ABSTRACT

An urge of having eco-friendly products to control or reduce the pollution has driven us back towards the utilization of natural resources. Researchers and manufacturers are constantly exploring various raw materials and techniques to have such products with aesthetics for various end use. The present experimental work, was aimed to develop sustainable woven sound resistant materials using two minor cellulosic fibers – Sisal and Ramie which can be installed for a sound proof eco-friendly ambiance. To understand the commercial viability of such products, a commercial bulk enzyme treatment was done. Another challenge was also successfully overcome i.e. to spin the sisal fibers.

Enzyme treatment was initially conducted using lab procedure to optimize the recipe and then commercial level trials were explored. To evaluate the effectiveness of enzymes, both the untreated and treated fiber samples were tested with feel and touch method and tensile strength test. Finally, for commercially viable process the treatment was conducted using Launder-O-Meter and the samples were evaluated by SEM, EDS, XRD, FTIR and tensile strength tests for structural analysis. Amongst the treated fibers sisal being stiffer fiber even after softening treatment, hand spinning technique was the only possible method to spin them into yarns. However, machine spinning technique was used for ramie yarn preparation, while both the untreated yarns were prepared using hand spinning technique only.

From both the untreated and treated yarns as well as fibers, woven samples with different weaves – Plain, twill and double cloth were developed as front layer, while for backing layer nonwovens of ramie fibers with different GSM were developed. All the fabrics were subjected to evaluate GSM, thickness and air permeability. For sound absorbing and noise reduction results the samples were individually tested using a fabricated sound absorption testing instrument at various distance and frequency for standard optimization. At optimized standards the combination of samples as a product were further evaluated for sound resistant application. However, the results of combination of samples ranged between 0.29 to 0.99, which could be considered for installation as per the required level of dB absorption as well as infrastructure.

The superlative product having combination of both the woven and nonwoven samples showing highest noise reduction coefficient was subjected to anti-microbial and

fungal as well as flame retardancy tests, to add features in the final eco-friendly sound resistant product. The results reveal that the samples are aesthetically appealing, quite resistance to microbes and fungi and are good flame retardant.

Hence, this kind of fabrics can be used as fabric blocks, fabric panel or fabric mounted on the wall for acoustic purpose will be aesthetically appealing also. The entire fiber to fabric process being eco-friendly will be the additional benefit. While commercialization of the fiber to fabric process is also viable, thereby will have positive impact on health, environment and overall economy with the increase utilization of these fibers.