ABSTRACT

Natural fibres and bio agents have been studied for liquid holding capacity for various functional applications. This study involves three distinct part as following. In the first part biosynthesis of bacterial cellulose was carried out under ambient conditions by gram-negative bacterium *acetobacter xylinum* using standard medium and modified media. The yield of cellulose in these media was compared. Bacterial cellulose was characterized using infrared spectroscopy and scanning electron microscopy. Its water holding capacity was assessed and results were compared with that of plant cellulose. Bacterial cellulose and plant cellulose were treated with extracts of novel natural herbs such as bitter gourd (*momordica charantia*), *tridax daisy (tridax procumbens)* and with chitosan to impart antibacterial activity. The treated samples demonstrated good antibacterial property against *Staphylococcus aureus* and *Escherichia coli.* Modified bacterial cellulose demonstrated better antibacterial activity than that of modified plant cellulose.

In the second part, calatropis gigantea fibre is studied for the oil absorption characteristics through detailed theoretical analysis of free space followed by experimental verification. The degree of free space in the fibre are calculated and compared through x-ray diffraction techniques and the Density Gradient Column (DGC) technique. The chemical compositions of the fibres are studied through chemical analysis and FTIR technique. Experimental trials for oil absorption with specific reference to applications belonging to oil water mixture and the oil vapour absorption have been studied. Surface morphology of the fibres were also studied through SEM. The crystallinity of the fibre as revealed through X-ray is found to be 59 %. Equations to establish the free space calculations have been developed.

Accordingly, the free spaces of the fibrous web with and without considering the hollowness of the fibres were also developed and verified with the experimental trials. The oil absorption from the oil-water mixture study revealed that the almost 100% oil absorption is possible with 0.5 g mass of fibre for up to about 9 g mass of oil with times ranging from 9 to 16 with and without considering the hollowness in the fibre. The oil vapour absorption study has revealed that the hot vapours of oils are not absorbed by the web rather they contribute to remove the hydrophobic substances as they cross through the web noted through the mass reduction of web after oil vapour absorption study.

In the third part based on various assessments carried out for free space in the *calatropis gigantea* web structures, oil holding capacity of webs, the bio activeness of natural oils such as *neem*, *castor*, *tulsi*, could lead to develop mosquito repellency for healthcare applications. The fibre webs were treated with natural oils and subjected to analyse the mosquito repellency study and was found that the *neem* oil showed 90.4 % efficacy.