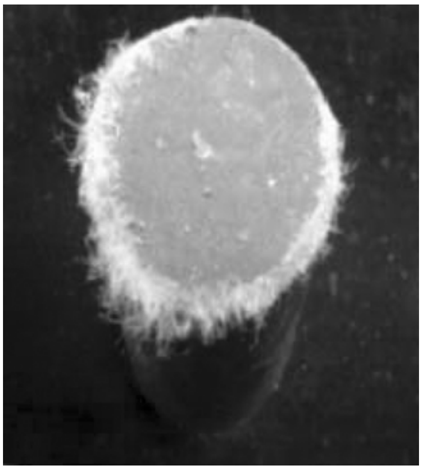
# In this issue

## Conceptual advances in the analysis of geomorphic systems and application to the large Ganga river system

One of the main sustainability agendas of the coming decades is the proper management of our natural freshwater systems. Therefore, a multi-scale (temporal and spatial) understanding of large river systems is critical. Jain *et al.* (**page 1300**) provide a brief review of geomorphic concepts, i.e. scale, magnitude–frequency, equilibrium, threshold, hierarchy, sensitivity, connectivity, nonlinearity and complexity, and then reanalyse the available multi-scale data of Ganga river system in this new conceptual framework for gaining insights into the large Ganga river system. Such large systems show complex threshold-driven behaviour, because of large spatial and temporal diversity and variability. The concept of threshold is critical to explain river dynamics and associated processes such as the Kosi avulsion of August 2008. It is pointed out that prediction of the future morphologies of landforms is difficult but the probability of reaching a particular geomorphic state after understanding spatio-temporal variations may be estimated. It is argued that holistic studies of Indian large river systems that integrate geomorphic, sedimentologic, stratigraphic, hydrological, geochemical and ecological data will help in building a science-based knowledge system for practicing river management (including river health assessment) and river engineering. Besides highlighting important research questions at different scales, the authors suggest that integration of geomorphology–ecology–hydrology at modern time scale ($10^0$–$10^2$ years) and the quantification of geomorphic connectivity at longer time scale ($10^2$–$10^4$ years) is a major challenge in the understanding of large river systems.

## Reactivity, workability and strength of potassium versus sodium-based geopolymers

Ordinary Portland cement (OPC) has been the most commonly used binder for concrete making. Manufacture of OPC involves high energy and fuel consumption. The major by-product carbon dioxide is a well-known global warming gas. Therefore, there is a strong need for a more energy efficient and green binder system with reduced carbon footprint. Such a system has emerged in the form of geopolymers. Geopolymers belong to the family of aluminosilicate polymers and represent a new type of materials on the border line between vitreous, ceramic materials and those based on the traditional inorganic binders and building materials and consist of cross-linked units of $AlO_4^-$ and $SiO_4$ tetrahedra, where charge balancing cations are provided by alkali metal cations and is synthesized from predominantly silicon and aluminium materials of geological origin or by-product materials. Chemical bonds of Si–O and Al–O are among the most stable covalent bonds in nature. Normally, geopolymerization of aluminosilicate minerals from industrial wastes, such as fly ash and ground-granulated blast furnace slag is brought about by using highly concentrated alkaline activator solutions at high temperature. Sodium-based compounds are widely used due to their easy availability. As potassium compounds have very low activation energy, it will be more effective to use as alkaline activator solutions. In the past, there are some contrasting results that have been reported with regard to the relative efficiency of sodium and potassium compounds. Therefore, a comparative study between sodium and potassium-based geopolymers is essential and has been brought out by utilizing lower concentrations of sodium and potassium



compounds respectively, at ambient temperature thereby eliminating the need for supply of energy. As the physical and mechanical properties of the resulting compound or a composite are a consequence of the physical and chemical processes occurring in a mixture after the blending of ingredients, some of the parameters which influence the geopolymerization process, viz. workability, setting time, degree of reactivity, pH and compressive strength are determined. Effect of sucrose and sucrose with tartrate on the above parameters has also been examined. Geopolymer formulation with potassium compounds imparted the maximum compressive strength with lesser water demand. See **page 1320**.