# EVALUATION OF BENDING PROPERTIES OF WOOD PLASTIC COMPOSITES BASED ON WASTE PET AND SAWDUST

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## 1 INTRUDUCTION

Composite materials can generally be defined as a combination of two or more materials that differ in size or composition on a macroscale. Flexural characteristics in the plastic range are an important mechanical property. The bending characteristics are determined from the stress-strain diagram, which is typical for each type of stress. Many mechanical properties can be determined from this diagram. A typical stress strain diagram is depicted in Fig. 1. The aim of this study was to determine the effect of different compositions on the bending characteristics of composite material in the plastic range.

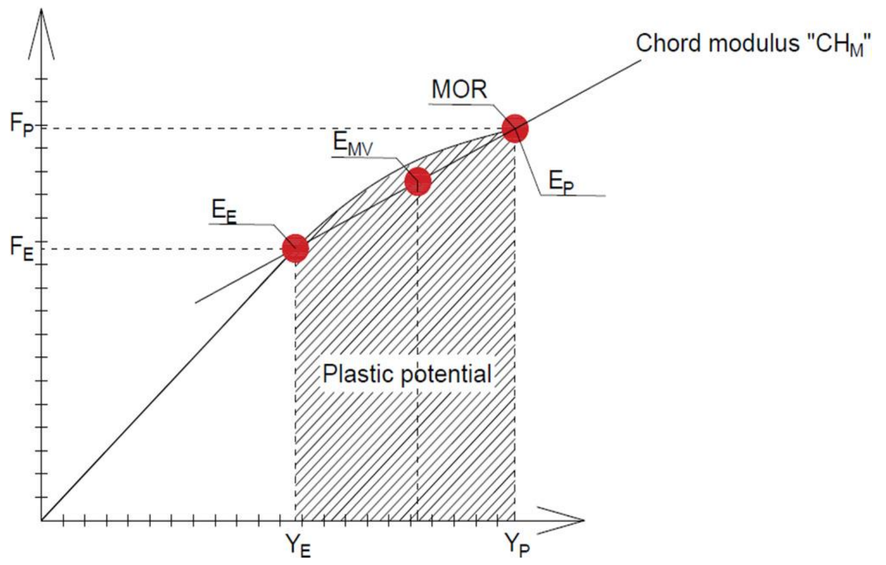


Fig. 1. The bending characteristics in plastic area of force-deformation diagram (adapted from ref. [1]).

## 2 MATERIALS AND METHODS

Sawdust dried in an oven at 103±2°C for 24 h. Fiber-to-Polymer ratio for reinforced composites were 20-60 wt% (table 1). The specimens were bent in middle-length distance using a universal testing machine in accordance with EN 13061-3. All the necessary data such as bending strength were obtained from the measured force-deformation diagrams. The limit of proportionality was determined for the point where the deviation of the curve from the linear part was greater than 1%. Statistical analyses including ANOVA and Duncan grouping test were evaluated by STATISTICA 14 (Statsoft Inc., USA) software.

Table 1. The composition of composites.

| Composite Code | Composition |
|---|---|
| 1 | Sawdust (40%), PET waste (60%) |
| 2 | Sawdust (60%), PET waste (40%) |
| 3 | Sawdust (50%), Y1000P polymer (50%) |
| 4 | Sawdust (20%), Rubber (40%), PET waste (40%) |

## 3 RESULTS AND DISCUSSION

Figure 2 shows the limit of proportionality of reinforced composites as well as Duncan grouping of the results. Sawdust based composites containing 50% fibers showed the highest limit of proportionality (4.872 MPa). Composites containing 60 and 40% natural fillers demonstrated lower amount of limit of proportionality and the minimum value of the mechanical property belongs to rPET composites reinforced with 20% sawdust and 40% rubber. Based on Duncan grouping test (Fig 2), there is no significant difference between reinforced composites containing 60% sawdust and 20% sawdust + 40% rubber. The bending strength of composites were depicted in figure 3. The results of bending strength and Duncan grouping demonstrated as same trend as limit of proportionality, where 50 and 40% filled composites with sawdust showed the higher bending strength values (40.194 and 17.247 MPa), respectively. The reinforced composites containing 60% sawdust and mixed natural fiber and rubber particles showed minimum bending strength without significant difference (Fig. 3).

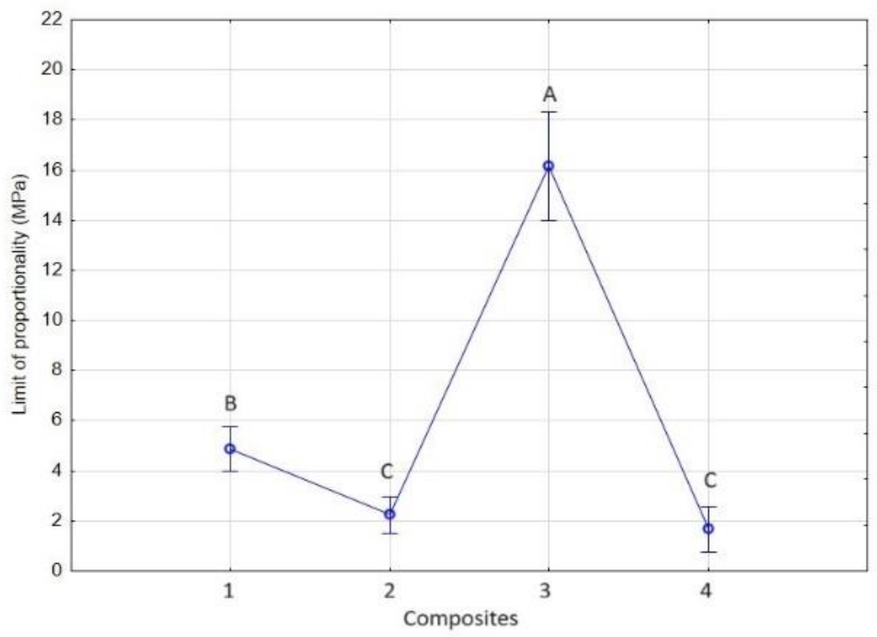


Fig. 2. The effect of different compositions on limit of proportionality of composites.

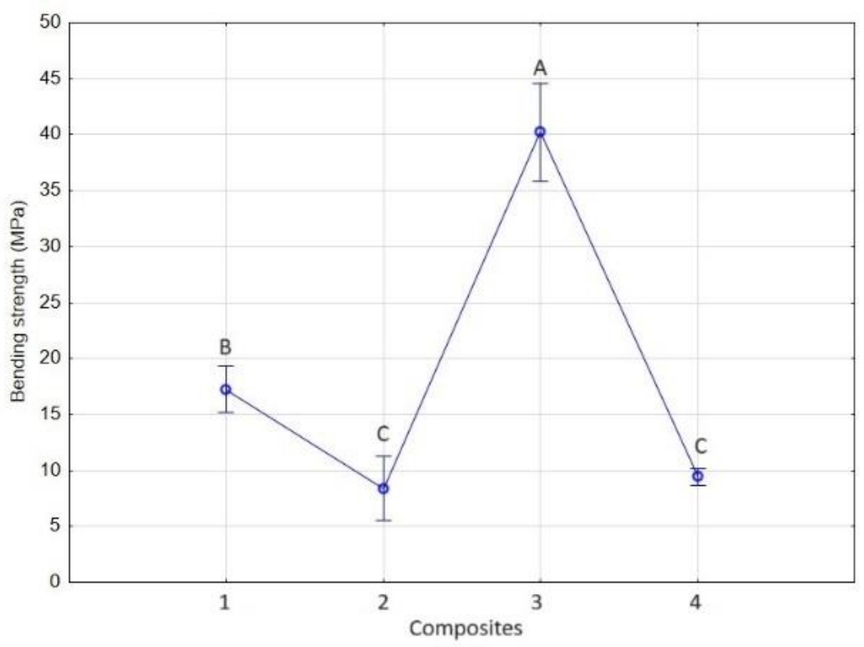


Fig. 3. The effect of different compositions on bending strength of composites.

## 4 CONCLUSION

The results of the study confirmed that both filler and matrix of composite play important role in mechanical properties and the effect of matrix is much more significant than different levels of fillers. According to the obtained results, biodegradable polymer reinforced with 50% sawdust showed the best performance in evaluated mechanical properties. The rPET composite containing 40% natural fibers demonstrated higher mechanical properties among all rPET composites. Based on the Duncan grouping results, there were no significant difference in mechanical characteristics of rPET reinforced composites filled with 60% filler (60% sawdust and 20% sawdust + 40% rubber). Generally, higher levels of filler (60%) decreased mechanical properties.

**REFERENCES**

[1] Sikora, A., Gaff, M., Hysek, Š., & Babiak, M. (2018). The plasticity of composite material based on winter rapeseed as a function of selected factors. *Composite Structures*, *202*, 783-792.

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