ABSTRACT

The present study has been carried out for the utilisation of waste bagasse for its application in technical textiles. Fibres were successfully extracted from waste bagasse. At different alkaline conditions viz. 0.1 (N), 0.2 (N), 0.3 (N) with varying time (60,120, 180 and 240 minutes). Based on chemical composition, tensile strength and fibre quantity using statistical data (DOE), fibre extraction conditions were optimised. Physical and chemical properties viz. microscopic appearance, length, diameter, moisture regain, chemical composition and tensile strength of the extracted fibre were studied. To facilitate extraction an apparatus (Sugarcane fibre extractor) was fabricated (Patent granted). The fibres were extracted at optimised conditions in the apparatus.

Since sugarcane extract has the inheritant property of oil sorption, the property was studied scientifically also, the extracted fibres were further modified with two chemical treatments viz. Acetylation, Cyanoethylation and Enzymatic treatments for enhancing its oil sorption capacity. The chemical treatment done were (i)Acetylation using acetic anhydride in the presence of perchloric acid ($HClO_4$) as catalysts and (ii) Cyanoethylation using acrylonitrile. The fibres were also modified with Enzymatic treatment using two enzymes viz. cellulase and pectinase. The modified fibres through all three modification treatments were tested for their oil sorption capacity, oil retention ability, recovery of sorbed oil and reusability of the sample. The results of oil testing were statistically analysed through a full factorial design of experiment. Based on statistical analysis the modification treatment parameters were optimised for all three treatments. Maximum oil sorption was achieved at around 23.72 g/g for Cyanoethylated fibre using 5% concentration of NaOH at 55℃temperature for 60 minutes. The recovery of oil from chemically modified fiber was high compared to untreated fibres indicating an increase in the property of oil recovery can be achieved by modification. The recovery of oil from enzyme-treated, cyanoethylated and acetylated fibre samples was about 74%, 73% and 69 % respectively.

The untreated and treated fibres were physically and chemically characterised through SEM and FTIR respectively. FTIR analysis revealed the changes in functional groups in cyanoethylation, enzymatic and acetylation treatment. Cyanoethylated fibre spectra showed a strong absorption band that appeared for the Nitrile group (−C≡N). Fibres were extracted in bulk through the fabricated apparatus. Sugarcane bagasse fibres have significant potential as a non-woven & composite application due to their high strength, environmentally friendly resource, low cost,

availability, and thus sustainability. Non-wovens were prepared through two techniques (i) needle-punch method in two different GSM and (ii) hand-lay up technique. Further, the non-woven were tested for sorption capacity test in three different viscosities of oil viz Motor oil (Mo), Light viscosity crude oil (LvCo) and High viscosity crude oil (HvCo). Non-woven treated with Cyanoethylation showed the highest sorption capacity and recovery properties, followed by enzymatic treatment and acetylation treatment respectively. The non-woven sorbent can absorb the oil from the water layer completely (2-3 times) and also recover the oil.

The study concluded that Sugarcane fibre has the inherent property of oil sorption which increased by treating the fibre through different treatments. Proper extraction methods will contribute to the maximum utilization of this agricultural waste. The researcher concludes that Non-woven prepared from Sugarcane bagasse fibre have a higher sorption capacity of oil as well as recovery. The outcome of this study suggested that it is possible to replace fully or partially synthetic oil sorbents with chemically modified sugarcane bagasse fibre for oil spill cleanup application which comes with other advantages like waste management of waste Sugarcane bagasse and better biodegradability.