Mechanical Properties of Novel Bionanocomposites

Ranjeet Pokharel[1], Prof. Prabir Patra[1,2]
1.Department of Mechanical Engineering 2. Department of Biomedical Engineering
University of Bridgeport, Bridgeport, CT

ABSTRACT: In the present communication, a study on the synthesis and mechanical properties of a new series of green natural resins based bionanocomposites consisting of acacia, almond, neem and drumstick as resins with nano silica and nanosized calcium oxide as reinforcing fillers has been reported. Mechanical properties such as tensile, shear, adhesive and wear properties were investigated. Present work reveals that mechanical properties such as tensile strength, water resistance and wear resistance of bionanocomposites increases to considerable extent when reinforced with Nano powders of calcium oxide and silicon dioxide. These results are compared with the epoxy resin based nanocomposites. The bionanocomposites have potential to have widespread bioengineering applications.

Introduction: Increased environmental awareness and consciousness throughout the world has developed an increasing interest in natural resins and its applications in various fields. Natural resins are now considered as serious alternative to synthetic resins for use in various fields. The use of natural resins as reinforcing materials in both thermoplastic and thermoset matrix composites provides positive environmental benefits with respect to ultimate disposability and best utilization of raw materials. Natural resins composites have been studied and reviewed by a number of researchers. During the past few years, a number of significant industries such as the automotive parts production, construction or packaging industries, interior house decorative and polymer industries have shown massive interest in the progress of new bio composites materials.

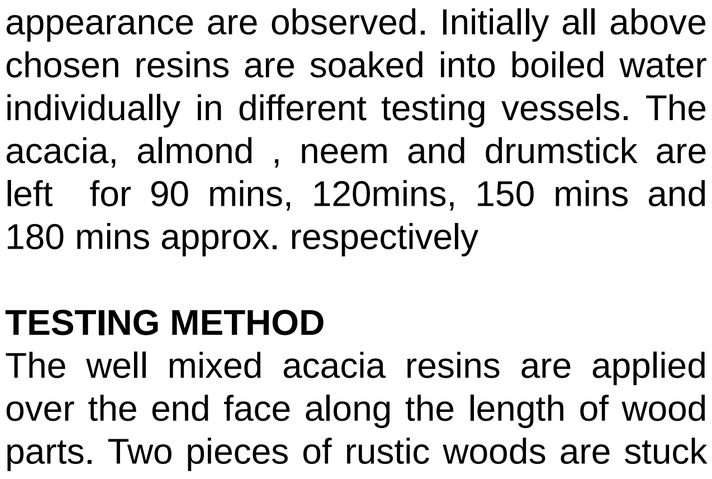
EXPERIMENTATION

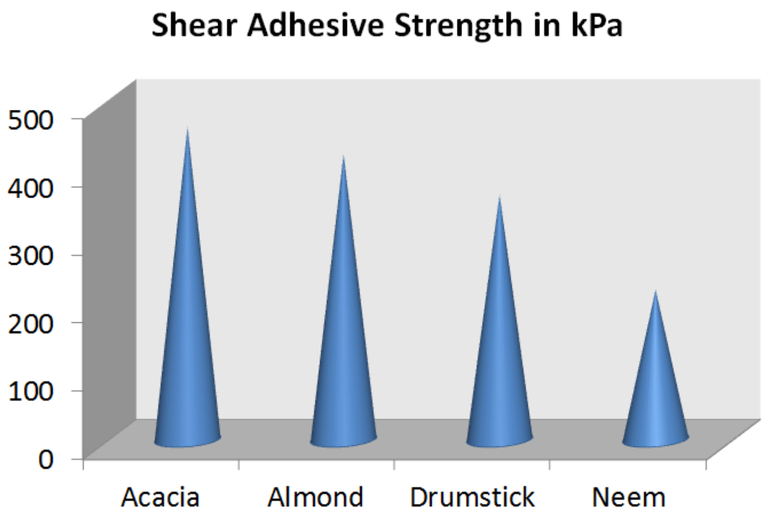
1.SYNTHESIS

The polymer such as acacia, almond, neem and drumstick are selected and physical appearance are observed. Initially all above chosen resins are soaked into boiled water individually in different testing vessels. The acacia, almond , neem and drumstick are left for 90 mins, 120mins, 150 mins and 180 mins approx. respectively

TESTING METHOD

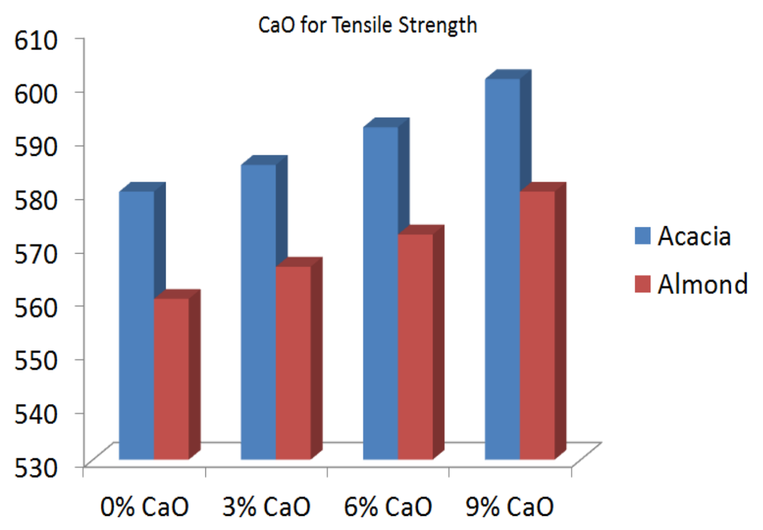
The well mixed acacia resins are applied over the end face along the length of wood parts. Two pieces of rustic woods are stuck to one another sideways. Same method is followed for almond, neem and drumstick resins. Min. of 12 hrs. of curing time is provided for letting it stick properly in normal atmospheric condition and min. of 8 hrs. in case of dry environment and high sunlight. Min. of 3 pairs of woods are done with sticking for each resins. In each pair of sample, two hook made up of mild steel are used to support them by holding it in two hole on their either side. Same supports are used for all samples of each resins. During tensile testing, two ends of the hook are clinched with two fixed hook of testing machine.

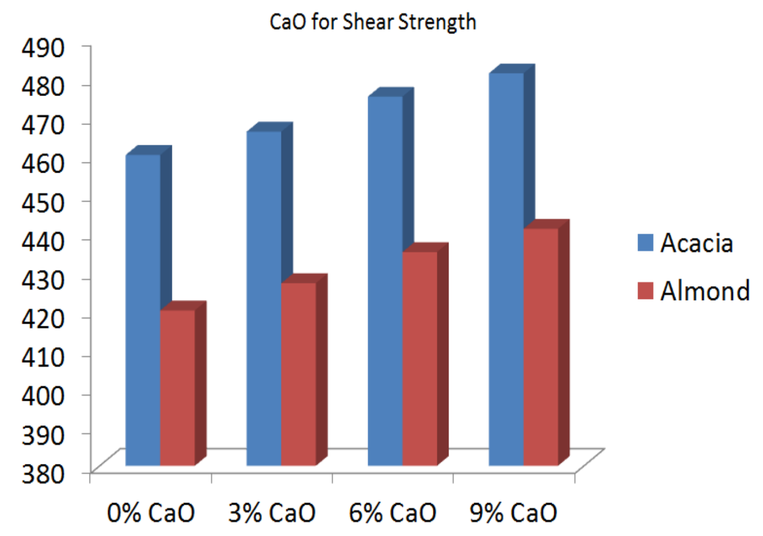


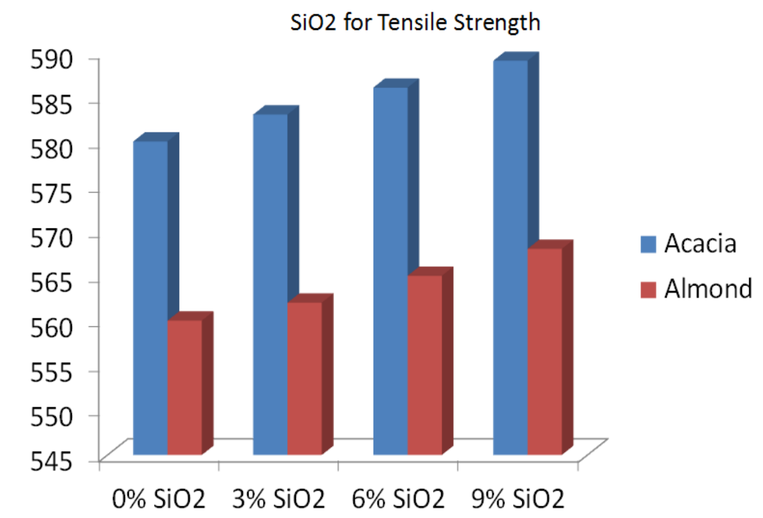


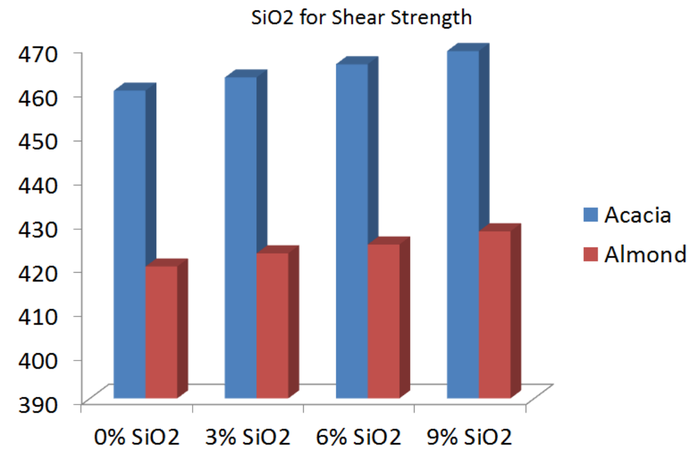
REINFORCEMENTS OF NANO PARTICLES

The addition of Nano powders in the mixture of resins improves the tensile and shear strength of the samples. After the synthesis of the resins and before applying to the rustic wooden samples, the calculated amount of nano calcium oxide and nano silicon dioxide is mixed with resins. Then applied over the wood and left it for same curing time above under same conditions.



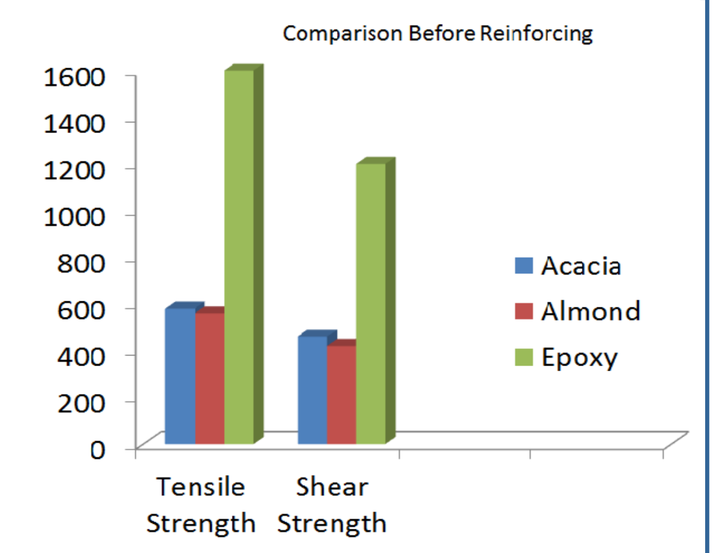


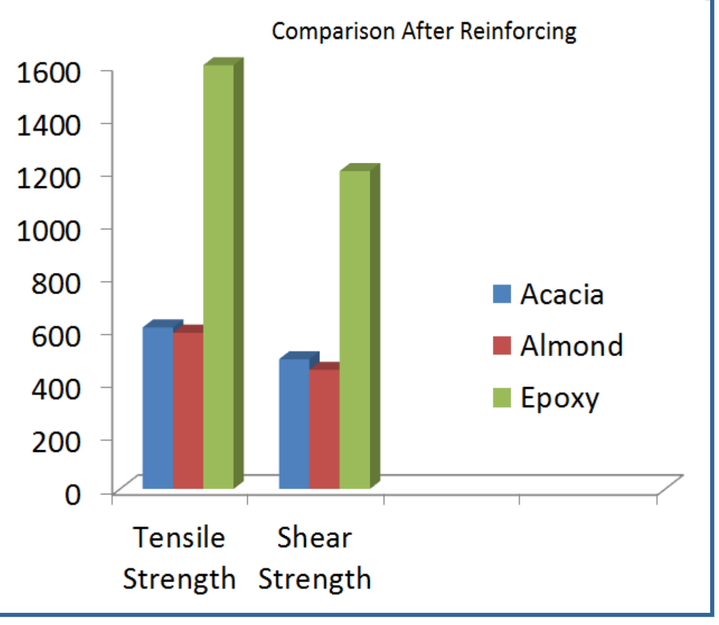




COMPARING BEFORE REINFORCING NANO PARTICLES

The tensile adhesive strength and Shear adhesive strength of the two best natural resins are compared with epoxy resin.





RESULTS

Various test methods are adapted for mechanical characterization of natural resins reinforced polymer composites. After comparing the natural resins with epoxy resins without reinforcing and with reinforcing, it has been found out that the mechanical properties of natural resins are found to be better in the later than that of the former.

CONCLUSION

The mechanical properties of bionanocomposites are slightly lower than that of the epoxy composites . Since the natural resins have numerous advantages like bio degradability, conservation of petroleum resources and mainly no effects in environment, the natural bionanocomposites can be used in specific applications without any health hazard.