



# PRAKRITI SANRAKSHAN

## Newsletter

Volume 3, Issue 3, Jul. - Sept., 2020

### ABOUT US



### Save the Environment (STE)

**SAVE THE ENVIRONMENT (STE)** is the organization that aims to spread awareness to the society about environment, health and water. It was founded and registered on 19th November 1990. STE has collaborated with various organizations in the past 29 years such as All India Institute of Hygiene & Public Health, AIH&PH and India Canada Environment Facility, DRDO, Ministry of Defence, Department of Science and Technology (DST), Indian Institute of

Management (IIM), Ahmedabad to mitigate the effects of arsenic and provide arsenic-free drinking water.

The vision of the society is to protect present and future generations from various Environmental Hazards. The NGO has been actively organizing various interactive sessions such as conferences (National and International), workshops, seminars and awareness programs including poster competitions, quiz competitions, science exhibitions and webinars among the future generations.

## OUR EVENTS



# SAVE THE ENVIRONMENT

A Society for Research Awareness and Social Development

## Weekly Webinar Series

### TALK 01# Nanotechnology as Potential Candidate to Tackle COVID-19 Virus.

The ever-growing crisis of COVID-19 pandemic has undoubtedly changed our lives and restricted human interactions. Nevertheless, amidst this pandemic, Save The Environment has realized its ways of providing interactive educational platform through the webinars to educate the students and serve society. Encouragingly, STE as a society for research, awareness and social development has continued its efforts for conducting the weekly webinar series, which was initiated in the mid of August, 2020 and is still being continued including the months of September and October, 2020.

working as Project Associate at Indian Agricultural Research Institute (IARI), Pusa, New Delhi. Following this, **Dr. Kshipra Misra**, President, STE briefly introduced the speaker of the day, Dr. Dinesh Rangappa.

Prof. Dinesh Rangappa is well known among the National and International Scientific and academic community for his expertise in Nanotechnology, Materials Science and Engineering, Environmental Science, Materials Chemistry and Nano-chemistry. He has immensely contributed in novel process development for nanomaterials synthesis and production, design and engineering of functional

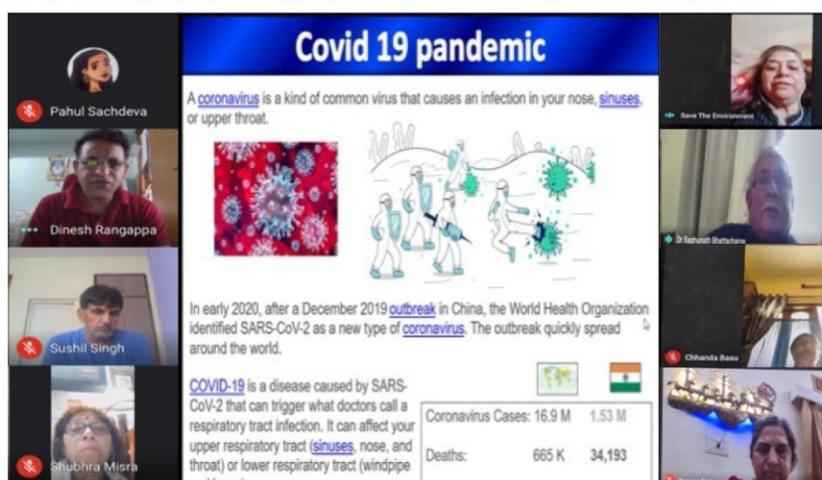
### Talk 01# Nanotechnology as Potential Candidate to tackle Covid-19 Virus

#### Our Speaker



*Prof. Dinesh Rangappa*

**Professor & Program Coordinator,  
Department of Nanotechnology  
Visvesvaraya Technological  
University, Karnataka.**



The weekly webinar series was started on 15 August, 2020 by a talk delivered by **Dr. Dinesh Rangappa**, who is Professor and Program Coordinator at Department of Nanotechnology, Visvesvaraya Technological University, Karnataka. The session began with an introductory presentation about the progress and efforts of STE so far and was presented by **Ms. Jigni Mishra**, who is member STE management and currently

Nanomaterials for Energy storage, Photocatalysis, Photoluminescent, Inorganic Pigment, Wastewater treatment, and Biomedical applications. He has also extensively worked on Li-ion battery electrode materials and device fabrication, Nano-sensors and Solar cells development. Dr. Rangappa delivered a talk on the topic entitled “Nanotechnology as potential candidate to tackle COVID-19 virus”. To begin with, he

briefly gave a comprehensive conceptual introduction about nanotechnology including its history, techniques, approaches and applications in several fields such as biomedical and drug delivery; agriculture and food; biotechnology; environmental sciences; textiles; etc. In his talk, Dr. Dinesh also explained the SARS-CoV-2 virus structure and mechanism of its pathogenicity. Afterwards, he explained the applications of nanomaterials for prevention and treatment of COVID-19 infection. He also exemplified applications of various nanomaterials-based vaccines against coronaviruses briefly stating their function and mechanism of action. Furthermore, the applications of nanoparticles based antiviral agents for disinfection of coronaviruses with description regarding their function

and inhibition was also highlighted. The role of nanozymes for defending the COVID-19 infection was also mentioned.

The webinar talk was meticulously designed and presented in the best possible way. It was a descriptive, comprehensive and informative talk. The response of the participants was astounding and appreciable. There was a question and answer session also, which was interactive and demonstrated enthusiasm and keen interest of the participants. The session was concluded with a vote of thanks by Ms. Jigni Mishra. The team STE, is whole-heartedly thankful to Prof. Dinesh Rangappa for enlightening us with his talk.

## Talk 02# Holistic Environmental Approach for Sustainable Society

### Our Speaker



*Prof. Umesh Kulshrestha*  
Professor,  
School of Environmental Sciences  
Jawaharlal Nehru University,  
New Delhi

**Creation of Artificial Huge Lakes to Control Dust Air Pollution in Delhi**

**Air Pollution in Delhi**  
Holistic Solution: Creation of Lakes

**Top Need**

1. Haryana border
2. U.P. Border

- More water evaporation will trigger Occasional Rains.
- Rains will scavenge Atmospheric Dust.
- Will wet the unpaved roads and open soils controlling the resuspension of dust.
- Lakes will control Desertification.
- Will support against water scarcity in future.
- Will help in Biodiversity enhancement.

**Other Possible Measures to Control Dust in Delhi**

**R&D oriented Efforts**

1. Emphasize for quality controlled monitoring data
2. Uniform sampling protocol for sampling height and road distance
3. Only one nodal agency for top management
4. Start reporting speciation of PM
5. Redefine PM Criteria and AQI

**Policy Oriented Efforts**

1. Control construction dust
2. Improve road conditions Metro type rapid public transport
3. Express bye pass roads for outskirts connectivity
4. Stringent PUC check
5. Bharat VI standards
6. Switch over to CNG for all types of vehicles
7. Provide improved stoves to replace traditional 'chullah' in rural areas
8. Stop biomass and biofuel burning for winter time heating
9. Make compulsory primary education within 5 km circle
10. Introduce 'work from home' scheme
11. Increase greenbelt
12. Inter state task force for controlling trans-boundary pollution

### TALK 02# Holistic Environmental Approaches for Sustainable Society.

The second talk of the weekly webinar series was delivered on 23rd August, 2020 by **Prof. Umesh Kulshrestha**, Dean & Professor at School of Environmental Sciences, Jawaharlal Nehru University, New Delhi. The session was coordinated by **Dr. Anuja Bhardwaj**, member STE who began the webinar with an introductory presentation about STE. **Dr. Kshipra**

**Misra**, President, STE briefly introduced the speaker of the day, Prof. Umesh Kulshrestha before proceeding for the talk. He has 26 years of experience in Environmental Sciences. His area of expertise includes: aerosol and precipitation chemistry, climate change, air pollution, reactive nitrogen, air pollution chemistry and transport, atmospheric depositions and biogeochemical cycle, air pollution impact on plants etc. Prof. Umesh Kulshrestha has been associated with

various international and national programs on atmospheric science including Indian Ocean Experiment (INDOEX), Asian Brown Cloud (ABC), IGAC-DEBITS-CAD (Composition of Asian Deposition), Composition of Asian Aerosol and Precipitation (CAAP), Surya, ISRO-GBP-Integrated Campaign on Aerosol Radiation Budget (ICARB), etc.

He started his talk entitled **“Holistic Environmental Approaches for Sustainable Society”** with an understanding of the term “Holistic Approach” in context to the sustainable environment. He stated that holistic approach can be actualized if we assemble the knowledge of all the components, i.e., place and function; connecting capacity from micro to macro; by including all the dimensions in interpretation for e.g., reviewing the scenarios, family budgeting and development of prototype be it weather, raw material or life and; estimate the consequences based on natural laws for instance, climate change. He proposed the idea of creating *“Artificial Huge Lakes”* to control dust-air

pollution in Delhi-NCR, illustrating a holistic approach. He emphasized that we must lessen our activities which result in or add-on to the air pollution since anthropogenic activities are major reason for it. This was evident from the statistics for air pollution which showed reduction in air pollution during the COVID-19 lockdown, especially during the month of March, 2020.

Prof. Kulshrestha also highlighted the importance of Yoga and Ayurveda and Herbal interventions for treating respiratory diseases which are caused due to air pollution. Conclusively, for a sustainable society we must collectively consider socio-economic, mental or human-related and biome-related factors to save the environment, holistically. The talk prompted several participants to ask questions and they appreciated the speaker, Prof. Umesh Kulshrestha for an informative and educative presentation. The team STE is also grateful to Prof. Umesh Kulshrestha for delivering the talk and supporting us in our efforts.

### Talk 03# Green Chemistry: Designing Chemistry for Environment and Human Health

#### Our Speaker



**Prof. R. K. Sharma**  
Coordinator,  
Green Chemistry Network Centre  
Department of Chemistry,  
University of Delhi.

The screenshot shows a webinar interface with a central presentation slide. The slide title is "Green Chemistry Practices in Teaching & Research". Below the title, it states: "Green Chemistry Network Centre (GCNC) established in Delhi University under the recommendation of a panel of world leaders headed by Professor Paul Anastas (known as father of Green Chemistry) aims to:"

- Build a Green Chemistry Network
- Prepare and disseminate the GC Material
- Design trainings
- Take up Green Chemistry Research Prc. (CSIR, UGC, DST, DBT, INDUSTRY)
- Setting up of GCNC Laboratory (Ministry of Textiles)

Other visible content on the slide includes a map of India, a section on "Plastic Contamination" with bullet points: "80% floating debris in oceans is plastic", "Projected to grow 10-16M in 10 years", and "Plastic found in 45-66% seabirds & marine mammals". There is also a section on "Catalysts" stating they are essential in the synthesis of 80% of chemical industry products.

Participant names visible in the webinar grid include: R.K. Sharma, Sushil Singh, Dr. Vineet Kumar, Dr. Raghunath Bhattacharya, Malti Goel, and Tripti Shivastava.

#### TALK 03#Green Chemistry: Designing Chemistry for Environment and Human Health.

The STE team was able to sustain its endeavors in continuing its webinar series with a talk delivered as on 29<sup>th</sup> August, 2020 by **Prof. R. K. Sharma** on the topic

**“Green Chemistry: Designing Chemistry for Environment and Human Health”**. The session was coordinated by **Dr. Anuja Bhardwaj**, member STE and **Dr. Kshipra Misra**, President, STE briefly



introduced the speaker of the day, Prof. R. K. Sharma who is the Coordinator, Green Chemistry Network Center (GCNC), Department of Chemistry, University of Delhi. He is a fellow of Royal Society of Chemistry (RSC) and the Honorary Secretary of RSC London (North India Section). Apart from this, he is also the member of American Chemical Society (ACS) and the faculty advisor of International Student Chapter of ACS. His research interests primarily focus on the fabrication of silica based organic-inorganic hybrid materials for their applications as scavengers, sensors and catalysts, designing of novel metal-chelating inhibitors of transcription factor NF- $\kappa$ B-DNA binding, chemical speciation, molecular modelling studies, etc. He is the editor of "Hazardous Reagent Substitution", a green chemistry series book, that features several aspects regarding reagents used for various chemical transformations. Prof. Sharma is the distinguished recipient of several prestigious awards including 2010 INSA-JSPS award to visit Japan, 2010 UGC-TEC award to visit Mauritius, 2002 INSA-JSPS award, 1999 World Green Award, 1998 Research Grant Award by RSC London, 1995 Indo-German Award and 1995 UGC National Research Scientist award. He is UGC

member of expert committee for evaluation of national and international projects and DST WTI PAC committee member for evaluation of Research Proposals.

In the webinar talk, Prof. R. K. Sharma explained how Green Chemistry could be harnessed for the betterment of our environment and hence human life on the planet. He emphasized that building of a Green Chemistry Network is important so that Green Chemistry material can be synthesized and disseminated; trainings must be conducted and; Green Chemistry Research Project must be taken up by institutions and organizations. He exemplified all these aspects with the efforts made so far by him and his GCNC team for tackling the environmental pollution through Green Chemistry. His talk was appreciated and the team STE received a lot of appreciation notes for his talk and efforts. Several questions were put up by the participants demonstrating their attentiveness in the topic. The entire team STE is thankful to Prof. R. K. Sharma for educating us with the concept of Green Chemistry and advances made in India till now and how in future it can be promoted and harnessed for saving the environment and mankind.

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#### **TALK 04#Impact of Groundwater Arsenic Ingestion in the Human Environment: A Case Study of the Ganga Plains.**

Our organization, STE has always been working since its establishment in 1990, towards the management of arsenic contamination of drinking water in India (West Bengal, Bihar and U.P.). The session was coordinated by **Dr. Anuja Bhardwaj**, member STE and **Dr. Kshipra Misra**, President, STE briefly introduced **Dr. Nupur Bose**, our speaker for the fourth talk of the weekly webinar series. Her talk was on the topic "Impact of Groundwater Arsenic Ingestion in the Human Environment: A Case Study of the Ganga Plains" and was conducted on 6<sup>th</sup> September, 2020.

Dr. Nupur Bose who is Associate Professor and Head, Department of Geography, Research Faculty, Department of Environment & Water Management, A. N. College (Patliputra University), Patna has been awarded research awards such as: Sweden's Linnaeus-

Palme Academic Exchange Award, 2017, to undertake teaching of a course in Water Management at post graduate level in Land and Water Resource Division, KTH Royal Institute of Technology, Stockholm in April 2017. She has also received Erasmus Mundus Teacher Exchange Award to Department of Technology, Policy and Management, Technical University, Delft, The Netherlands as guest researcher in 2010.

Her research areas include: spatio-temporal assessment of drinking water quality and availability, with emphasis on arsenic and fluoride contaminated ground waters; socio-economic and health aspects of compromised drinking water quality, and implemented mitigation strategies and sustainability of clean water supply in rural areas of Bihar state, India. She has been actively contributing in various researches as Project Investigator and in collaborations.

## Talk 04# Impact of Groundwater Arsenic Ingestion in the Human Environment: A Case Study of the Ganga Plains

### Our Speaker



**DR. NUPUR BOSE**

Professor and Head,  
Department of Geography,  
Research Faculty,  
Department of Environment & Water  
Management,  
A. N. College [Patliputra University]

Dr. Nupur Bose introduced the audiences with arsenic and certain facts regarding it. She mentioned that arsenic is a carcinogen and is bio-accumulative toxin which has a known history to cause mass poisoning of a population.

She briefly stated that majorly geogenic or anthropogenic sources have led to arsenic contamination of groundwater. In the Ganga Plains, next to West Bengal, the State of Bihar is the most affected area with the problem of arsenic contamination of groundwater. She collectively described developmental issues, mass arsenic poisoning, arsenic in food chain and geogenic arsenic in water and soil as “the Arsenic Crisis”. She shared her findings and results during the talk. Her work demonstrated that in the State of Bihar, which has an agro-based economy the major causes of arsenic contamination in soil and water is geogenic in nature. Therefore, in such regions capping of contaminated hand pumps and bore wells; rainwater harvesting unit; use of arsenic filters and tapping of treated surface water were possible mitigation strategies which have been adopted in middle and lower Ganga basin. She appealed the audience to participate at community levels for managing the issue of arsenic contamination

of soil and water. She also suggested bioremediation (phytoremediation) as a solution for arsenic contamination of soil and water. Overall, her talk was elaborative and familiarized with the progress made by her research group for managing the menace of arsenic contamination in the Ganga plains for managing arsenic contamination of soil and water. Several dignitaries from the audiences showed their interest in her talk and work, both which definitely stimulated everyone among the audience to discuss the nuisance of arsenic contamination, especially in rural India. We, the entire STE team, is grateful to Dr. Nupur Bose for sharing her research work and expertise on this platform.

### TALK 05# Filter the Unknowns? A Low-cost Drinking Water Solution for Rural Communities.

Water purification is requisite to assure safe human consumption and to prevent diseases caused due to up take of contaminated water. The economic constraints of rural communities are the most affected in their ability to implement water-treatment systems. This is an important issue to be addressed and hence, the next talk of our weekly webinar series, 2020 entitled “Filter the Unknowns? A Low-cost Drinking Water Solution for Rural Communities” was concerned

with it. The webinar talk was conducted on 12<sup>th</sup> September, 2020 and was began with an introductory presentation about the advancements of STE, presented by **Ms. Jigni Mishra**, who is member, STE management and currently working as Project Associate at Indian Agricultural Research Institute (IARI), Pusa, New Delhi. Following this, **Dr. Kshipra Misra**, President, STE briefly introduced the speaker of the day, **Prof. Satinder Kaur Brar**.

Prof. Brar is Professor and James and Joanne Love Chair in Environmental Engineering, Lassonde School of Engineering, York University, Toronto, Ontario, Canada. Her research is on the intersecting areas of environmental engineering and its impact on the overall well-being of the global community. She primarily works in the two converging fields of value addition of wastes and removal of emerging contaminants. Many national and international awards and honors have been bestowed on her that prove her research mettle. Recently in 2019, she was honored by the Water Environment Federation as Eddy Principles/Processes Wastewater Medal winner. It was an honour to have her among us for the webinar talk.

In her talk, Prof. Satinder began with the grim reality of the unavailability of drinking water, especially in rural communities. She mentioned about the toxicity of 'microcystin', a very prominent cyanotoxin. Prof. Brar cited the need of an amplified version of sand filter.

During her talk, she was later joined by **Dr. Pratik Kumar** who is a PhD graduate in Water Science at Institut National de la Recherche Scientifique-Earth Environment and Terre, Québec, Canada. His research interest mainly lies in wastewater and drinking water treatment.

His specific research area includes surface adsorption/biodegradation studies for various drinking water pollutants and enzyme bioprocessing for different application in electrochemistry and fuel cells for the wastewater treatment. Dr. Pratik Kumar took over to describe how they developed the technique of microcystin-LR using bioaugmented sand filter. This innovative technique focused on modifications like increasing porosity and removal efficiency of the filter while maintaining cost effectiveness as a major aspect.

## Talk 05#

### Filter the unknowns?

### A low-cost drinking water solution for rural communities

#### Our Speaker



*Prof. Satinder Kaur Brar*

Professor & Love Chair in Environmental Engineering  
Lassonde School of Engineering,  
York University, Toronto, Ontario, Canada

**OVERVIEW**

POCs comprise pharmaceutical compounds, antibiotics and other Contaminants of Emerging Concerns (CECs)

CECs: Chemical discovered in water or in the environment that had **not** previously been detected, or were only present at insignificant levels

CECs include: Pharmaceutical Personal Care Products, Pesticides, Algal Toxins.

**MODIFIED SAND: ADSORBENT IN FILTER UNIT**

Material	Surface Area (BET)	Removal Efficiency
Raw sand	~1.8 m <sup>2</sup> /g	20%-40%
Graphite sand	~18.8 m <sup>2</sup> /g	100%

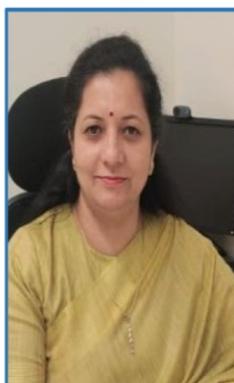
Note: Graphite sand is more rough and porous surface than sand (BET: 18.8 m<sup>2</sup>/g).

Overall, the talk encompassed several advantages of the biofilter including its higher water quality score and better techno-economic feasibility. Following the talk delivered by Dr. Nupur Bose on arsenic contamination of water and soil in the Ganga Plains; this webinar was appropriate to address the remedial solution for water contamination, especially in rural areas. The STE

fraternity is grateful to Prof. Satinder Kaur Brar and Dr. Pratik Kumar for familiarizing us with their technological efforts. The session was interactive with lots of questions asked by the participants and many of them shared their views and suggestions for the technology described, after the webinar talk was concluded.

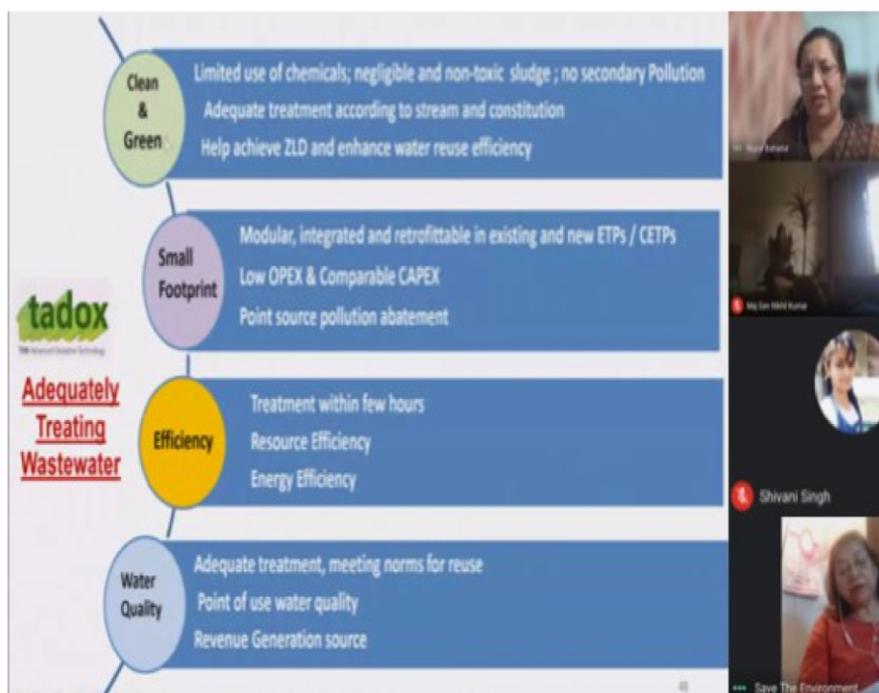
## Talk 06# Adequate Treatment of Wastewater: A Necessity to Meet SDG-6 and Address Issues of Climate Change

### Our Speaker



**Dr. Nupur Bahadur**

Fellow & Senior Scientist  
The Energy and Resources Institute (TERI),  
New Delhi, India.



### TALK 06# Adequate Treatment of Wastewater: A Necessity to Meet SDG-6 and Address Issues of Climate Change.

Save the Environment organized the sixth talk of its webinar series as a National Webinar in collaboration with Faculty of Biotechnology, Institute of Biosciences and Technology (IBST), Shri Ramswaroop Memorial University (SRMU), Lucknow, U.P. on 26<sup>th</sup> September, 2020. The event was chaired by Dr. Kshipra Misra, President STE and Former Additional Director, DIPAS, DRDO, Delhi and Dr. Mahesh Kumar Basantani, Director, IBST. The Co-Chaipersons for the session were Dr. Sachidanand Singh, Dean, Faculty of Biotechnology and Mrs. Chhanda Basu, General Secretary, STE. The event was coordinated by Dr. Siddharth Vats, Assistant

Professor, Faculty of Biotechnology, IBST and Dr. Anuja Bhardwaj, Research Associate at STE. The students, Ms. Shivani Singh Sengar, Mr. Aditya Singh and Ms. Krati Saini from SRMU universities also assisted diligently as student coordinators in organizing and conducting the National webinar.

The webinar was started with a welcome note by SRMU student and later the efforts of STE were shared among the audience by Dr. Anuja Bhardwaj. Our Speaker of the day during the National Webinar was Dr. Nupur Bahadur who delivered a talk on “Adequate treatment of Wastewater: a necessity to meet SDG-6 and address issues of Climate Change”. Dr. Kshipra Misra took the privilege of introducing her to the participants. Dr. Nupur Bahadur is presently working



as Fellow & Senior Scientist in The Energy and Resources Institute (TERI), New Delhi. She is also Honorary Associate Professor, Faculty of Science, Engineering & Built Environment, Deakin University, Australia; Adjunct Faculty, Department of Regional Water Studies, TERI School of Advanced Studies, Delhi; Vice-Chair, International Water Association-India and Member of Programme Advisory Committee, Singapore Water Convention, 2021.

She is Co-Founder & CTO of Perfect Advanced Water Solutions Pvt. Ltd. (PAWS), a Start Up developed to commercialize her invention TERI Advanced Oxidation Technology (TADOX). TADOX involves Photocatalysis as an AOP to treat highly polluting industrial and municipal sewage wastewater streams. She has 20 years R&D and teaching experience and four Indian Patents and a Trademark, under examination to her credit. Prominent Awards won by her includes- 'Design and Manufacturing Technologies for 'Make in India' by Ministry of Science and Technology, Govt. of India during IISF-Dec. 2015; VIWA-2018 Outstanding Woman in Science (in Chemistry) by Venus International Foundation, Chennai for demonstrating excellence in her discipline and STE Water Award 2019 for Technological Innovation in Wastewater Treatment by Save The Environment (STE) Society, Kolkata. Recently, she was awarded Aqua Excellence Award 2019 for 'Development of Technology' by Aqua Foundation during 13<sup>th</sup> World Aqua Congress held in association with Ministry of Jal Shakti, Govt. of India.

Dr. Nupur Bahadur initiated her talk with a small introductory about TERI relating to its contributions for managing wastewater. She explained that the wastewater is not a “waste” rather it is a source of water, if appropriate scientific technology is applied and resources are integrated and optimized to obtain safe water. This can enable us to attain the Sustainable Development Goal-6 (SDG-6), established by the United Nations General Assembly in 2015. The SDG-6 aims to “Ensure availability and sustainable management of water and sanitation for all”.

She mentioned that already there are numerous technologies put into practices for the treatment of

wastewater. However, these have several drawbacks associated with them, especially the issues of longer duration of treatment and high operational or treatment costs. Even the concept of “zero discharge disposal” has not proven to be advantageous since, it is practically difficult to obtain quality water without any residue from wastewater treatment for safe usage. Overall, the current available technologies are energy driven and not cost-effective for their sustainable application. Moreover, as highlighted by her the wastewater discharge and its subsequent treatment is a chain between wastewater treatment and climate change. She introduced the audience with the technology developed by TERI to manage the issues of wastewater management, called as TADOX.

TERI's Advanced Oxidation Technology or TADOX has advanced oxidation process (AOP) as its core technology; through which highly generated hydroxyl radicals are generated which are highly oxidizing and non-selective and result in oxidative degradation and mineralization of targeted pollutants. The technology includes nanotechnology also in combination with AOPs; together referred as Advanced Oxidation Nanotechnology (AON). Hitherto, TADOX technology has been successfully applied for the treatment of industrial wastewater from different industries such as chemical (anisole plant), pharmaceuticals, oil drilling site and tannery besides the municipal sewage wastewater treatment. Dr. Nupur and her team through their extensive research have found the technology to be promising. She shared her experimental data with the audience also.

Conclusively, she called TADOX as an advantageous technology when compared with the existing technologies with the benefits of being a clean and green technology; with small footprint; resource and energy efficient and a revenue generating adequate water treatment technology that is applicable at point of use. The webinar talk was very informative and illustrated that innovative and practical applicability of science and technology along with the societal awareness and individual efforts we can achieve the UN's sustainable development goals.



The entire STE fraternity was deeply honored to have among us Dr. Nupur Bahadur as our speaker of the day and; for enlightening and sharing her expertise with us, enabling the team STE to accomplish one of its aims i.e., social awareness about technical advancements for managing environmental issues such as wastewater

management. We are also thankful to Faculty of Biotechnology, IBST, SRM University especially, Dr. Mahesh Kumar Basantani, Dr. Sachidanand Singh, and Dr. Siddharth Vats, for collaborating with us and making it a successful event.

**We will be continuing our “WEEKLY WEBINAR SERIES, 2020”. The STE team is pleased to invite you all for joining us with our upcoming talks in the webinar series!**

## World Ozone Day Virtual Celebrations

**19<sup>th</sup> September, 2020**



**SAVE THE ENVIRONMENT**  
A Society for Research Awareness and Social Development

**World Ozone Day 19<sup>th</sup> Sept., 2020**

Scientists during 1979, confirmed gradual thinning of Earth's Ozone Layer in the upper atmosphere caused by the release of ozone depleting substances (ODS) from the human activities and adverse impact of UV radiations on various components of the environment. Ozone layer is a protective covering in the Earth's stratosphere that prevents the harmful UV radiations from reaching the earth and helps in reducing increased risk of skin cancer and cataracts; besides damage to the various ecosystems.

On September 16, 1987, the United Nations and 45 other countries signed **the Montreal Protocol** on substances that deplete the Ozone Layer. Since then, Scientists and Governments from around 197 countries have rallied together and banned the use of ODS such as chlorofluorocarbons (CFCs), carbon tetrachloride (CCl<sub>4</sub>), methyl chloroform (CH<sub>3</sub>CCl<sub>3</sub>), hydrobromofluorocarbons (HBFCs), hydrochlorofluorocarbons (HCFCs), methyl bromide (CH<sub>3</sub>Br), etc. Ever since, this day is celebrated as the **International Day for the Preservation of the Ozone Layer**. This year, we celebrated 35 years of global

Ozone Layer protection with the theme, “**Ozone for life**”; reminding us that ozone is essential for our life on Earth and we must continue to protect the ozone layer for our future generations also. According to the latest Scientific Assessment of Ozone depletion completed in 2018, parts of Ozone layer have recovered at a rate of 1-3% per decade since 2000. Efforts towards curbing climate change have also helped in protection of Ozone Layer. Consequently, once a pressing environmental nuisance, the ozone layer depletion is one of the lesser environmental concern today as the size of the “ozone hole” that had developed in 1980s, starting over Polar regions (Antarctica) has reduced progressively. As in for now, the ozone layer is healing but the story is not over yet. We must keep working together, progressively to protect it for the environment, ourselves and our present and future generations. With this perspective, **Save The Environment (STE)**, organized a Webinar themed “**Ozone Layer & Climate Change: Human Efforts**”, as a part of its awareness programs among the society on 19<sup>th</sup> September, 2020 on the occasion of World Ozone Day, 2020.

The **objectives of the webinar** were:

1. To promote the society for working together to preserve the ozone layer and apply the same will to heal the planet for a brighter and more equitable future for all humanity.
2. To provide a common platform for researchers, academicians and students to address and discuss the global issues of climate change including ozone layer preservation and global warming.

The event was graced by our speakers of the day: **Dr. Malti Goel** and **Mr. Mahidhara Davangere**. The audience was welcomed by coordinator of the event, **Dr. Anuja Bhardwaj**, who is also member STE. To begin with the event, a brief presentation about STE was delivered by her and succeeding this, **Dr. Kshipra Misra**, President, STE introduced the first speakers of the day, Dr. Malti Goel.

Dr. Malti is Chief Executive of Climate Change Research Institute and Former Adviser at Department of Science and Technology (DST), Government of India. She was CSIR Emeritus Scientist in the Ministry of Science & Technology, Government of India and is a climate change expert. Her multi-disciplinary research areas include: physical sciences, materials sciences and atmospheric sciences. She has made pioneering

contribution to promotion of industrially oriented joint technology research projects in socio-economic sectors dealing with energy conservation, greenhouse gas control technology and carbon dioxide sequestration etc. Dr. Malti Goel has received several fellowships, awards and honors including Bharat Jyoti Award in 2012 for outstanding contribution to society and the PEARL Foundation Life Time Achievement Award during the year 2016 in Climate Change Research.

Dr. Goel delivered a talk on the topic entitled “**32 Years and Healing-Our Planet, Our Life**”. Considering the fact that the audience included not only the college students but also school children, Dr. Malti Goel began her talk with a general introduction about “Ozone Layer” and its significance. She described the earth system as dynamic consisting of air, water, land and life. She explained that ozone is classified as a secondary air pollutant since, it is formed in the atmosphere as a result of reactions of primary pollutants with other chemicals present in the atmosphere in the presence of sunlight. Ozone is formed when the oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds react in the presence of sunlight. She stated the fact, that not only ozone layer depletion is a concern but formation of ozone gas is also a major issue. Ozone is a greenhouse gas contributing to the global warming and can have low to severe health

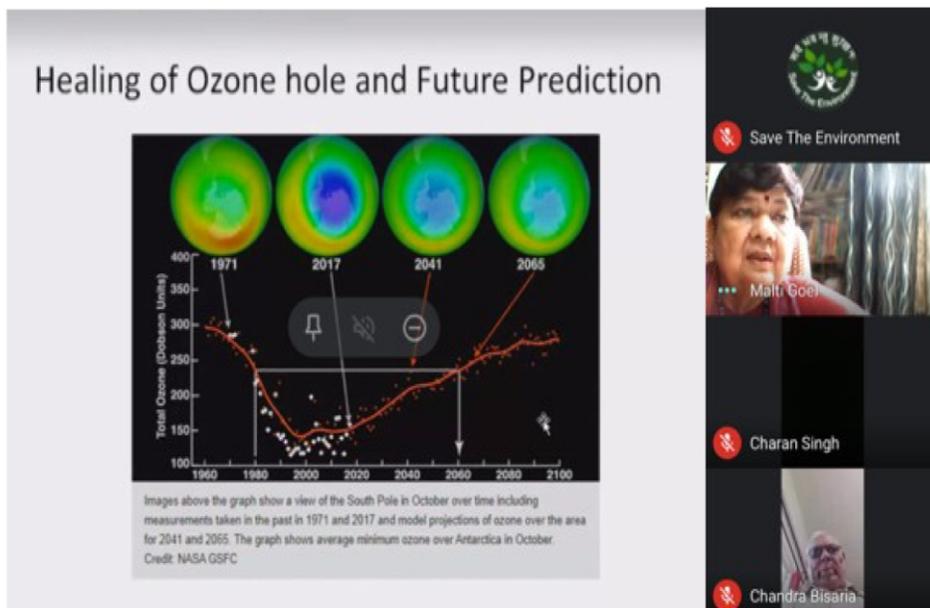
### Talk# **32 Years and Healing-Our Planet, Our Life**

#### Our Speaker



*Dr. Malti Goel*

Chief Executive, Climate Change  
Research Institute  
&  
Former Adviser, DST, GoI



implications such as chest pain, coughing, throat irritation and airway inflammation. However, during the lockdown phase due to COVID-19 pandemic, a significant decrease in ozone was observed in the Delhi-NCR regions which has again started to increase from 15-40  $\mu\text{g}/\text{m}^3$  to 25-70  $\mu\text{g}/\text{m}^3$  after the lockdown was eased.

Dr. Malti familiarized the audience with the Montreal Protocol which was established in 1987 and aimed to prohibit the use of CFCs which are the main contributors for Ozone Layer depletion. The treaty has completed its 32 years in 2019 and it has been noted that ozone layer in the stratosphere is healing. She updated the audience that as of now, hydrofluorocarbons (HFCs) such as difluoromethane (HFC-32) and difluoroethane (HFC-152a) are the most environmentally safe refrigerants for usage. Recently, in 2019 amendment to Montreal Protocol called Kigali Amendment has entered into force; suggesting phasing out HFCs with new materials and finding newer ways in the cooling industry thereby restricting the ever-raising issue of global warming. India in a long-term

vision has also launched COOLING ACTION PLAN in 2018 for reducing cooling energy demand to address the cooling requirements across various sectors.

On concluding notes, Dr. Malti requested the audience to plant trees in order to combat the issues such as climate change and hence global warming. Her talk was self explanatory, informative and has definitely spread awareness among the society about the global issues of increased ozone concentration and depletion of the ozone layer, both. Irrefutably, a natural balance of ozone and maintenance of the ozone layer is of greatest significance for sustainable development and a healthy life.

**Mr. Mahidhara Davangere** was our second speaker of the day and was introduced by President, STE, Dr. Kshipra Misra to the audience. He is the Founder and Managing Director of Pramatha Analytics Pvt. Ltd. (which was founded in 2010) – an Actuarial Risk Management and Consulting firm with Headquarters in Bengaluru, India with offices in Malaysia, South Africa, UAE, and US. He has been advising Venture Capitalists and Angel Investors on exit planning using various

## Talk# Climate Change and Risk Management-An Actuarial Perspective

### Our Speaker



*Mr. Mahidhara Davangere*

Founder & Managing Director,  
Pramatha Analytics Pvt. Ltd.

The screenshot shows a Zoom meeting interface. On the left, a presentation slide titled "Actuarial Climate Change Interventions" lists several items: Energy Pricing, Carbon Pricing, Catastrophe Bonds, Climate Change Modeling, Weather Derivatives, Disaster Management, Data Analytics for Farming, and Crop Insurance. Below this, another slide titled "Task Force on Climate-related Financial Disclosures" contains two bullet points: one about the TCFD framework released in June 2017, and another about the benefits of standardizing financial reports. On the right, a grid of participants is visible, including "You", "Malti Goel", "BS BACHHAL", and "Mahidhara Davangere".



actuarial risk modeling techniques and have 16 years of experience in Research and Financial valuation covering industries like Banking, Insurance and Financial sectors across India, Australia, South Africa and other emerging African markets. Notably, he is the First Indian to be elected as a Council Member of 160-year-old International Body – Institute & Faculty of Actuaries (IFoA) in UK. Mr. Mahidhara is also Chairman, Working Group on Wider Areas of Actuarial Science, Institute of Actuaries of India (2017-2018) and Secretary of Advisory Group for Data Science since 2018. He has recently, i.e., July, 2020, took over as Deputy Chair, IFoA Finance & Investment Board.

Mr. Mahidhara Davangere delivered a talk on the topic entitled “**Climate Change and Risk Management-An Actuarial Perspective**”. He initiated his talk with an introduction about the concept of actuarial science and its application in various fields. He highlighted the fact that there are only a few fully qualified actuaries. In India, there are only 500 actuaries and worldwide the number is 50,000 only. He emphasized on the applications of actuarial science in the assessment and management of risk associated with climate change. He stated that climate change creates uncertainty, posing a significant threat to the sustainability of our global ecosystems, health and economies. According to the several actuarial surveys, climate change has been ranked as a highest risk. The implementation of actuarial science can be made feasible by developing long-term models combining scenarios and probabilities and involving the expertise of climatologists to extract the appropriate information from the statistically significant scientific data available till date.

***From The Editor's Desk...!***

### **Urban Green Spaces Support Healthy Living**

By **Dr. Anuja Bhardwaj**  
Editor, STE

Urbanization or urban development is crucial for the economic growth and improvement of social inclusions but alongside it also results in pollution-air, water

He also mentioned that it is better to develop financial risks management models which must be adaptable to the continued evolution of emerging trends. He suggested various actuarial climate interventions such as energy pricing, carbon pricing, catastrophe bonds, climate change modelling, weather derivatives, disaster management, data analytics for farming and crop insurance. He proposed that collaboration between actuarial and other professional bodies is essential in policy making and planning programs and models for deciphering the solutions to climate change and risks associated with it.

The webinar talk was informative and has suggested a new way i.e., actuarial science which although has its roots seated in the history for tackling the global issues such as global warming. Mr. Mahidhara's words created enthusiasm among the participants and they had put a lot of queries making it an interactive session. We received good feedbacks for the talk and some of the participants called it as an interesting learning session, which it turned to be indeed. The dignitaries among the audience expressed the need of ACI, India to come forward and financially support actuarial science-based organizations for solving the problems of carbon burns/emissions and pollutants. Dr. Anuja Bhardwaj concluded the webinar with a vote of thanks. The entire STE team is grateful to Mr. Mahidhara Davangere for delivering an enlightening and useful talk. The team STE has tried its best to conduct the webinar series and virtual celebration as its interactive awareness program and will continue to do amidst COVID-19 pandemic when social distancing is the only way to prevent it. The team STE is extremely thankful to our audience who regularly participate and also the new comers. In future, we will continue to provide the best information pertaining to environmental issues and interactive platform for discussions crucial for saving the environment.

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and/or land. Thus, urban development must be sustainable. This is necessary to promote the decoupling of living standards and economic growth from usage of environmental resources; protection of local and regional ecosystems; reduction of both urban and rural poverty; and considerable reduction in pollution. Sound urban development will accelerate progress towards achieving sustainable development goals (<https://sustainabledevelopment.un.org/>

content/documents/2569130918-SDSN-Why-the-World-Needs-an-Urban-SDG.pdf). Hence, one of the imperative and unavoidable goal along with urban development is conservation and enrichment of the environment. Consequently, a better quality of urban environment will benefit the human health. Urban green environments, such as parks and urban forests, are elements of environment which many instinctively consider healthful (Lanki *et al.*, 2017). Urban green space can enhance the city environment by influencing temperature, wind, humidity, rainfall, soil erosion, flooding, air quality, scenic quality, and plant and animal diversity. In addition, urban green space may provide important social and psychological benefits that enrich human life. Recent demographic studies have found a positive association between exposure to urban green space and the perceived general health of residents. Living in areas with walkable green spaces also increased the longevity of senior citizens, independent of age, sex, marital status, baseline functional status, and socio-economic status (Song *et al.*, 2014).



**Image:** Urban spaces.

**Source**<https://www.sciencealert.com/increasingurban-tree-cover-gives-community-mental-health-a-boost-says-new-study>.

Links between green spaces and health have been recognized throughout history, and were one of the driving forces behind the urban parks. Previously, many of the mechanisms behind such links were poorly understood or lacked rigorous scientific evidence. However, modern research techniques have provided opportunities to study the mechanisms behind associations between green space and health with increasing sophistication and help satisfy contemporary scientific standards of evidence

demanding to inform policy and practice (<https://sustainabledevelopment.un.org/content/documents/2569130918-SDSN-Why-the-World-Needs-an-Urban-SDG.pdf>). Visual and physical contact with natural greenery provides benefits more than just our health and well-being (<https://edepot.wur.nl/418844>; <https://livingroofs.org/health/>). These include both mental health benefits (such as reduction of stress) and physical health benefits (including cleaner air). Access to green space can bring about direct improvements in a person's heart rate and blood-pressure, and can aid general well-being (<https://livingroofs.org/health/>).

Several mechanisms have been proposed by which living close to green areas may affect positively health and are described as follows (<https://sustainabledevelopment.un.org/content/documents/2569130918-SDSN-Why-the-World-Needs-an-Urban-SDG.pdf>).

### 1. Improved Relaxation and Restoration

Contact with nature can produce a positive effect on those who have high levels of stress. Visual contact with greenery or nature works as a non-threatening natural stimulus. Exposure to such a relaxing stimulus triggers a parasympathetic nervous system response leading to enhanced well-being and relaxation. Furthermore, natural settings may also provide an effortless involuntary attention and restore it, thereby enabling improved performances in cognitively demanding tasks. It has also been demonstrated that exposure to green spaces reduces neural activity in the subgenual prefrontal cortex and alleviates depression symptoms. The psycho-neuroendocrine responses to forest environments have also been found to exhibit correlations with lower concentrations of cortisol, reduced pulse rate, lower blood pressure, greater parasympathetic nerve activity and lower sympathetic.

The psycho-neuroendocrine responses to forest environments have also been found to exhibit correlations with lower concentrations of cortisol, reduced pulse rate, lower blood pressure, greater parasympathetic nerve activity and lower sympathetic nerve activity when compared to the city environments. Besides, there are several studies that demonstrate



restorative physiological responses associated with viewing or being in green space, including reduced blood pressure, heart rate, skin conductance and muscle tension (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

## 2. Improved Social Capital

Green spaces can play an important role in fostering social interactions and promoting a sense of community. Urban green spaces have been shown to facilitate social networking and promote social inclusion in children and adolescents (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

## 3. Improved Functioning of the Immune System

Visiting a forested environment has been reported to augment human natural killer cell activity and improve immune function which lasted for approximately one month (Song *et al.*, 2014). Living in residential areas with more street trees was shown to be associated with lower asthma prevalence. One hypothesized immunological pathway is exposure to commensal microorganisms in biodiverse natural environments, which can play an immunoregulatory role. Studies have demonstrated that increased biodiversity in the environment around homes is linked with reduced risk of allergy. Greater exposure to commensal microorganisms, especially in the early life, may lead to more diverse skin and gut microbiomes, and provide protection against allergy and autoimmunity. It has also been suggested that the human microbiome associated with natural environment may improve mental health (Braubach *et al.*, 2017).

## 4. Enhanced Physical Activity, Improved Fitness and Reduced Obesity

Physical activity has been shown to improve cardiovascular health, mental health, neurocognitive development, and general well-being and to prevent obesity, cancer and osteoporosis. Providing urban green space may encourage people to spend more time outdoors and facilitate physical activity. Urban green spaces can also make outdoor activity enjoyable and

easy, thereby encouraging less sedentary lifestyles (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

## 5. Anthropogenic Noise Buffering and Production of Natural Sounds

Noise pollution associated with continuing urbanization has a major and increasing threat to human health. Studies suggest that a well-designed urban green space can buffer the noise, or the negative perception of noise, emanating from non-natural sources, such as traffic, and provide relief from city noise (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016). The natural noises in natural spaces: green or blue, also contribute in masking noise pollution by enhancing soundscape pleasantness (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

## 6. Reduced Exposure to Air Pollution

Vegetation (trees, shrubs, herbs and grass) can dampen the impacts of road traffic and industries and improve air quality in urban residential areas by decreasing the levels of air pollutants and reducing atmospheric carbon dioxide through carbon storage and sequestration (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016).

## 7. Reduction of the Urban Heat Island Effect

The Urban Heat Island effect can be a serious health hazard during heat waves and extreme heat events. It arises due to replacement of vegetation with impervious heat-absorbing surfaces in urban areas. Exposure to excessive heat is linked to increased morbidity and mortality. In a study, the parks in urban areas had an average cooling effect of approximately 1°C and it extended up to 1 km from the park boundary. During warmer weather, trees can provide shade and reduce the demand for air conditioning and, especially, in warmer countries, they can provide comfortable outdoor settings and allow people to avoid heat stress. In cooler climates, trees can also provide shelter from wind and thereby reduce heating demand in the cold season (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016).



### 8. Enhanced Pro-environmental Behavior

Pro-environmental behaviour can be defined as “behaviour that consciously seeks to minimize the negative impact of one's actions on the natural and built world”. Researchers suggest that pro-environmental behaviour can be induced by external stimuli, particularly by experiencing natural environments. Recent research has supported this, showing that exposure to nature may increase cooperation and, when considering environmental problems as social dilemmas, sustainable intentions and behaviour. There is also evidence that childhood experiences in nature appear to enhance adult environmentalism. If pro-environmental actions are widely adopted, people can contribute to substantially reducing carbon emissions thereby potentially preventing detrimental effects of climate change on health (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

### 9. Optimized Exposure to Sunlight and Improved Sleep

If access to green space supports greater time spent outdoors among the population, it is likely to be accompanied by increased exposure to sunlight, which can have positive effects as well as negative effects. Humans get most of their vitamin D from exposure to sunlight, and optimum levels of vitamin D are important for overall health and well-being, especially bone density, so access to green space may contribute to better levels of vitamin D and associated health benefits. In a study, influence on the levels of Vitamin D in older people, was observed at different pastimes. It was found that vitamin D levels were significantly higher in those who engaged in outdoor activities, rather than for those who did not. The levels were particularly high for those who cycled or partook in gardening. Natural light also contains a spectrum of light wavelengths, some of which may be beneficial or detrimental. For instance, sunlight brings the risk of exposure to dangerous levels of ultraviolet (UV) light. However, recent research also suggests that UV-induced release of nitric oxide from skin may have unexpected health benefits, including lowering the incidence of hypertension and cardiovascular

disease (CVD) that is particularly associated with lower latitudes and winter months. Light exposure, particularly to blue light, is also recognized as way to stimulate alertness and cognition, and to promote healthy sleep. Exposure to blue light is implicated in metabolism and circadian rhythms, where naturally occurring patterns of daylight support healthy circadian rhythms but exposure to blue light at inappropriate times (e.g. at night) may suppress the secretion of hormones that influence such rhythms (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016.).

Adequate sleep is crucial for good health, while sleep deprivation has been linked to adverse health outcomes, such as metabolic syndrome, cardiovascular morbidity and mortality, and neurocognitive disorders, such as dementia. It has been observed that green space access may benefit health through increasing people's exposure to natural patterns of daylight, hence helping to maintain circadian rhythms (Urban green spaces and health. Copenhagen: WHO Regional Office for Europe, 2016). In addition to the above-mentioned health benefits of urban green spaces; they may also provide significant economic and ecological co-benefits such as reduction of fossil fuel usage through enhanced use of cycling and walking and wildlife habitat supporting biodiversity in urbanized areas. Overall, cities that build and maintain well-connected, attractive green spaces are likely to have healthier, happier and more productive citizens with fewer demands for health services (Braubach *et al.*, 2017).

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## THE ARTICLES...!

### Hydrogeological Isotope Technique for Recharging Natural Springs

**Dr. Sakshi Painuli**

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#### Introduction

Ever since prehistoric times, water has been used as a symbol of purity and devotion. In Indian scriptures, it has been mentioned that “*Water is the gift of Nature for the welfare and survival of all beings.*” It is the basis for life and livelihood and; plays an important role to harbor and sustain development. It covers about 70 per cent of the Earth's surface and out of that only 3 percent is available for human use as freshwater. Contrary to the past, our present developed technological society has become indifferent to this miracle of nature and our drinking water has become far from being pure. Nature always keeps itself balanced and has several natural phenomena to keep itself stable. However, as a

consequence of rise in anthropogenic activities there has been an ecological imbalance. This variance has not only harmed the environment, flora, fauna but also human civilization to a larger extent. Our natural heritages like rivers, oceans, springs, seas, etc. has been contaminated, exploited and mistreated by human malpractices. Consequently, the availability of freshwater has become a critical matter in some regions of the planet. Accordingly, this issue has attained an important geo-political and societal concern globally.

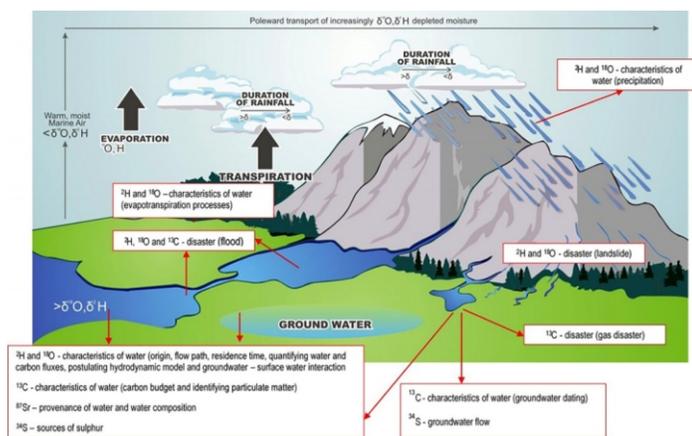
#### Indian Scenario

India is mostly characterized by a unique and distinctive geographic variability. This distinctive variation is thrived with infinite reserves of finite natural resources. In India, the total utilization of water is 1,123 billion cubic meter (BCM). The per capita availability of water has been reduced to 1,148 cubic meters (Year: 2018) from 5,177 cubic meters (Year: 1951).

In the hilly and mountainous regions of India, the water for domestic use (drinking, washing, cooking, etc.) is largely derived from shallow wells (*Naula*) and springs (*Dhara*). Basically, springs are the major component of the hydrosphere, where the groundwater drifts onto the surfaces. In spite of this, today various regions of Himalaya which majorly depends on the springs are facing scarcity of drinking water at alarming levels. The deterioration in discharge from springs, which sometimes even causes the springs to dry up entirely is the major problem behind drying up of these springs. According to NITI Aayog, around 30% of the springs have almost dried up, and an additional 45% of the springs are on the verge of drying up. Thereby, affecting approximately 60% of the population in mountainous villages. As a result of this paucity, particularly during summers there might be long queues or people might have to resort to collection from another, often distant sources; or collect water during the night-time. Also, there have been reports of conflicts over the distribution of the water. To solve this problem, we have to explore the potential possibilities of water conservation system by means of modern approaches in science and technology along with better management of water resources.

### Hydrogeological Isotope Technique

To achieve the requirement of water resources in the mountain region many techniques have been used. Rainwater harvesting technique has also been carried out in these regions but it seems to have limited success. Whereas, in last few years, a modern technique like “Isotope Hydrogeological study” has attracted the interests of the researchers for spring water recharging. The isotope technology (Shivanna *et al.*, 2008) provides a unique tool for generating the recharged areas and thus, improves the efficiency of rainwater harvesting measures. This technique gives a direct understanding into the movement and distribution procedures within the hydrological system and has been used for more than five decades. Isotope technique is based on the fact that water in its natural state possess several environmental isotopes and the results are predicted from their abundance variations accordingly. The isotopes used to investigate the hydrological systems are the heavy stable isotopes of the water molecule. The most common isotopes used for the study are water isotopes-deuterium ( $^2\text{H}$ ); oxygen ( $^{18}\text{O}$ ) and radioactive isotopes- tritium( $\text{H}$ ); carbon ( $^{13}\text{C}$ ,  $^{14}\text{C}$ ).



**Figure 1:** Application of stable isotopes in hydrological studies (Source: Syakir *et al.*, 2018)

These stable isotopes are remarkable indicators of the water circulation; whereas, the radioactive isotopes are used to determine the residence time. The existence of springs usually depends on various characteristics of recharge area including geology of area, surface cover, slope of ground surface and permeability of topsoil. In

this regard, scientists have carried out the isotope technique for identification of appropriate recharge area of groundwater and origin of the springs with several specifications which consists of conventional and non-conventional methods.

### Technology specifications:

- Identification of recharge zone through environmental isotope techniques
- Slope studies (15-45 degree)
- Construction of check dams (1.5 mtr deep and 2-3 mtrs long), percolation tank (dimension according to the site), trenches (40-60 cm deep and 2-3 mtrs long).
- Identification of location specific plant species for plantation (water holding capacity).
- Water discharge rate (0.5-100 ltrs/minutes).

The isotope technique complements the more traditional hydrological and hydrogeological methods employed in water resource investigations. The technique is successful in different regions of Himachal Pradesh and Uttarakhand (Sinha *et al.*, 2008; Shivanna *et al.*, 2008; Kumar *et al.*, 2012) for estimation and revival of groundwater and spring catchment areas.

### Conclusion

The hydrogeological isotope technique is a nuclear method that helps in managing the natural water resources by providing the knowledge about the water age, origin, movement and quality in underground aquifers/water basins. This technique has proved to be an important tool in solving issues related to the physical hydrology and geochemistry of river basins. Stable isotopes such as oxygen ( $^{18}\text{O}$ ) and deuterium ( $^2\text{H}$ ) have actively participated in providing information related to reconstructing and understanding the history of required hydrological systems. Besides, these isotopes, radioactive carbon ( $^{13}\text{C}$ ) and tritium ( $^3\text{H}$ ) isotopes also contributes in paleoclimate and palaeohydrology studies. This technology will help in increasing the availability of water in hilly areas which will result in many positive effects such as drudgery reduction, increasing agricultural production, animal

husbandry, improving ecology, promoting economic the advancement in hydrogeological technique will help us in disaster risk management of watersheds by providing the accurate information regarding potential natural hazards and recognizing the patterns of ancient and modern isotopic signatures of ecosystem.

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## Why Covid-19 Kills More Men?

By **Aditi**

Student, Masters (Forensic Science)

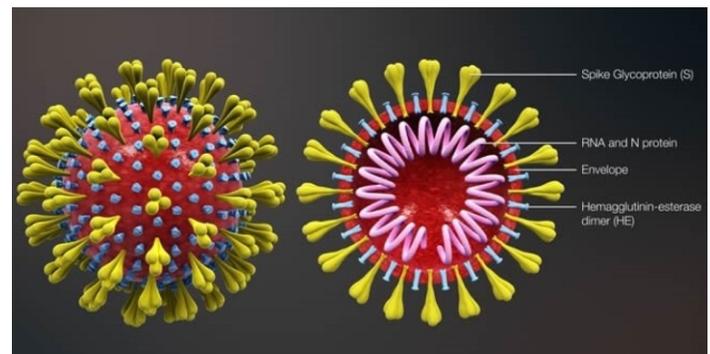
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### Introduction

COVID-19 commonly known as coronavirus is an infectious disease caused by a newly detected virus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COV2). In December 2019, an outbreak of a novel coronavirus disease (COVID-19) occurred in Wuhan city of China, putting the world on

alert. Coronavirus has spread very widely and frequently throughout the globe. We all know that due to this virus most of the world was under lockdown, since the virus spreads through physical contact among humans. Thus, social distancing is the best option to prevent the spread of the virus. Several studies across the world have shown that the mortality rate is more for men than women for COVID-19 infection and the potential reasons for this run the gamut from biology to bad habits. A study published in *Frontiers in Public Health*, reported that men and women were equally likely to contact the novel coronavirus infection.



**Image 1:** Coronavirus .

**Source:** <https://www.scientificanimations.com/> / CC BY-SA (<https://creativecommons.org/licenses/by-sa/4.0>)

However, males are more likely to suffer severe effects of this disease than females and men had nearly 2.5 times the death rate than that of women. In India, Health Ministry data suggested that among **1,65,799** men made up about three-fourths. In India, Health Ministry data suggested that among 1,65,799 men made up about three-fourths of death (Data as on May, 2020). While, in Europe about 63 percent of deaths related to COVID-19 have been among men as stated by World Health Organization (WHO). Looking at the scenario in the New York City, the mortality rate was approx. **17,58,422** which comprised men almost twice as women. Looking at the scenario in the New York City, the mortality rate is approx. **17,58,422** which comprised men almost twice as women (Data as on May, 2020). In the largest COVID-19 dataset, over 70% of the patients who died were just men, and being male was a significant risk factor for worse disease severity, regardless of age.

Now the question arises that why such a pattern was observed??

Some of the points mentioned below will enable you to get into the core idea of this why!

According to the experts, a stronger immune system of females than men could be one of the major reasons. They also added to this statement that men tend to engage in more risky behaviors such as ignorance of physical distancing, and they are also relatively reluctant in taking symptoms seriously than women. To understand this observational fact, some of the suggested reasons by experts are mentioned below.

**1) Men and women are biologically different**

A major difference between males and females is their sex chromosomes and genes that lie on both of these chromosomes. As we all know women have two copies of the same chromosome (called the X) while men have only a single X chromosome and a small Y chromosome.

**2) The Y chromosome and associated hormones**

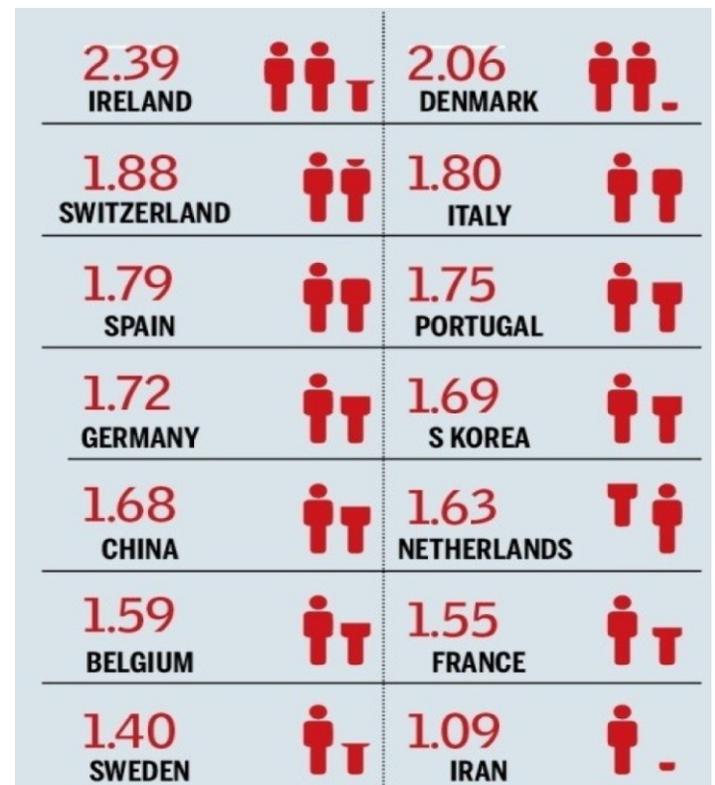
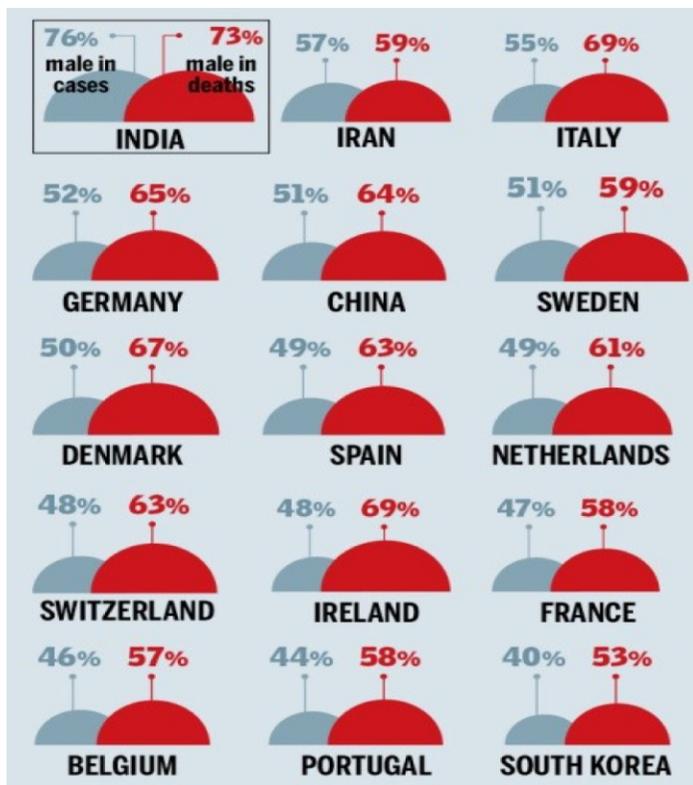
The Y chromosome contains hardly any genes along with SRY (a type of gene which influences behavior). It

may be possible that "toxic Y" could lose its regulation during aging and this might hasten aging in men and also render them more susceptible to the virus.

However, a bigger problem for men is the male hormones like testosterone levels which are implicated in several diseases and might influence the lifespan of an individual as well. Males also lack the requisite levels of estrogen which are sufficient in females and are known to protect them from various diseases, including heart disease. Moreover, relatively higher levels of the male hormone, testosterone in males make them more prone to unhealthy habits such as smoking and drinking. Also, as mentioned earlier, they pay less heed to take health advice as well as medical help.

**3) Two X chromosomes are better than one**

The X chromosome usually bears more than 1,000 genes with different functions in all sorts of many things, including blood clotting, routine metabolism and brain development. The presence of two X chromosomes in XX females provides a buffer to them that if a gene on one X is mutated or not.



**Image 2:** COVID-19 infection data of different countries based on percentage of males and females infected. **Source:** [https://timesofindia.indiatimes.com/india/wh\\_y-covid-19-kills-more-me/articleshow/75060496.cms](https://timesofindia.indiatimes.com/india/wh_y-covid-19-kills-more-me/articleshow/75060496.cms)

Males have XY and thus, they lack this X chromosome backup. Accordingly, it is generally males who suffer from many sex-linked diseases such as hemophilia (i.e., poor blood clotting).

The number of X chromosomes also have a big impact on many metabolic characters and so, this “X” effect goes far to explain the topic “why males have a higher morbidity rate than the females”. Another issue is the immune system of men. As mentioned above, females exhibit a stronger immune system than males. The reason is; there are at least 60 immune response genes on the X chromosome, and women have double in number than males which provides a broader spectrum of defense towards infections including viral in females.

#### 4) Angiotensin-converting enzyme 2

The study also reports that the enzyme angiotensin converting enzyme 2 (ACE2) enables the coronavirus to infect healthy cells, this may explain why men are more vulnerable to COVID-19 than women. A recently published study reported that men tend to have a higher concentration of the enzyme ACE2 in their blood than women. It has been found by researchers that the coronavirus easily adheres to the receptors of ACE2 thereby, enabling the coronavirus to infect healthy cells. This provides another explanation to why men are more vulnerable to COVID-19 infection than women.

#### 5) Other factors

**Pollution** could also be playing a vital role in elevating COVID-19 mortality rates among men. In most cultures like in India, men are more engaged in outdoor work, which exposes them to conditions associated with extreme climate and pollution. This could be a direct factor which can have impact their response to an infection like COVID-19.

Another fact also is that, usually males of the family are caretakers of their families. They are intended to put the priorities of other family members before them and thus, as a result of their **negligence** they might delay seeking healthcare and ignore symptoms of illness.

**Smoking** is another example. Male smokers account for more percentage of smokers than the females. It is a

well-known fact that smoking is detrimental for respiratory health and is a cause of the underlying respiratory conditions common among COVID-19 patients.

**Social expectations around masculinity** could also make men less likely to follow safety guidance for instance, wearing face masks; regularly washing hands and use of hand-sanitizer during the day.

#### Conclusion

Male gender is a risk factor, independent of age towards susceptibility in patients with COVID-19 infection. Older men with diseases are more at risk than younger ones. This topic calls for more research to explore the exact reason and physiological mechanisms involved for why men are more at risk than the females. This observation entails further research to better comprehend the explanations with scientific evidence and peer reviewed publications on the concerned subject. However, it is recommended that until then additional supportive care and intensive care units might be necessary, especially for older **MALE** patients.

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## Students Corner...!

### The Power of Mother Earth: The Best Physician



By **Maneeza Khan**,  
Class X,  
**The Heritage School, Kolkata.**

Humans have always considered themselves to be the most elite of creatures, boasting about being the most successful species to have ever graced this planet and creating a whole new digital world. Well, I am certain they did not take into consideration that there might be something else which can bring their achievements to a screeching halt-Nature itself. This thought takes me back to a fleeting childhood memory.

We lived in a peaceful neighborhood, surrounded by a lush overgrowth of towering trees. Those evenings were filled with the sweet symphonies of the birds and the concurrent chirping of the crickets. It was Nature making its own unique voice for the world to hear. It

was also home to a curious family of mongooses, always lurking in the shadows yet making their presence known. Alas, this was soon replaced with the ear-splitting sounds of hammering and drilling which drowned those sweet melodies of Nature. The beautiful haven had fallen prey to those countless construction projects which laid the land barren, the mongooses long gone. However, when I opened about this with my grandfather and expressed the need to find a solution, he just peered at me and mysteriously said “Nature does not need to be healed. It heals itself.” I would never have believed those words but just like a cocoon unravels into a vibrant butterfly, Nature soon showed its own colors. When my neighbor sent me a picture of that barren site dotted with lush grass and a couple of mongooses peeking out, I emotionally realized the irony, for this time humans had not created a digital technique to overcome COVID-19, instead resorting to retreating back into their houses.

What humans fail to realize today that technological advance with the development of super tech machines and powerful industries does not provide a better standard of living which is all today's generation cares about. The best gift that we can provide to the coming generations is a home, just a home where safety, comfort and the essence of life will be provided. For we will not be remembered for our technical and digital

achievements, but by our role as the citizens of the Earth and the respect which we had held for her. Today, it is clearly derived that we have failed in that. The recent COVID pandemic, Cyclones in West Bengal, Odisha and Maharashtra has provided a living proof that we humans are powerless against Mother Nature.

No matter the situation, Mother Nature is the ultimatum power and will, in time, heal herself.

After all, we belong to the Earth, for she is the best physician.

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### My Lockdown



By **Vidushi Bhardwaj**  
IX-B,  
**Mount Carmel School, Dwarka.**

Out of the blue, stepped in a disease,  
Brought lockdown along, which wouldn't budge to  
cease.

No colleagues, no friends,  
In the lockdown environment, I had to blend.

The studies did not wait,  
Online classes were knocking at the gate.

In front of my laptop, I sat still,  
Work was piling up like a hill.

I wouldn't exercise, wouldn't go out,  
Day by day, I was getting stout.

Washing utensils, mopping the floors,  
I realized how hard were these chores.

Everything was silent, I could hear the air blow,  
Time seemed to move immensely slow.

God would help, I was sure,  
I hoped the doctors would soon find a cure.

Out of the blue, everything was sealed,  
Maybe giving nature it's time to heal.

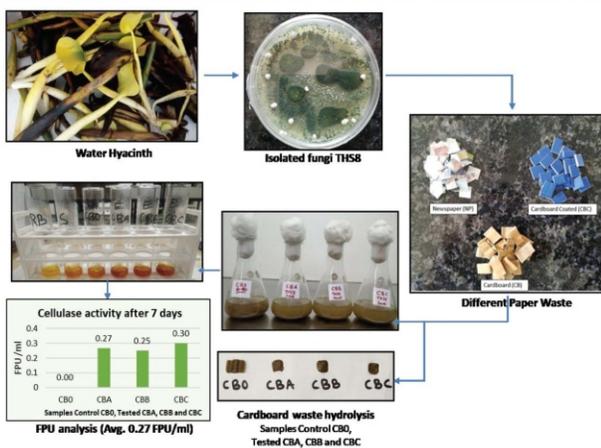
  
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