In this issue

Nuclear Energy from Thorium

Non-proliferation, reduction of waste

As of now, most of the energy produced by nuclear fission uses U^{235}. India has very little of the precious isotope and has to depend on international supply. The estimated reserve of the uranium isotope may only suffice to provide energy for the next two centuries. So the price for this fuel may go up.

One way out is to use U^{238} in breeding reactors. The unused fast neutrons from U^{235} fission can convert isotope U^{238} to Pu^{239}. Since Pu^{239} is fissile, along with energy, one can produce nuclear fuel. In fact, more nuclear fuel is produced than is consumed. But use of this plutonium isotope leads to bigger problems: radioactive nuclear waste. Moreover, it is weapon grade nuclear material and raises issues related to non-proliferation.

Thankfully, India has an abundant supply of thorium. The Th^{232} isotope can even absorb slow neutrons and convert them to U^{233}, another fissile material. This can also produce more nuclear fuel than is consumed. Moreover, use of Th^{232}, as starting material, reduces the burden of dealing with nuclear waste and does not come into conflict with nuclear non-proliferation goals.

In a General Article on **page 1607** in this issue, scientists at BARC, Mumbai, provide a road map for the future of nuclear energy and sketch out alternative routes and technologies that can use thorium in the Indian context.

Metabolomics of Plants

A challenge and an opportunity

From pain killers such as aspirin, to antimalarials such as quinine and artemisinin, to anticancer drugs such as taxol, many therabeutic agents are secondary metabolites of plants. More than 200,000 secondary metabolites from plants have been explored. And this is only the beginning. A lot remains to be explored.

Thankfully, new experimental techniques and technologies such as Liquid Chromatography coupled to Mass Spectrometry, Gas Chromatography coupled to Mass Spectrometry, Quantitative high-performance liquid chromatography photo-diode array analysis, ultra-performance liquid chromatography, quadrupole time of flight mass spectrometry, principal component analysis of NMR Metabolic Profiles and ^{1}H NMR conjugated spectrometric techniques are now available to the scientists. These make the task easier. It is now possible to screen plants for their secondary metabolites on a larger scale than ever before. After Genomics and Proteomics, Metabolomics has become the rising star in research.

In a Review Article on **page 1624** in this issue, scientists, from the Jadavpur University and the Hyderabad University, argue that plant metabolomics have an important role in drug standardization, quality evaluation and scientific validation of herb based medical systems such as Ayurveda and Unani. It is time Indian scientists become the rising stars of metabolomics.

Progressive Loss of Vision

Genes identified in dogs

Many breeds of dogs show progressive loss of retinal function in both eyes. But the onset and progression vary between breeds. This allows genome-wide association studies, linkage studies and a targeted gene approach to understand the genes involved.

Scientists in the Anand Agricultural University, Gujarat, used a targeted gene approach on nine cases of progressive retinal atrophy in dogs and compared them with normal dogs. They have thus identified the genetic mutations involved in three genes. In a Research Article on **page 1640** in this issue, they say that, though the rods and then the cones and later the optic nerve itself are affected, the genes responsible are primarily involved in the transduction of retinal stimulation.

This approach, if used on a larger scale, would be useful in understanding all the genes that may be involved. Perhaps research on man's best friend can help quicker identification of the genes involved in similar problems in humans, say the scientists.

Solar Thermal Collectors

ZnO nanofluids outshine others

Flat plate solar collectors and parabolic solar thermal collectors have been in use for long, much before solar energy conversion to electricity became a reality. The finding, that a colloidal suspension of nanoparticles in a liquid medium can increase the efficiency of direct absorption solar collectors by a few thousandfold, has re-ignited interest in thermal collectors.

Silver nanofluids, copper nanofluids, carbon black nanofluids, TiO_2 nanofluids and ZnO nanofluids have all been tested for the purpose. Scientists have also been experimenting with different base liquids such as propylene glycol, ethylene glycol and water. So a concerted search for the right combination of nanomaterial and base fluid that will be most commercially viable is necessary.

Now, in a Research Communication on **page 1664** in this issue, a team of engineer scientists from Madurai, Chennai and Coimbatore come up with a combination that lowers the cost significantly: ZnO in water. Their method for making the nanofluid is simple. They tested different concentrations of ZnO nanoparticles from 0.1, to 0.2, 0.3 and 0.4 wt%. Using ZnO nanofluids with different volume fractions, they were able to achieve better absorption than that predicted.

Though the nanofluid with 0.4 wt% of ZnO was more effective in collecting and transmitting heat, 0.3% wt% was more stable. Compared to other nanofluids, the sedimentation of the nanoparticles is much slower. Scientists say that this combination of nanoparticles and base fluid is not only less costly, but also more environment friendly.

The ZnO particles they used ranged from 200 to 500 nm. Moreover, the shapes of the particles were also quite varied. By carefully controlling these parameters, scientists feel that the ZnO based nanofluid can be an even better option for use in solar collectors.

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