

The other CO₂ problem

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THE global environmental threat is growing as the world is going to face another problem in near future alongside the global warming and climate change. The discovery of this emerging global problem is quite recent and it has received relatively little attention until now but within the next few decades it may turn out to be one of the most severe in terms of impacts on marine life.

Due to the continued high level of CO₂ emissions in the atmosphere, seawater chemistry is changing which is causing it to be more acidic. This phenomenon termed as "ocean acidification" appeared in the scientific literature for the first time in 2003. This is also being known as the "other CO₂ problem" or the "evil twin of global warming" because the same human induced CO₂ emission that is causing global warming and climate change is also responsible for this acidification of the oceans. Ocean acidification specifically refers to the increase of seawater acidity (i.e. decrease of ocean pH) due to its absorption of CO₂ from the atmosphere.

The underlying chemistry behind ocean acidification is very simple.

Carbonic acids are very unstable and convert into hydrogen ions (H⁺) and bicarbonate ions (HCO₃⁻). It is a natural process in the surface water of the oceans and includes a series of chemical reactions. However, since the industrial revolution we have released more and more CO₂ in the atmosphere. Therefore, the ocean has also absorbed greater amount of CO₂ at increasingly rapid rates which is too much for the ocean's natural ability to adjust to changes in CO₂.

Studies show that our oceans have already absorbed about a third of all CO₂ released into the atmosphere. As a result, chemical balance of the ocean is significantly changing causing too much increase in hydrogen ions (H⁺) which is ultimately causing the acidity in the water to increase (i.e. decreasing ocean pH level) the phenomenon named "ocean acidification". What is worrying scientists is the current rate of pH drop (i.e. rate of acidification) which is about 100 times faster than that experienced by marine ecosystems globally for the last 20,000 years.

Impacts on marine life and human food security

Ocean acidification is a global issue. However, it will happen more rap-

haps within the next few decades because cold water can absorb CO₂ more than warm water. Ocean acidification, according to studies conducted so far, would affect early life stages (gametes, larvae, juveniles) of many marine organisms as they are very sensitive at those stages. In case of adults, stress caused by ocean acidification may affect their health and reduce their growth rates and reproduction. Organisms may survive but their reduced reproductive capacity might result in less offspring.

Fisheries and aquaculture industries are now at great risk from future ocean acidification both directly through the impacts on the commercial organisms themselves and indirectly through the impacts on the food webs (on the organisms they prey upon) and the habitats they depend on to complete their life cycle. Amongst the organisms most threatened by ocean acidification are the shell-building ones such as corals, calcareous plankton (coccolithophores) and algae, molluscs (pteropods, oysters, mussels, clams, etc), echinoderms (sea urchins, starfish, brittle-stars, etc) and some crustaceans.

Because ocean acidification, with decrease in pH level, will decrease the availability of carbonate ions (CO₃⁻) in the water and this ion is very important for these kinds of organisms since it is used for their calcification - the process by which these kinds of organisms produce their hard shells and skeletons. The less carbonate ions availability in the water would hamper the calcification, slowing down the growth rates and decreasing the structural strengths of these organisms.

If ocean pH continues to decrease, at some point carbonate ions in the water can drop to such a level ('under-saturated' conditions) that it would even lead to dissolution of existing calcium carbonate shells and skeletons of organisms. Consequently, with other shell-building organisms, corals which also use carbonate ions (CO₃⁻) for building their structures, would be badly affected. Coral reefs offer spawning, nursery and feeding grounds to many species and thus provide habitat for at least a quarter of all marine species. Currently, most of the coral reefs all over the



Now the ocean suffers from rising level of CO₂

world are already threatened due to bleaching (response of corals to a stress caused by warmer waters), overfishing, destructive fishing and pollution.

Ocean acidification, if not controlled, would exacerbate the situation and could destroy all the coral reefs by as early as 2050. If reefs disappear, many of the reef associated species would face extinction. Consequently, worldwide reef fisheries which provide 9-12% of the world fish landings will collapse. Tourism related to reefs in different countries of the world (at least in about 94 countries) will be stopped as well.

Will Bangladesh be affected?

Bangladesh, situated in the tropical region, has an extensive coastline of 710 km and an Exclusive Economic Zone (EEZ) of about 164,000 square km with the Bay of Bengal. If the current trend of CO₂ increase continues, Bangladesh would be affected by the increasing acidity in the Bay as well but not severely before the end of this century. Moreover, ocean acidification would occur alongside some other processes such as warming of the seawater, sea-level rise which might more complicate the consequences. Organisms and ecosystems have to deal with several major rapid changes at once.

Our marine fisheries contribute around 20% of the total fish production. Combined impacts of ocean acidification and some other climate change related processes might affect the abundance, composition and distribution pattern of our marine fish stocks and thereby

have an effect on commercial harvests. With increasing acidity in the water, particularly the shell-building organisms might experience severe negative effects and consequently the commercially important species that feed on them. This might bring substantial direct ecological and economic losses.

In Bangladesh, coral communities are found only around St. Martin's Island. Here, a total of 66 coral species have been recorded. They are currently struggling with human pressure and high level of sedimentation, and in near future they are expected to face sea-level rise and increased temperature. Future ocean acidification will exacerbate the situation and might speed up their complete disappearance. If the coral reef disappears, around 86 species of coral reef associated fish recorded from St. Martin's Island might vanish as well.

Oceana, an international organization for ocean conservation, evaluated the likely vulnerability of different countries of the world to continued ocean acidification. According to their analysis, unlike global warming and climate change, the major emitters of CO₂ are likely to be among those countries most affected by ocean acidification. The five most vulnerable countries to ocean acidification are - Japan ranking first in the analysis, followed by France, the United Kingdom, the Netherlands and Australia. Among the 187 countries ranked, China and the United States, the world's top CO₂ emitters, rank 13th and 8th respectively, while the rank of

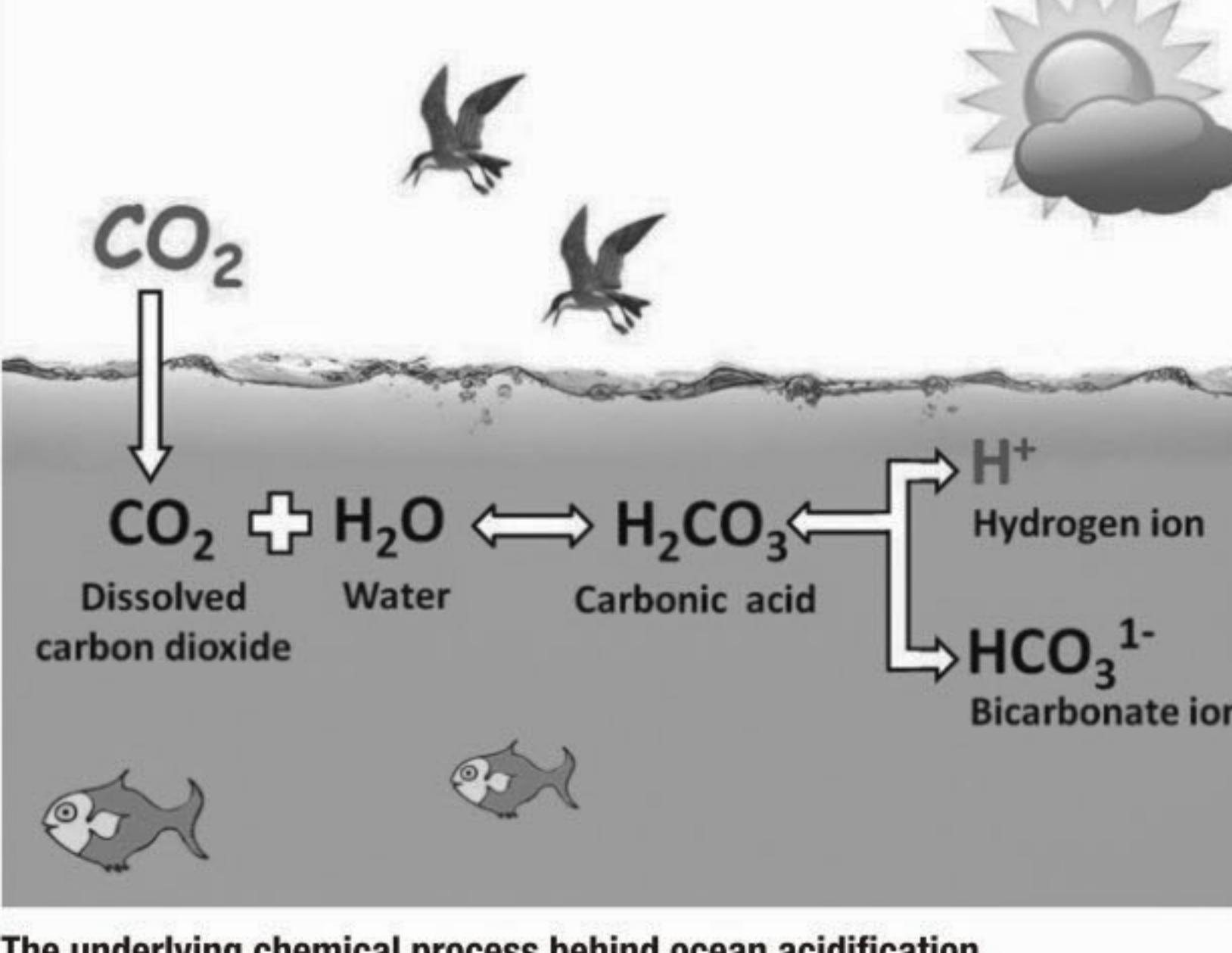
Bangladesh is 65.

The results of Oceana analysis indicate that more than a third of the world's population will be affected by ocean acidification. Until now, most of the studies evaluating impacts of ocean acidification have been carried out in the high latitudes and in the temperate regions since those areas will be affected first. Very few researches have been done to identify the most vulnerable elements of tropical ecosystems. Perhaps no effort has been made so far in Bangladesh as well to identify the threats associated with ocean acidification.

Mitigation

There is no practical solution to this problem except relying on nature to take its course which might take thousands to millions of years for total recovery. Until then the only realistic action we can take is to reduce our global CO₂ emissions significantly which will help slow the rate of acidification in the oceans as well. To date, ocean acidification has received relatively little media coverage. Policy makers need to realize that the measures that only address global warming and climate change are not enough to fully confront global change impacts. Vulnerable countries including Bangladesh need to be concerned about this emerging environmental problem and include ocean acidification alongside climate change in their national action plans and strategies.

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The underlying chemical process behind ocean acidification

When the atmospheric carbon dioxide (CO₂) comes in contact with the surface water of the ocean, CO₂ dissolves there to form a weak acid known as carbonic acid (H₂CO₃).

idly in some parts of the world than others and its impacts will also vary on the basis of local conditions. The cold polar and sub-polar waters are going to be affected first and per-

Holistic approach to environmental preservation

The natural environment is being modified by human activities aiming to provide themselves housing, food, medicine and many other facilities for enhancement of comfort. It is the crying need of time to preserve natural environment, protect environmental pollution and restore degraded natural resources again for human survival.

MAHFUJ RAHMAN

ENVIRONMENT refers to our surroundings that include all things living and non-living. Both the materials and their condition are important aspect of the environment. Nature can change naturally as considered by paleo-environmental scientists. Climate of the earth changed many times. Extinction of dinosaurs is supposed to linked with change of local climate. That is a different thing. But that "due to human intervention environmental conditions are being changed" is vital concern for existence of many organisms.

Air, water and soil are being polluted due to various human activi-

ties. Some scientists say that man began to pollute the environment since he learnt to create fire. In the 19th century man learnt the way of utilising heat energy to do mechanical work by inventing steam engine. Invention of steam engine dependent on coal is a landmark in the history of environmental science. It provoked the industrial era of human civilization and initiated the pollution of environment in a cognizable scale.

Environmental degradation incurs economic losses. Polluted water as raw material demands treatment that raises production cost. Waning biodiversity is shrinking our genetic resources at the global scale. Examples abound.

Environmental pollution has its direct impact on public health. Toxic gases emitting from industrial process afflict the health of workers. Pollution of water leads to various infectious diseases. Soil contamination induces various toxic effects on living system through food chain.

The destruction of natural environment is also responsible for various environmental banes at local, regional and international levels. Acid rain, depletion of ozone layer and global warming as a result of 'Green House Effect' are challenging mankind's existence on the earth surface.

Major causes of environmental pollution are:

- Lust for better life without

considering environmental aspects

- Exponential population growth
- Technological advancement without impact mitigation measures

Major means of environmental pollution so far are:

- Transportation
- Industrialization
- Urbanization
- Warfare
- Information Technology
- We must know about
- Life supporting processes on the earth surface
- Mechanisms of environmental pollution
- Techniques to protect the environment

It is the very ecosystem in which we live can be polluted, disrupted and destroyed if proper measures are not taken. Even it is not possible to correct our surrounding environment for good. We must engage our efforts to conserve, protect the environment and prevent pollution continuously.

What we need to do are:

- Continuous environmental monitoring
- Environmental impact assessment for any proposed development
- Product life cycle assessment

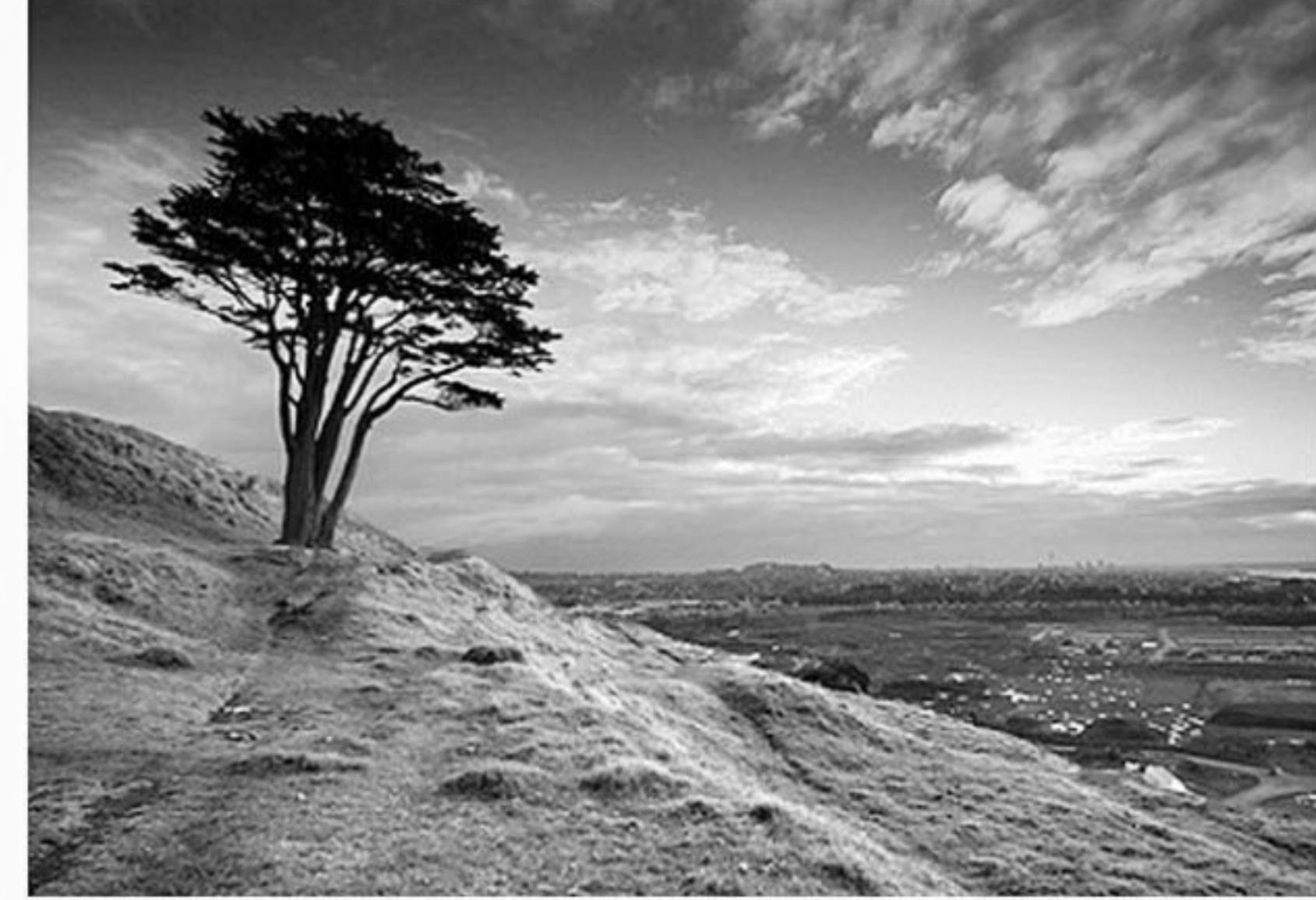
for sustainable production and consumption

- Waste management plan for local government
- Protection of water resources
- Conservation of biodiversity

Human being is central character of change on the planet. The natural environment is being modified by human activities aiming to provide themselves housing, food, medicine and many other facilities for enhance-

ment of comfort. It is the crying need of time to preserve natural environment, protect environmental pollution and restore degraded natural resources again for human survival. We must keep in mind that people are central to environmental pollution and they have to recover from it themselves.

THE WRITER IS AN ENVIRONMENTAL ACTIVIST.



The environment we need to preserve for our own sake