Liquid socking Ability of Hybrid Biocomposite Material Having Epoxy Resin Matrix and Reinforcement of Chicken Feather Fiber

Gagan Bansal, Kartik Kaushik, Pankaj Negi, James Kunjwal

Abstract: ***Different materials have different water socking ability and that makes it a hydrophobic and hydrophilic in nature. Biocomposite materials have become the need of current material development technologies. The immense use and application of biocomposite material is helping the researchers to upgrade the material's composition as per need. In the current research, the life durability of chicken feather fiber based hybrid biocomposite materials, having epoxy resin CY- 230 thermoset polymer matrix is characterized. The prepared sample with 5wt% CFF and 3wt% Extracted Fish residue power (ERP), considered optimum composition during mechanical characterization was tested n different atmospheric conditions for 3 days. The conditions adopted are submerged in water, mustard oil, soda, milk and Lemon water. The weight readings and geometrical measurement are taken in every 12 hours. The result obtained shows that the minimum weight change of sample was the one immersed in water. The readings obtained shows that liquid socking ability becomes almost constant after 2 days i.e. 48 hours. The absorbability analysis concludes that the difference in the absorption rate and capacity depends on the viscosity of the immersing liquid.***

Keywords: Extracted Fish residue Powder, Chicken Feather fiber, Characterization, Biocomposite, Composite Materials, Absorbability,.

I. INTRODUCTION

In the current research work, the experimental analysis of the prepared hybrid composite is characterized. The biocomposite material is made of Epoxy Resin (CY- 230) matrix, amalgamated with Chicken feather fiber(collected as livestock waste from poultry and processed in materials Lab at GBPUA&T, Pantnagar) as fiber [1]. The material is initially prepared using Hand lay-up technique with different weight % of CFF in CY 230 epoxy resin. The mechanical characterization of the prepared samples was performed. The Rockwell hardness, Izod Impact test, Tensile and compressive strength etc were identified [2]. The results showed 5wt % CFF in Epoxy resin as a feasible composition for casting composite material with CFF fiber. Later, 5wt% CFF was amalgamated with fish residue powder with different weight percentages and 3wt% composition was termed most feasible composition based on mechanical characterization[3].

Revised Manuscript Received on March 20, 2019.

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The optimum sample (5wt% CFF and 3wt% fish residue power in Epoxy resin) [4] are now test under different environments like water, milk, soda, lemon water and mustard oil. The test similar to water absorption and thickness swelling [5] is performed in the 34 degree temperature (Month : JUNE, State: Uttarakhand, City: Rudrapur). Readings are recorded in every 12 hours, the result obtained are tabulated as shown in results and discussions.

II. METHODOLOGY

Firstly, the waste livestock waste i.e. CFF is collected from the poultry. It is then randomly processed [6], washed, cleaned and dried. The composite materials made of CFF and Epoxy resin CY 230 were prepared and mechanical characterized. The results showed that 5wt% CFF and 3wt% fish residue powder in Epoxy resin has comparatively best mechanical strength [7]. The sample has been physically tested for physical and theoretical density [4] as shown in figure 1 and 2. The variation is discussed in results section. For absorbability analysis of the hybrid biocomposite sample was done using five different liquids i.e. water, lemon water, soda, milk and mustard oil. The sample was immersed in the liquid for 72 hours and 6 readings were taken in the fixed interval of 12 hours. The digital weight measuring machine was used with least count of 0.01gm. All the readings taken are the average values of the 3 trials by three different persons for the same environmental and physical conditions. The results obtained were plotted and illustrated.

III. RESULTS AND DISCUSSIONS

Looking for the experimental and theoretical density of all the samples (Figure 1 and 2) prepared, it was observed that at every composition theoretical density is comparatively higher as compared to Experimental Density. From figure 1 we can see that the pure epoxy has the weight density of 1132.08 kg/m^3 i.e. 1.56% less than the theoretical density (1150 kg/m^3). Figure 1 clearly shows the decrease in weight density with increasing CFF weight percentage as chicken feather is lighter in weight (density = 800 kg/m^3 approx.) as compared to pure epoxy. The theoretical density for neat epoxy is 1150 kg/m^3. The linear fall of 3.79% in the magnitude of density is recorded from 0 (i.e. 1132.08 kg/m^3) to 5 wt% (i.e. 1089.12 kg/m^3) of CFF in prepared composite. All the readings are tabulated from 0wt% CFF to 7wt% CFF sample.

As it can be seen 7 wt% of CFF in epoxy resin has 1078.51 kg/m^3 (figure 1) of experimental density. The total decrease in Experimental density is 5.19% between 0 to 7wt % CFF decrease in density was recorded during the total composites fabrication. Almost similar decrease is observed in theoretical density. The complete comparative analysis can be seen in figure 1.

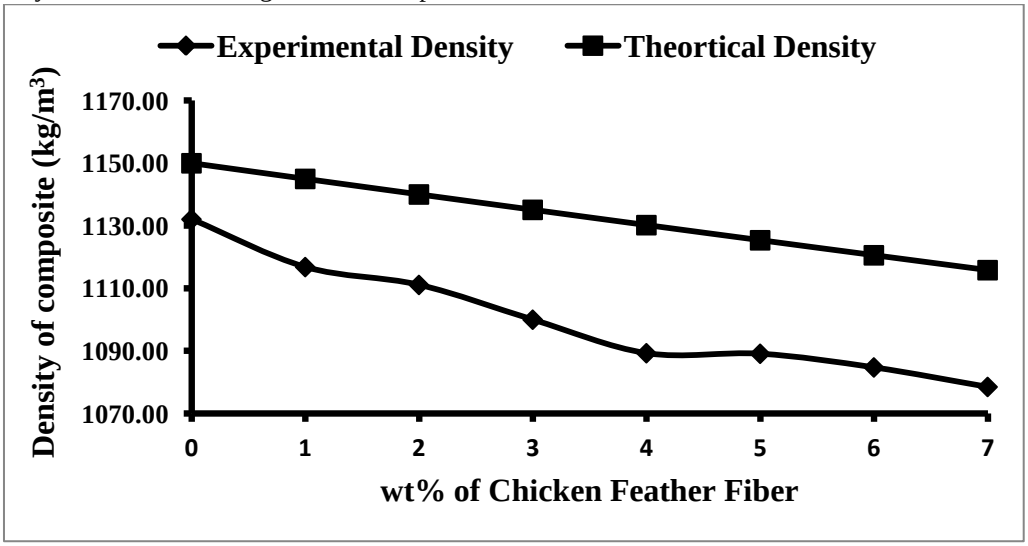

Figure 1: Theoretical and Experimental Density of CFF and CY 230 composites

After the mechanical test, 5wt% CFF in epoxy resin was considered to be the best composition for preparing fixed residue reinforced composites. The Theoretical and Experimental Density of hybrid Composite samples with varying weight percentages of extracted residue powder (0 to 6%) is observed and plotted as shown in Figure 2. Here 0wt% extracted residue powder means sample with 5wt% CFF and 0% ERP. As 5 wt% of CFF s considered as optimum composition for fabricating hybrid composite. The samples were prepared and experimental density were noted. The readings (Figure 2) show that a continuous rise in density is observed with increasing the percentage of ERP. At 0wt% (1089.12 kg/m^3) the reading is of 5wt% CFF in Epoxy resin and at 6wt%of residue powder it is 1145.45 kg/m^3 . The rise of 5.17 % is monitored during the experimentation from 0 to 6 wt% (Figure 2). At 3wt% ERP the Theoretical and Experimental Density are 1135 kg/m^3 and 1116 kg/m^3 respectively.

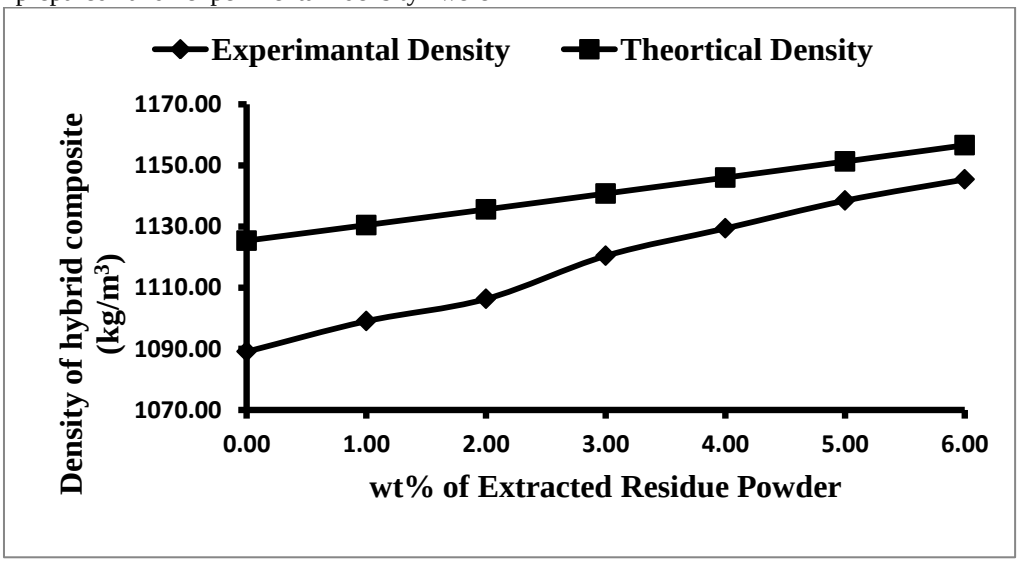

Figure 2: Theoretical and Experimental Density of hybrid Composite samples.

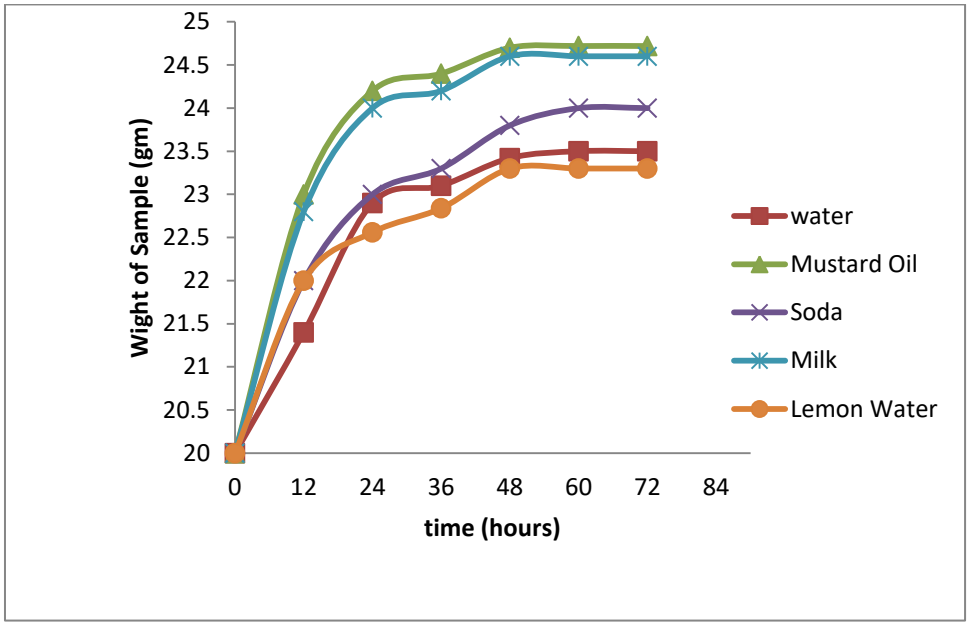

Figure 3: Sample weight reading after every 12 hours under different immersed conditions

The prepared hybrid composite sample with 20gm (fixed) initial weight having Epoxy resin reinforced with 5wt% CFF and 3wt% extracted residue powder were dipped in different solutions like water, mustard oil, Soda, milk, and Lemon water for 72 hours (3 days). The weight was observed for every 12 hours as shown in figure 3. Also figure 4 highlight the percentage change in total weight of the sample after the end of 3 days. The results obtained shows that 17.5, 23.6, 20, 23 and 16.5 percent weight change was obtained in the prepared samples when kept in water, mustard Oil, soda, milk and Lemon water respectively (Figure 4).

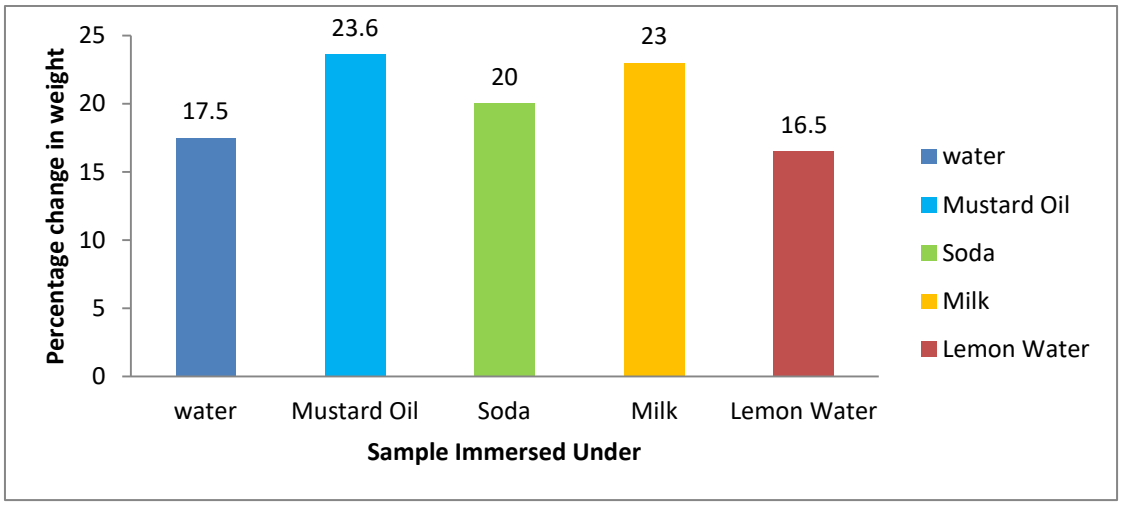

Figure 4: Percentage change in Sample weight under different Immersing Mediums

The variation in relation of the different absorbing rate is predicted to be due to the difference in their viscosity and fluidity. From figure 3, it can be observed that after the first 12 hours of immersing sample into liquid, the rise in weight of the sample were 1.4gm, 3gm, 2gm, 2.8gm and 2gm for water, mustard oil, soda, milk and Lemon water respectively. The maximum absorption was observed in the mustard oil i.e. 15% weight rise (20gm to 23gm) in first 12 hours. It is also interesting to note that the sample immersed in soda and lemon water shows almost similar durability and absorbing capacity in the first reading taken after 12 hours (i.e. 10% increase in weight). The minimum weight rise is seen in sample dipped in water with 1.4gm weight rise. The readings obtained on the third day shows that absorbability becomes almost constant after 2 days i.e. weight measured after 60 hours and 72 hours were almost similar.

After the end of the 3 days, the layer of the sample immersed in water, soda and lemon water were found to be rough that shows the fastest degradation of sample in these environments.

IV. CONCLUSION

Finally, after obtaining all the results for the density and absorbability analysis of the sample, we can withdraw following conclusions.

- For sample with 3wt% Extracted residue powder in 5 wt% CFF reinforcement, the Theoretical and Experimental Density are 1135 kg/m^3 and 1116 kg/m^3 respectively.
- The Experimental densities of all the samples are comparatively less than the Theoretical density.
- The minimum absorbability in the composite sample in the beginning is for sample immersed in water and maximum for mustard oil.
- After the first 12 hours of immersing sample into liquid, the rise in weight of the sample were 1.4gm, 3gm, 2gm, 2.8gm and 2gm for water, mustard oil, soda, milk and Lemon water respectively.
- Composite samples immersed in lemon water and soda showed almost similar absorbability in the first reading taken after 12 hours but at the end of 3 days, sample immersed in soda has higher absorbability towards soda then lemon water.
- The readings obtained shows that absorbability becomes almost constant after 2 days i.e. 48 hours.
- It concludes that for liquid socking ability the difference in the absorption rate and capacity depends on the viscosity of the immersing liquid.

V. ACKNOWLEDGEMENT

The authors would like to thank Graphic Era Deemed to be University, Dehradun, Graphic Era Hill University Dehradun and Graphic Era Hill University Bhimtal for providing all sorts of support and amenities in carrying out the current research work.

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