Cement composites using various types of fibres is a relatively new construction material developed through extensive research during the last three decades. Even though interest on this new material generated about three decades ago, large-scale use of the cement composites has been on the increase only over the past fifteen years. Several organizations in India and abroad have been carrying out research and development work on fibre reinforced cement composites – (FRC) since the early 1970's, especially, on synthetic fibres. However, investigations on the suitability of natural fibres (i.e. plant / vegetable origin) as reinforcement in cement matrices for producing building materials for low-cost housing, have been initiated only during the last two decades.

Studies on wet-state properties of cement/cementitious materials are also important apart from hardened state properties, for better understanding of the behaviour and assessing their suitability as a building material. Traditionally, the wet state properties have been studied using various workability tests, which are mostly empirical, and do not measure the inherent property of the material. Moreover, such tests created difficulties in comparing the results from different methods and the experimental results of various investigators, and to stipulate specifications for mix proportioning. To overcome the above problem, a pioneering research work on ‘rheology of cement /cementitious materials’ in U.K was initiated and is in progress for the past 2 to 3 decades, in various developed countries. As a result of such efforts, Rheometers / Viscometers for determining the basic rheological parameters, namely, ‘yield stress’, and ‘plastic viscosity’ have been developed, evaluated, and calibrated for a variety of cement /cementitious materials. But the above instruments are very costly and not that easily available in developing countries. However, certain conventional and non-conventional methods have the scope and potential for evaluating the rheological characteristics of composites, which needs to be advantageously exploited. Based on the comprehensive review of published literature, it is found that there is still scope for further and wider study on the cement /cementitious system with natural fibres, to arrive at a proper mix proportion having good workability, and without compromising much on the strength and durability of the composite.

One of the inherent drawbacks of natural fibres i.e. embrittlement in an alkaline medium can be improved by various methods. Among them, use of ‘mineral admixtures’ in the composite is found to be the effective method, with several advantages. Of the several pozzolans that are used in cement system even though, flyash is abundantly and widely available, the actual utilization is very less. However, there is scope for its larger utilization in cement systems. Moreover, its reported use in natural fibre composites, is rather rare and scarce. Hence, there is a necessity for a comprehensive study on such composites, i.e. natural fibre flyash cement composites.

Therefore, in the present study, a preliminary investigation was conducted in terms of four natural fibres namely, coir, sisal, hibiscus cannebinus and jute and based on that, sisal fibres were chosen for workability and rheological studies on the mortar composites. Flow table test (to determine the ‘mobility’ of the mix) and the ‘direct box shear test’ commonly used in Geotechnical Engineering (to determine the ‘stability’ of the mix) for three mix proportions (1:3, 1:4 and 1:5) at various aspect ratios (upto 300), flyash contents (10 – 70%) and fibre contents (0.25 – 2.0%), were considered.
Strength (compressive, flexural, split – tensile) characteristics of the composites, flexural and impact strength characteristics of mortar composite slabs and durability of composites, were experimentally determined for 1:3, at a constant flow value (110%) for the above range of flyash and fibre contents. Sisal fibre roofing sheets were cast manually (1:3, flow value = 65%; flyash = 10 - 30%; fibre content = 0.25% - 2.0%). Performance of the above composite sheets (flexural and splitting loads, impact strength, water absorption and water tightness characteristics), were experimentally evaluated and compared with that of a popular commercial roofing sheet, available in India.

From the comprehensive experimental results, the water – demand in terms of W/B ratios for a desired flow value and cohesion and the influences of flyash and sisal fibre contents on W/B ratios of the cementitious composites, have been highlighted. The range of fibre contents and aspect ratios, which are desirable to achieve certain levels of workability, and the rheological characteristic (i.e. cohesion), have been identified. Moreover, the positive influences in enhancing the various strength and durability characteristics of the composites have also been highlighted. It is seen that the sisal fibre corrugated roofing sheets is comparable to the commercial roofing sheet, available in India. Finally, it can be stated that the chosen test methods can be used to evaluate the impact, flexural, rheological and durability characteristics of the composites, with confidence. The need to specify and carryout rheological studies and to develop specific instruments to measure rheological characteristics of natural fibre cementitious systems, has been emphasized, in the form of a recommendation.