# ABSTRACT

Chitosan (CS) is a natural polysaccharide. It is biocompatible and has good antibacterial properties. Moreover, being a biopolymer, it has good biodegradable characteristics. The properties of CS may be tuned and improved via chemical modification. Further improvement of properties may be achieved via the preparation of its composite with inorganic filler materials.

In this research work, we report the chemical modification of CS, a theoretical study of modification reactions on CS, the preparation of CS/clay biocomposite films and their characterization. The modified CS and the prepared biocomposites were characterised by various analytical techniques. The chemically modified chitosan (MCS) and the neat CS were characterised by FT-IR, UV-Vis, XRD, SEM, TGA, DSC and NMR analyses. The antibacterial activity of both these materials was evaluated by agar well diffusion method against *Escherichia coli* and *Bacillus subtilis* bacteria. It was found that MCS displays better antibacterial properties than neat CS. The theoretical study was also carried out to investigate the probable sites of CS which was used during the modification reactions. This study suggested two potential reaction pathways which were followed during the chemical modification of CS.

Attempts have also been made to improve the properties of neat CS via the preparation of its biocomposite with kaolin (KAO), bentonite (BNTN) and silica (SIO) clays. A series of biocomposites with these clays were prepared varying the amounts of clays to the weight of CS. The prepared biocomposites were characterized by FT-IR, UV-Vis, XRD, SEM, UTM, TGA and DSC analyses. Antibacterial activities of these biocomposite films were found to be better than neat CS. CS/BNTN biocomposite film exhibited the highest zone of inhibition against both types of bacteria than CS/KAO and CS/SIO clay biocomposites. Mechanical properties of the biocomposites were also evaluated and found to be better than neat CS. CS/BNTN biocomposite exhibited better tensile properties than the other two types of biocomposites. TGA analysis showed that the CS/SIO composite has better thermal stability than CS/KAO and CS/BNTN clay composites.



***Key Words***: Chitosan, clay, biocomposite, physicomechanical property, antibacterial property, swelling property and theoretical study