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Nanoporous zeolites

In many parts of the world, the falling per capita food grain production is reported due to the soil resource degradation. In order to reverse this trend, it is necessary to intensify crop production per unit of land. Our soils are either inherently low fertile or made less fertile due to intensive removal of nutrients. It is in this context, the farming with nanoporous zeolites assume greater significance. Zeolites are crystalline aluminosilicates. They are tectosilicates exhibiting an open three-dimensional structure containing cations needed to balance the electrostatic charge of the framework of silica and alumina tetrahedra and containing water. Zeolites are one of the greatest cationic interchangers and their cationic interchange capacity is two to three times greater than other types of minerals found in soils. They are natural materials with the ability to exchange ions, absorb gases and vapours, act as molecular-scale sieves and catalyse reactions owing to fixed pore sizes and active sites in the crystal lattice. Zeolites are important materials with very broad applications in refineries as catalysts, sorption and separation processes, and also in agriculture and environmental engineering. Some significant directions of zeolites' utilizations are discussed but the importance is growing day by day. Today, mainly synthetic zeolites are used widely in petroleum refining and chemical process industries as selective adsorbents, catalysts and ion exchangers. But the importance of zeolites has been realized in a greater extent in the agriculture sector. The current growing awareness of the phenomena and availability of inexpensive natural zeolites in the world have aroused considerable commercial interest. Zeolites are becoming the subject of interesting study in various agricultural issues. K. Ramesh *et al.* (**page 760**) review the possible areas of utilization of zeolites in farming and the researchable issues.

Makhana

Makhana (*Euryale ferox* Salisbury), an exclusive aquatic cash crop, is a monotypic genus with limited genetic variability. It has nutritional and medicinal properties and supports cottage industry. A. K. Verma *et al.* (**page 795**) highlight the cultural practices, genetic variability among available germplasm, biochemical changes during seed germination and sensitivity to gamma irradiation for induced mutagenesis. As Makhana is an aquatic plant and the seeds germinate when it is inside the water, different biochemical changes (protein, MDA content, POD-, SOD-, GR-, APX- and CAT-activities) at different stages of seed germination were studied. RAPD pattern was studied from 17 accessions and no distinct variation was observed, indicating homogeneity of all available accessions.

No improvement work was initiated earlier on Makhana using induced mutagenesis techniques. As it is monotypic genus, induced mutagenesis is the best available method for its improvement. Sensitivity of Makhana to gamma rays was studied to induce desirable genetic variability (spineless strain, new better varieties, early flowering/early maturity strains, high yielding variety with increased seed number, increased seed weight, increased seed size, increased fruit number, increased floral stalk, increased berry size, etc.). Makhana was found to be sensitive to gamma radiation and new desirable variety with improved commercial traits can be developed through induced mutagenesis.

Deep-ocean exploration using remotely operated vehicle

Work class remotely operated vehicle (ROV) rated for 6000 m depth of operation (ROSUB 6000) has been developed at the National Institute of Ocean Technology, Chennai for deep-ocean resource studies. This system is being developed for the exploration of deep-sea mineral deposits such as poly-metallic nodules, gas hydrate, cobalt crust and other deep-ocean scientific observations in Indian waters. ROSUB 6000 comprises ROV, Tether Management System (TMS), Launching and Recovery System (LARS), control console with hardware and software, power house with high voltage power distribution system and Winch system with 7000 m umbilical cable. ROV developed has six degrees of freedom which is achieved with seven thrusters with maximum forward speed of two knots. The payload includes two heavy duty manipulators, underwater luminaries, colour and black and white cameras, sonar and other sensors. Several qualification sea trials were conducted above 1000 m water depth in the Bay of Bengal and Arabian Sea during 2006–2009. Design depth qualification sea trial was conducted at Central Indian Ocean Basin at a depth of 5289 m during April 2010.

G. A. Ramadass *et al.* (**page 809**) present the details of ROV-based deep-water scientific expedition performed to decipher the surface expression of gas hydrate at a depth of 1017 m in the Krishna–Godavari basin of the Bay of Bengal during September 2009. High-resolution bathymetry with multibeam sonar, vertical profiles of dissolved oxygen and water temperature were also collected in real time using ROV. Live images of sea-floor habitats and deep-sea organisms such as deep-sea fishes, shrimp, corals, holothurians and polychaetes were recorded and identified. Probable deep-water coral reef province is being established for the first time from deep waters of the Bay of Bengal and the exploration results brought out chemosynthetic habitat at the expedition site in the Bay of Bengal.