollution, it is necessary to measure odour in a manner that is accurate, precise and acceptable. The instrumental method may be adopted for known compounds and for mixtures of unknown substances, sensory method is preferred.

CPCB has strongly recommended that Pilot plants / Best Management Practices to control odour pollution may be installed / demonstrated sector wise to display the technology.

There are different processes and technologies for odour pollution. They include biofiltration, chemical scrubbing, carbon adsorption, chemical oxidation, incineration, green belt development etc. When decisions are made on an odor control technology, there are always two determinants that go into the decision: odor removal effectiveness and cost. In the recent times, there is one more additional determinant, viz., whether the method is clean and green.

Electrolytic processes offer clean and green solutions for many applications such as

synthesis of industrial chemicals and pollution control. One good example is the replacement of conventional chemical coagulation process by electro-coagulation. The desired reactions are mediated by the participation of electrons at the working electrodes. Chemical additions are minimal. Operating conditions are also mild. The present application of electrolytic process addresses the odour pollution of hazardous waste water arising from a processing facility.

It is characterized by high BOD and COD values of 10 and 30 grams/litre respectively. It has very foul odour and intensely black colour. Odour threshold value (D/T) is >200 for the waste water and the source of odour is due to organic sulfur compounds presumably. It has high TDS value of 80 grams/litre contributed by chloride and other soluble inorganic salts.

Electrolytic process has been chosen to control the odour of this waste water for several reasons: Conductivity of the waste water is good and is 40-50 mS/cm. Chemical additions are not required for odour elimination. It is an ambient temperature process. No secondary waste is generated after odour treatment.

Using graphite as anode electrode and Stainless steel as cathode, experiments were conducted using DC power supply and the process was demonstrated successfully at 25 litres scale to the end user. Under the experimental conditions, the odour has been completely eliminated in less than 30 minutes of electrolytic reaction without addition of chemicals. Experiments showed

that electrical energy requirement for odour removal is about 10 watt hours/litre of waste water treated. *It has also been observed that the dark colour of the waste water has almost completely disappeared upon continuation of the process for another 1.5 hours under experimental conditions*

In conclusion, choice of a particular process or technology for odour control depends on several factors. Important among them are



SET UP FOR ELECTROLYSIS



DC POWER SUPPLY

composition of the odour source to be treated, cost of treatment, degree of treatment required, eco-friendliness of the process adopted, etc. Electrolytic process has been demonstrated to be very successful for the hazardous waste water of a processing facility for odour control.

It has been also shown to be effective for colour removal of the waste water as well.



Waste water before treatment –Left flask

Waste water after electrolysis- Right flask



Control and Management of Air Pollution

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Pollution in itself knows no boundaries; it sweeps across all the regions with no bias to the source of its origin. Air pollution is a global public health emergency as stated by UN¹ and needs to be minimized and managed at the war scale due to its multifold effects on the environment and health causing high rates of mortality. As per WHO around 7 million premature deaths occur due to air pollution, killing 800 people globally every hour. People living in low- and middle-income countries are subjected to exposure to air which do not meet minimum air quality index. The UN¹ projects a figure of US \$32 trillion, which could be saved if we act against air pollution.

Various measures are being taken globally to tackle air pollution, countries are switching to cleaner fuels, opting for cleaner cooking options, using air purifiers, governments are committing to limit GHG and CO₂ emissions. Various innovative solutions are researched, and many have been made available in the market. It is necessary to access the technology to validate these solutions and implement multiple options based on the requirements. These innovations can be broadly categorized as (i) Detecting and monitoring solutions and (ii) Control and management. The present article is focused on the control and management of air pollution, some of the innovations are discussed below:

City Tree²

This tree is developed by Green City Solutions with a larger surface area which is

having sensors to measure the air quality, it has internal watering tank. The tree is actually a wall with moss growing across covering its entire flat surface and the wall in itself is mobile, it can be carried to any location.

Oxygen Chamber²

This oxygen chamber is constructed in Delhi with the joint effort of the company Nurturing Green and the Delhi Metro Rail corporation. The Area is consisting of three regions-having the nursery, green house and an outside area which consists of the oxygen room, this is consisting of anti-polluting plants, helping in reducing the pollutants substantially.

Vertical Gardens²

The concept has been realized in China where the towers comprising plants are being constructed, giving it the appearance of vertical gardens. The towers are predicted to produce 60 kg of oxygen every day.

Smog free tower²

The design of this tower is prepared by a Dutch Engineer/designer and aims at capturing the carbon particles, these particles are then converted to make a piece of Jewellery. It is the world's largest outdoor air purifier

Clean Air Bubble²

This is an indoor air purifier "Wynd" works best when placed near bedside or on desk in a distance of 3 feet. The device detects the

quality of air and then regulates the speed of the filter, creating the bubble of clean air.

Air purifying billboard²

These billboards are efficient in removing dust, metal, stone particles etc. specifically from the construction zones. The billboards are capable to produce fresh air equivalent to around 1,200 trees.

Giant Sprinklers²

The sprinklers work on the principle of Wet deposition, a phenomenon that occurs naturally. The polluting particles are removed using rain drops and snowflakes. These sprinklers are effectively used on the exteriors of the high-rise buildings.

Photosynthesis bikes²

These bikes are designed to generate oxygen rich fresh air and strips away the particulate matter from polluted air upon peddling. The bike is designed by Lightfog Creative & Design Company.

Smog eating pavement²

These pavements are designed to perform photocatalysis, wherein the layer of titanium dioxide coated on the pavement helps in removing the NO_x from air and has the potential to remove and reduce smog by 45 %

Shellios³

A Delhi based start-up company Shellios has designed helmets for the bikers which are equipped with in-built air purifier. The cleaning of the air is done by a battery-operated module fitted with a micro USB charging port for battery. The helmet is attached to a Bluetooth app that helps in

knowing about when cleaning is to be done for the air purifier.

Chakr Innovation-Ink and paints³

This start-up company produces inks and paints from the soot generated by the diesel generators. The particulate pollutants-black carbon particles are collected using solvent and is further processed to remove the carcinogens and heavy metals and then converted to purified carbon-based pigments-inks and paints which are used by several industries for printing their packaging material in India.

Kaalink-Ink and paints⁴

This is a start-up company a spinoff of MIT Media Lab, which uses a handheld device to capture carbon from the cars. The carbon is further processed to remove the carcinogens and other impurities and then converted to high quality ink which is much cheaper than traditional alternatives and is reducing the air pollution. This ink is mostly used for printing newspaper, magazines and T-shirts.

Nasofilters³

These filters produced by the company “Nasoclean” are meant for single use and can be used effectively for 12 hrs. These filters comprising the nanofibers are worn on nostrils and claim of 95% efficiency in removing the PM_{2.5} without obstructing the breathing.

Fuel from pollutants⁵

The research scientists from University of Antwerp and KU Leuven have developed a device that purifies air and produces hydrogen fuel. This device containing thin membrane is powered by solar energy and makes the air clean by degrading the

collected contaminants and in turn converts them to Hydrogen which can be used as fuel.

Anti-Smog Guns⁵

The Anti-Smog guns spray water vapour into the air which help in absorbing the pollutants providing a short-term solution during days when there is heavy smog and difficulty in breathing. These guns are being tested in Delhi for its efficacy.

There are several efforts made by scientists and companies to bring innovation, precision and sustainability in managing the air pollution, several platforms and grants are made available for the same. India is also putting in its best efforts in finding the solution, taking measures in preventing and reducing the air pollution and more so to improve the air quality index of Delhi. The government of India launched the Urban Labs Innovation Challenge in partnership with University of Chicago Trust, to crowd source best local ideas to tackle air pollution in Delhi. The selected ideas are under testing at the Chicago Urban Labs, EPIC-India⁶ supported by Delhi Dialogue and Development Commission of Delhi.

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ADMISSION PROCESS STARTED

**Post Graduate Diploma in Sustainable Environment
Management (PGDSEM)**
Academic year 2019 – 20

Environmental management techniques are integral to conservation, agriculture, forestry, industry and countryside planning. This part time autonomous course is designed for people already in environment-related employment, who wish to develop their careers by updating their knowledge and skills. It aims to satisfy an industrial and public sector demand for science and engineering qualified environmental management personnel.

Eligibility: Professionals from government, industries, consultancy and NGO working in field of environment

Duration: One year- Part Time



COURSE HIGHLIGHTS

- Highly experienced faculty
- Industry centred curriculum with emphasis on hand on practical experience
- Interdisciplinary approach
- Innovative pedagogy
- Focus on innovation through project activities and entrepreneurship
- Linkages with various stakeholders like industry, consultancy and Govt. dept.
- Focus on improving individual skills
- Exposure to workshop, conferences and seminars
- Specialized library
- Industrial visits



- Application forms can be filled online and submitted in hard copy with cash of Rs.500/- and supporting documents to SIES IIEM Office at Nerul.
- Last Date for the submission of application forms: 1st July 2019

Report of ‘Training and Business Development Program in Decentralized Wastewater Treatment Systems’

SIES Indian Institute of Environment Management had organized a ‘Training and Business Development Program in Decentralized Wastewater Treatment Systems’ from 8th to 10 May 2019 in collaboration with Ecosan Services Foundation, Pune and CEWAS South Asia, Business Competence in Wastewater Treatment and Sanitation. The training was supported by Department of Science and Technology, GOI.

Mr. Dhawal Patil and Mr. Saurabh Kale imparted training on design of an Anaerobic Baffle Reactor, Anaerobic Settler, Anaerobic Upflow Filter and Constructed Wetland System for Sewage treatment. Ms. Pallavi Deshmukh delivered a lecture on “Entrepreneurship”. The lecture was followed by group activities and development of business model.



SIES IIEM DEDICATED TO ENVIRONMENT MANAGEMENT THROUGH R & D AND OUTREACH ACTIVITIES



ABOUT SIES IIEM

- SIES IIEM was established in 1999. It has been contributing in the fields of R&D activities and Academics in the areas of Environment Management and Biotechnology.
- IIEM is recognized by Department of Scientific and Industrial Research for research activities and has successfully completed various research projects with funding from DST, BRNS, DBT, ICMR, MOEFCC, MMREIS and several other agencies.
- IIEM also conducts consultancy services, organizing seminars, workshop and providing community service through research and creating awareness.



INFRASTRUCTURE AND FACILITIES

State of Art Facilities to conduct R & D and consultancy in the areas of Environmental Science and Management. Laboratories are equipped with the equipments like HPLC, AAS, GC, HVS et.

CONSULTANCY SERVICES

Drinking Water and Waste Water Quality Parameters

- Physical parameters
- Chemical parameters
- Microbial parameters: Total Coliform Test, *E. coli*, Fecal streptococci Manganese
- Heavy Metals: Lead, Copper, Nickel, Iron, Cadmium, Zinc, Aluminum

Soil Quality Index for Agricultural and Landscape Applications

- Physical parameters
- Chemical parameters
- Major Nutrients
- Minor Nutrient
- Secondary Nutrients

Waste Management

- Training programs
- Characterization of Solid Waste for Composting and Vermicomposting
- Compost Quality Index (Physical, Chemical & microbial parameters and seed quality index)
- Testing, characterization and standardization of bio-fertilizers from
 - N fixers
 - P Solubilizers – PSB, AMF

GIS based Environmental Planning and Management

- Natural resource mapping
- Groundwater recharge study
- Site selection
- Database management
- Training Program

Sustainability Solutions for Mitigation of Climate Change Vulnerability

Biomass Characterization for Physical, Chemical and Biochemical Parameters

- ❖ Moisture content
- ❖ Nitrogen
- ❖ Phosphorus
- ❖ Potassium
- ❖ Crude protein
- ❖ Lignin
- ❖ Cellulose
- ❖ Hemi-cellulose
- ❖ Fibers
- Antimicrobial and Antioxidant Testing Screening and Evaluation of Bioactivity of Synthetic Chemicals and Natural Compounds

Providing CSR Solutions for Environment and Society

Technical Support in CSR	CSR Services
Support in the development of CSR strategies for industries	Linkages with NGO partners
Implementation of CSR strategies in industries and execution of activities in the areas of environment and societal development	Community engagement and mobilization
Stakeholder engagement	Capacity building
Compliance and regulatory affairs in the areas of environment	Training and outreach activities
Impact Assessment of CSR activities by industries	Volunteering
CSR Communications	Promotions

Natural Capital Assessment Services

- Implementation of Natural Capital and Ecosystem Services Concept
- Integration of business practices and decision making with natural capital and ecosystem services concept.
- Assessment of Natural Capital and Ecosystem Services
- Qualitative and quantitative approaches
 - GIS mapping
 - Foot printing
 - Stakeholder engagement
- Land Use and Biodiversity Opportunity Mapping Training and Capacity Building

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Environment in News Headlines

Satellite data and AI to monitor air pollution

Satellite data would be used by an AI firm WattTime, the images would be processed to track the emissions from power plants and other big polluters. The technology would be using sensors which would detect heat through infrared imaging along with the sensors for detection of nitrogen dioxide emissions. Real time emissions would be monitored using the AER programme. This project is backed by Google.

Source: Vox, 27th May.'2019

Inks made from air pollution

Graviky labs produce the ink from air pollution by capturing it with Kaalink, a retrofit technology which can be designed to fit in chimney stacks and diesel generators. The technology can also be used for ambient air converting particulate carbon as a recyclable waste to make high grade Air-Ink. It has cleaned 1.6 trillion lts. of air so far.

Source: National Geographic, 8th July, 2017

Sensors & Predictive Analytical Solution

Weave Air provides sensors and predictive analytical solutions which helps in detecting, diagnosing and predicting the air quality thereby reducing the cost of high value air distribution systems, improving air quality and saving on energy. It uses advanced sensor array technology to measure metrics core.

Source: WeaveAir.com

Pollution absorbing paint technology

Airlite paint is a non-invasive, effective paint which can be applied on the exterior and the interior of the areas of the building. The technology was developed by leading scientists in 2003 and then has been tested rigorously before its launch. It eliminates upto 88.8% air pollution, eliminates 99.9% bacteria, cuts cooling costs upto 50%, repels dust and airborne dirt, prevents mold and neutralizes odour. It is 100% natural, VOC-free and water soluble.

Source: Futurebuild, 18th Jan.'2018

Reducing Smog with roofing granules

3M has designed the roofing granules with photocatalytic coating that gets activated by sun rays and generates the radicals that bind with the smog chemicals and transform them into water soluble ions. This has capacity equivalent to trees.

Source: UN Environment News-Business unusual: four innovations to clear the air 28th May' 2019

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Forthcoming Events

Celebration of World Environment Day on June 5, 2019. Theme- Beat Air Pollution.

Articles, photos etc. are invited for next issue (July-September, 2019) of the Newsletter on the theme 'Environmentally Sound Technologies'

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