

Innovation 1

Carbon Dioxide Capture: Is this the Future of Sustainability?

Imagine the billions of tons of carbon dioxide (CO₂) humans have been spewing into the atmosphere since the industrial revolution. This is a problem because CO2 absorbs heat, contributing to global warming. Scientists have been right all along in warning us of the dire consequences if this trend continues.

We need to cut down excess CO₂ by reducing the demand for products and services from high-carbon emission industries. A notable example is shifting from fossil fuel to renewable energy sources. To take immediate action against carbon emission into our atmosphere, carbon capture and storage technology can be used to capture and store excess CO₂ for future applications.

Oxyfuel combustion, the burning of fuel in pure oxygen, significantly reduces the flue gases that are produced from burning fuel and other materials. The rationale for oxyfuel combustion is to produce a CO2-rich flue gas, making it easier for its sequestration. The flue gas volume, mass, and oxides of nitrogen content are reduced compared with conventional air combustion.

Direct air capture technology can also be used to store captured CO₂. Similar to plants absorbing CO₂ from the atmosphere during photosynthesis, direct air capture technology works by extracting CO₂ directly from the atmosphere. CO2 is extracted and stored underground, while the rest of the air is released back into the atmosphere.

Advances in artificial trees for CO2 capture, notably by Dr. Klaus Lackner of Arizona State University, have also been encouraging. Artificial or mechanical trees have shown the potential to capture CO₂ from the atmosphere just like natural trees do but at 1000 faster rate than a tree of a comparable size.

For industries that emit CO₂, carbon capture and storage technologies will be critical to continuing operations, meeting targets, and securing a sustainable future.

Mohamed AlHosani **Chief Sustainability Officer BEEAH Group**

"Protecting the environment does not mean compromising development, on the contrary, the two can develop a synergistic relation.

We need to harness the power of technology that we have today, for the benefit of the environment."

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BEEAH Success Story

Did COVID-19 Improve the Air Quality of Sharjah?

The year 2020 presented a lot of challenges, at home, in the workplaces, in our communities and cities, and forced us to make lifestyle changes. However, as human and industrial activities became predominantly virtual, the environment may have reaped some benefits. The reduction in the number of cars on the roads and the pause in industrial operations led to a significant improvement in the air quality of our cities.

In Sharjah, the BEEAH Environment Services (BES) team investigated the impact of COVID-19 lockdown on air quality, using state-of-the-art technology at the BEEAH air quality monitoring stations. Data were obtained from six ground air quality monitoring stations strategically located in residential, educational, industrial, and rural areas of Sharjah. The air quality trend of 2020 was then compared to those of 2019 and 2018.



Analyzing the data on the chemical compositions of the air, BES found that several of the criteria pollutants, notably nitrogen dioxide (NO2) and particulate matter (PM), significantly decreased in the lockdown months. In the AI Dhaid area of Sharjah, BEEAH recorded a 60% reduction in NO₂ emission as well as a reduction in ozone (O3) and PM emissions.

Nitrogen dioxide primarily gets into the atmosphere through burning of fuel in road vehicles, off-road equipment, and power plants. It is an O3 precursor reacts with other chemicals to form O3. Exposure to high concentrations of NO₂ is harmful to the human respiratory system, aggravating respiratory diseases. It also interacts with other atmospheric constituents to form acid rain.

The findings from this study show how human and industrial activities impact environmental quality. It also shows how measures to cut down pollutant emissions are critical to our health and environmental sustainability. Findings from this study will be helpful in future response efforts in the United Arab Emirates.



Innovation 2

"Plastic-Eating Enzymes" and Enzymatic Recycling Technology

Alarming environmental woes surround the use of plastics. Only a fraction of used plastics is recycled, and the conventional recycling techniques are limited by the number of recycles possible, as recycling produces lower quality products.

Plastics are dominating landfills, accumulating in oceans, and alarmingly found in the guts of whales and sharks. Its production and disposal contribute to greenhouse gas emission, and its incineration releases toxins into the atmosphere.

Thus, innovations for a circular plastic economy are inevitable. Could this effort be microbially driven?

Microbes produce enzymes. Enzymes catalyze (accelerate) chemical reactions. In humans, enzymes are responsible for breaking down complex food molecules to their simpler forms (monomers). In soils, enzymes are responsible for breaking down organic residues to release nutrients and further converting nutrients to their plant-available forms.



Heritage

"لقد عاش آباؤنا وأجدادنا على هذه الأرض وتعايشوا مع بيئتنا فى البر والبحر، وأدركوا بالفطرة وبالحس المرهف الحاجة للمحافظة عليها وأن يأخذوا منها قدر احتياجاتهم فقط، ويتركوا منهاما تحدفيه الأحيال القادمة مصدرا ونبعأ للعطاء"

"On land and in the sea, our forefathers lived and survived in this environment. They were able to do so because they recognised the need to conserve it, to take from it only what they needed to live, and to preserve it for succeeding generations." - Sheikh Zayed bin Sultan Al Nahyan

This quote echoes the significance of environmental conservation and management of our natural resources. Exploitation and mismanagement of natural resources have played out in various forms and settings. In developing countries, these are exemplified through forest encroachment in the continuous quest for fertile farmland, illegal forest exploitation by now sophisticated culprits, and influx of low-quality agrochemicals that have damaged agricultural soils, etc.

Among developed countries, there have been poor pollutant regulatory practices and aggressive exploration techniques for natural resources propelled by political gains, corporate greed, and in some cases, disregard for humanity. Also, the failure to embrace the reality of climate change despite the glaring consequences, remains a concern as positions on this topic are now used as political strategies.

The slow adoption or shift to renewable energy sources, circular economy, regenerative agriculture, and carbon capture practices, represents our presentday failure to invest in a sustainable planet for our future generations. We have continued to politicize the fate of the future generations.

The disparity between developing and developed nations further frustrates the global strive for environmental sustainability. The poorer nations struggle to meet food demand and are not yet at that leisure stage of having debates or investing in innovations on climate, environment, and future.

Our present-day exploitation of nature and mismanagement of resources could have a more damaging effect on future generations, far beyond our current imagination. The cumulative effect of those little things we individually ignore could be detrimental to our environmental sustainability pursuit.

We ought to conserve our natural resources and protect our environment to build a planet that will serve us and the future generations. This pursuit is a collective effort and every little step counts.



Certain enzymes found in microorganisms have shown the potential to convert the main plastic constituent, polyethylene terephthalate (PET), into its simple monomers – the concept of plastic-eating enzymes and enzymatic recycling technology. Notably, a bacterial species showed the potential to break down PET for food and produces a pair of enzymes that could break PET molecular bonds to its environmentally friendly monomers.

Recent advances are even more intriguing. Applying machine learning, scientists have engineered novel mutations to a natural enzyme possible of degrading PET in days and have also shown the potential to resynthesize PET from the recovered monomers.

Perhaps, a circular plastic economy will be microbially and enzymatically mediated.

Community

Contributing to the Goal with My Soilless Garden

The simple desire to make a positive difference is all it takes to stand out. Rumaitha Al Shehhi, a research assistant at the Ministry of Climate Change and Environment, UAE, wakes up every morning, adds nutrients to her small hydroponic garden and pulls a few leaves to add to her tea.

Passionate about environmental sustainability and realizing the significance of our individual contributions to the goal, Rumaitha has created a small hydroponic farm at her home using empty glass water bottles. She repurposed the bottles into a suitable growing environment for plants.

What is hydroponic farming? This entails growing plants without a soil medium but rather in a nutrient-rich water. There are many modifications of this technique enabling its application to residential and commercial (industrial) settings. However, we are focusing on using simple household items such as water bottles to grow plants indoors, a modification everyone can try.

It is important to ensure that the portion of the bottle housing the roots is dark, to prevent light which could trigger the proliferation of algae, a situation that can deplete the nutrients in the solution and contaminate the medium. This can be simply achieved by painting the glass bottles if they are transparent.

Rumaitha's motivation was to repurpose the glass bottles for her own benefits, growing simple plants she likes. She grows mint and basil, plants that are effectively supported by a hydroponic system.

"I use water mixed with a nutrient solution to help the plants thrive while keeping them indoors by a window. I add the mint to my tea and use the basil in my cooking." Just like that, Rumaitha is applying the principles of a circular economy – reusing and repurposing to reduce waste – and at the same time producing items she needs in the most environmentally sound manner.



Movie Review

Climate Refugees

The usage of the terms "climate war" and "climate refugees" are increasingly common among experts and entities at the forefront of the climate discussion

"Climate Refugees", a documentary film by Michael Nash, shades more attention on the now familiar topic of climate change and explores the possible interaction of overpopulation, resource depletion, and climate change – potentially, the toughest challenge mankind could ever face.

This documentary was filmed in Bangladesh, Tuvalu, China, Fiji, Chad, Sudan, Kenya, Maldives, Europe, and the United States of America. Michael Nash traveled the world for nearly two years documenting the impact of climate change and witnessing people from different countries forced to leave their homes due to climatic events with little or no protection.

Intense storms and sea level rise are forcing people out of their homes to other countries. In Sub-Saharan Africa, desertification and water scarcity are leading to food shortages and increased conflict over resources. Experts have predicted that if measures are not taken, more people will be uprooted because of sea level rise and increase in extreme events, droughts, and desertification.

Nash interviewed politicians, scientists, aid workers, and activists who echoed similar concerns on the issue. More harm to humanity is evident if carbon emissions are not reduced and the world reaches an



agreement on how to tackle climate change and environmental pollution.

Whether manmade or a product of nature, the changing climate is already creating a humanitarian crisis and will inevitably lead to worldwide instability. According to the United Nations, there are already more environmental refugees in the world than political or religious refugees.

Climate change is now considered a national security risk and the phrase "climate war" is being talked about in war rooms. Unfortunately, positions on climate change are still political.



GCC

Qatar: Old Tires, New Roads

The Gulf Cooperation Council member countries are not left out in innovations on environmental sustainability and the fight to make our planet less toxic, through their pursuit for zero waste, climatesmart practices, net zero, etc.

With a focus on waste elimination and pursuit for a circular economy, Qatar has led the effort on recycling of old tires, using them for asphalt production. Used tires could constitute a nuisance with various sources estimating up to one billion or more used tires disposed every year, globally. As gathered from various sources, the Ministry of Municipality and Environment, Qatar, on its official social media accounts, reported that 482,402 tires were processed in 2020.

The recycling of old tires for asphalt production follows a simple process as illustrated in "Asphalt: A magazine of the Asphalt Institute". Crumb rubber is produced by grinding rubber tires into very small particles. The reinforcing wires in the tires are removed by magnets, the fibers removed by the process of aspiration, and rubber particles sieved and separated into different sizes, depending on the need. The crumb rubber particles are then mixed in specific ratios with other additives to produce rubbermodified asphalt which could be used in road constructions.

Of interest, finding a use for abandoned tires is of great environmental significance as wastes are effectively utilized and eliminated, however, Qatar stands to gain more from this effort. Asphalt modified with ground tire rubber has been cited by the Asphalt Institute for positive qualities such as skid resistance, reduced pavement noise, improved ride quality, retarded aging and oxidation of modified binder, and enhanced pavement life.

Tip of the Month

You can contribute to the drive for a circular economy by simply repurposing commonly used plastic materials, for instance, a disposable grocery bag can play the role of a trash bag before becoming a trash.

Picture of the Month





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