

IN SEARCH OF DRINKING WATER

Desalination holds promise

ZUBAIR HOSSAIN

SAFE drinking water is essential to humans and other life forms. The coastal region of a country has to face tremendous drinking water crisis, as most of the water available is saline. In Bangladesh 19 out of 64 districts are in proximity to the Bay of Bengal. The chief difficulty in the development of appropriate water supply system for the communities in the affected area is that deep aquifers containing sweet water are not found at all possible locations in the coastal region. One of the most convenient options to ensure potable water is to make use of the abundant source of seawater and brackish water. One may think it to be insane - drinking a glass of seawater! Well, to bring down the salinity under specified limit, desalination is widely practised all over the world. Ways of desalination are many. The conventional methods of desalination of salt waters to produce fresh water such as distillation, electrolysis and reverse osmosis are intensive energy techniques. Due to increasing energy costs and declining energy sources, there is a growing interest in the use of low cost technologies.

Solar energy is free of cost and easily available. The technology



This plant was built on the rooftop of Civil Engineering Department building, BUET.

involved in distillation of saline water using solar energy is relatively simple and maintenance can be carried out by semi-skilled and unskilled operators. Moreover, Rural community is settled at widely spaced intervals. A centrally operated treatment plant would become costly in terms of supply pipes etc. Therefore, a study was carried out to evaluate the viability of a small solar desalination plant for a single family residing in the coastal area of our country.

A PLANT WAS BUILT

Presently, solar still plants, for

desalination purpose, are not in use in this country. Hence a plant was constructed on the rooftop of Civil Engineering Department building, BUET and plant operation was performed for the months of Nov 2011, Dec 2011, Jan 2012 and Feb 2012 to observe the variation of diurnal distillate production of such a plant. The diurnal output of the plant was found 1.198 litre per sq. meter of the basin on an average. The salinity removal of the plant was more than 92%. So the pure water obtained from the solar still can be mixed up with the

feed water prior to consumption. However, the mixture should not have salt concentrations beyond the tolerable limit. Other aesthetically important water quality parameters were tested in the output water (color, turbidity) to ensure its acceptability to the users.

As a material of construction brick was given preference because of its availability throughout the country and low-cost. Glass satisfactorily served the need of a transparent cover material. Inlet and outlet to the basin were PVC

pipes. The total cost involved to construct the plant was tk3800.00. More than 40 per cent of this cost was spent for paying construction labor. In rural areas where labor is cheap compared to Dhaka city, the cost can be considerably minimized.

The plant was run during dry season. If the plant was incorporated with a rainwater harvesting system, the output would obviously be very high. The future researchers in this area can investigate on it.

Lastly, a solar desalination unit makes use of renewable energy and as a result a green solution to the water scarcity problem. Locally available and cheap materials were used to construct the solar still. Low cost and sustainability were the key points of the study.

Summary:

Both seawater and solar energy is abundant and free in nature. Together they can ensure a great drinking water resource.

Installation of a small desalination plant is cheap. Maintenance can be carried out even by unskilled operators.

Solar desalination plant incorporates solar energy directly, no need of expensive PV cells. Use of renewable energy makes this technology eco-friendly.

The writer is a graduate in civil engineering from BUET.



BIOLOGY MICROBE

New bacteria species found



Scientists have discovered a species of cyanobacteria that makes tiny calcified structures inside its cells. Related microbes calcify on the outside.

SCIENTISTS have discovered skeletons in the cyanobacterial closet. A never-before-seen species of cyanobacterium loads its cells with little bone-like lumps that may act as ballast, helping to anchor the beastie in its home waters of a Mexican lake. The discovery, described in the April 27 Science, is the first report of such a microbe creating calcified structures inside its cells, rather than externally.

Scientists aren't sure what to make of the discovery. Related cyanobacteria play a major role in the planet's geochemical cycles. "It's interesting and opens up possibilities we hadn't thought about before," says Robert Riding of the University of Tennessee in Knoxville, who wrote a comment on the research in the same issue of Science. Because the microbe is the first of its kind, and so far, has been found in only one place, "it's difficult to know where it will lead," Riding says.

Geobiologist Karim Benzerara and his colleagues were investigating Lake Alchichica's stromatolites, knobby pillars of sediment and microbes that can form in shallow waters. The researchers cultivated slimy films of the microbes in a lab aquarium. Looking at the slime under a microscope, the team saw that some cells looked like they were filled with little pearl-like granules. "That's when we figured out that there was something special," says Benzerara of the CNRS Institute of Mineralogy and Physics of Condensed Matter in Paris.

The granules are an unusual mixture of calcium, strontium, barium, magnesium and carbonate. Because the ratios of these ingredients aren't the same in the granules as in the surrounding water, the researchers suspect that the cyanobacteria have some control over formation of the lumps and are actively transporting some of the ingredients into their cells. While the lumps occupy only about 6 percent of a cell, they change the microbe's density, increasing it by 12 percent. This might help the microbes move from the water column to the surface of an underwater rock or stromatolite, the researchers speculate.

Source: Science News



SMALL EYE

Tiny shark has glowing belly



The small eye pygmy shark is one of the world's tiniest sharks.

TINY sharks about the size of a human hand have a superpower of sorts: their bellies glow, according to new research that also showed these small eye pygmy sharks use the glow to hide from predators lurking below.

Scientists had proposed the small eye pygmy shark (*Squaliolus aliae*) sported light-emitting organs called photophores for use in camouflage, but that was never really tested, said study researcher Julien Claes of the Université catholique de Louvain in Belgium. "It wasn't even known if these organs were really functional, able to produce light," Claes added.

The small shark, which reaches a maximum length of just 8.7 inches (22 centimeters), lives well below the water surface in the Indian and western Pacific Oceans. The new research, detailed this week in The Journal of Experimental Biology, suggests their glowing bellies (a type of bioluminescence) would replace the downwelling light from the sun, or the moon and stars, that is otherwise absorbed by their bodies.

For the study, Claes and his colleague Jérôme Mallefet, along with Hsuan-Ching Ho from the National Dong Hwa University, Taiwan, captured 27 adult, small eye pygmy sharks off the coast of Taiwan and brought them to the National Museum of Marine Biology and Aquarium.

Source: Live Science



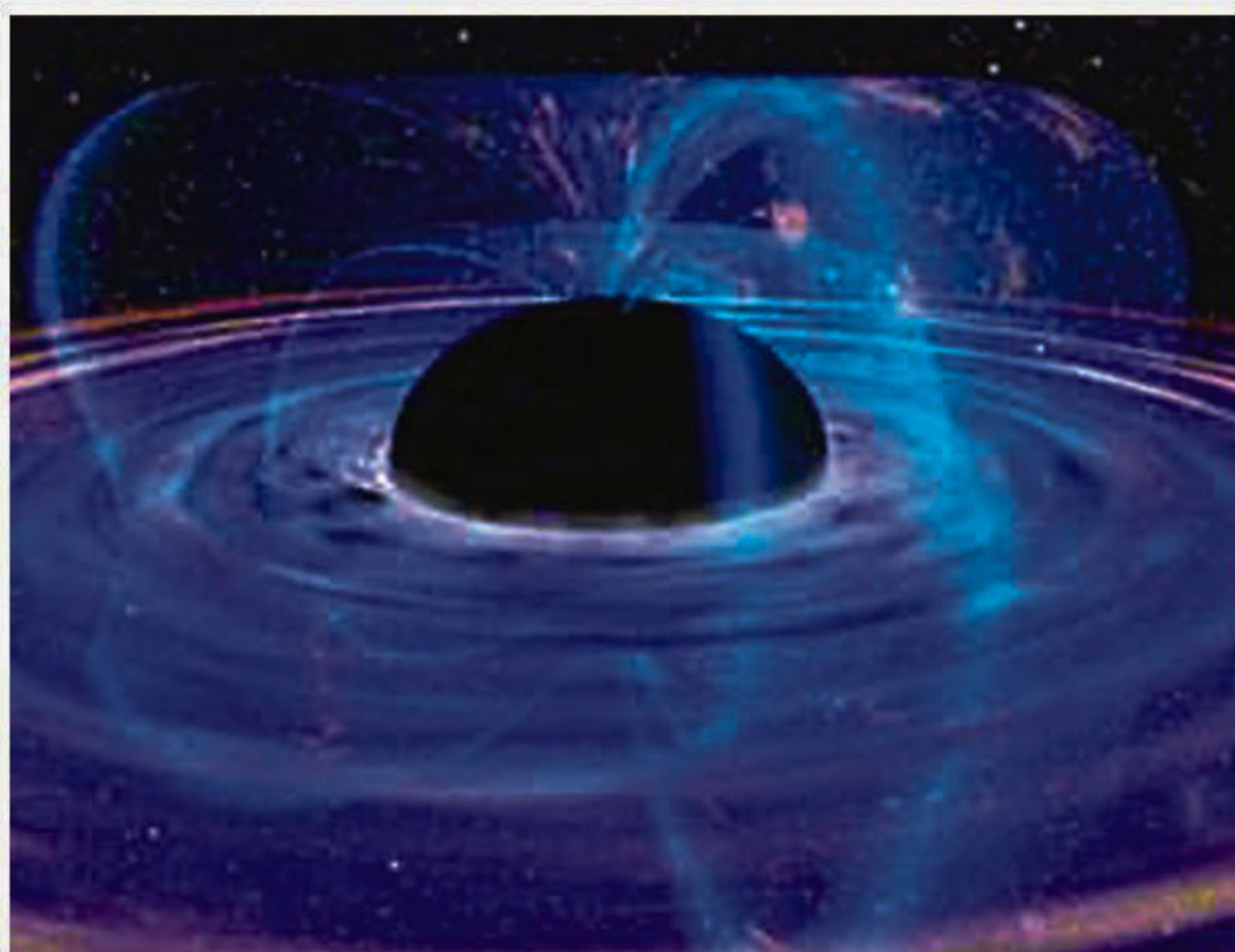
BIG BANG REMNANTS

Primordial black hole

OBAIDUR RAHMAN

A Primordial Black Hole (PBH) is a hypothetical black hole that may have formed in the early, highly compressed stages of the Universe immediately after the big bang. According to experts, during the first few moments after the big bang, the pressure and the temperature of the early Universe were very intense. In that condition, simple fluctuation in the density of matters may have resulted in local regions to get dense enough to create black holes. It is thought that due to the expansion of the Universe, most regions of high density quickly dispersed. However, primordial black hole would still be stable and exist till date.

It is believed that if scientists are able to determine how many primordial black holes are there, we would learn a great deal about the early stages of the Universe. Black holes with masses of more than 1000 million tons could be detected only by their gravitational influence on other visible matter or on the expansion of the Universe. There may be PBHs with a much smaller mass created due to collapse irregularities during the earlier stages of the Universe. Scientists believe those would have a much higher temperature and likely to be emitting radiation at a much higher rate. Since they are not formed by stellar core collapse like



Some scientists argue that Primordial Black Holes existed since the dawn of time.

other black holes, PBH can be of any size. As gravity would draw a PBH towards any matter, they are likely to be very common in and around galaxies. Gamma Ray Background indicates that there cannot be more than 300 PBH per cubic light-year on average.

One crucial way to detect primordial black holes is through watching out for ripples on the surface of stars because if the PBH passes through a star, its density would cause observable vibrations. This means that PBH are in fact much

smaller than the normal black holes and hence would not swallow up a star and all of its energy. Their collision with stars would cause noticeable vibrations on the surfaces of the star. Scientists believe they may be able to spot evidence of the mysterious dark matter by watching out for ripples. It has long been proposed that PBH could be a candidate for the dark matter and the ripples could provide observable proof of dark matter, which is believed to make up for 80% of all matters in the Universe!



FIERY VISITOR

Phenomenal fireball



Lisa Warren vis NASA/JPLA minivan-sized meteoroid dives through the atmosphere, leaving a trail of fire visible across Nevada and California. The space rock rattled windows over California's Central Valley at about 8 a.m. PT on Sunday, April 22 when it exploded in the upper atmosphere, releasing energy equivalent to a 5-kiloton burst. NASA experts estimate that the object weighed about 154,300 pounds (70 metric tons).

Source: Live Science



DID YOU KNOW?

What is ambergris?



Ambergris Latin: Ambra grisea, Ambre gris, ambergrease or grey amber) is a solid, waxy, flammable substance of a dull gray or blackish color produced in the digestive system of and regurgitated or secreted by sperm whales.

Freshly produced ambergris has a marine, fecal odor. However, as it ages, it acquires a sweet, earthy scent commonly likened to the fragrance of rubbing alcohol without the vaporous chemical astringency.[1] The principal historical use of ambergris was as a fixative in perfumery, though it has now been largely displaced by synthetics.



GRAPH EXETER

Wearable electronics invented

THE most transparent, lightweight and flexible material ever for conducting electricity has been invented by a team from the University of Exeter. Called GraphExeter, the material could revolutionize the creation of wearable electronic devices, such as clothing containing computers, phones and MP3 players

GraphExeter could also be used for the creation of 'smart' mirrors or windows, with computerised interactive features. Since this material is also transparent over a wide light spectrum, it could enhance by more than 30% the efficiency of solar panels.

Adapted from graphene, GraphExeter is much more flexible than indium tin oxide (ITO), the main conductive material currently used in electronics. ITO is becoming increasingly expensive and is a finite resource, expected to run out in 2017.

These research findings are published in Advanced Materials.

At just one-atom-thick, graphene is the thinnest substance capable of conducting electricity. It is very flexible and is one of the strongest known materials. The race has been on for scientists and engineers to adapt graphene for flexible electronics. This has been a challenge because of its sheet resistance, which limits its conductivity. Until now, no-one has been able to produce a viable alternative to ITO.

To create GraphExeter, the Exeter team sandwiched molecules of ferric chloride between two layers of graphene. Ferric chloride enhances the electrical conductivity of graphene, without affecting the material's transparency.

The material was produced by a team from the University of Exeter's Centre for Graphene Science. The research team is now developing a spray-on version of GraphExeter, which could be applied straight onto fabrics, mirrors and windows.

Source: Science Daily



University of Exeter researchers Dr Monica Craciun and Dr Saverio Russo.