

# Performance Testing of Hemp Shives in the Particleboard Core Layer

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- worldwide **wood shortage** intended for wood processing industry
- reason for searching of the opportunities to incorporate a certain proportion of **hemp shives** to the **core layer of particleboard**



## Reason for the research

- disadvantage of wood raw material is the **constant price increases**
- **sufficient available quantity** of hemp shives
- its **reasonable price**
- price could be **at least slightly lower** than the wood raw material price
- this material should be usable just in the **core layer** of particleboard
- an important issue is the **conservation** of the **physical and mechanical properties** of particleboard with the addition of hemp shives in the central layer in comparison with all-wood particleboard



Hemp Shives



Wood Particles

# Technological parameters

- **same technological parameters**, as used in routine practice in the particleboard production were used for the production of modified particleboard
- **dimensions** of the laboratory prepared boards: width 300 mm, length 400 mm, thickness 16 mm
- **density** of the boards:  $650 \text{ kg.m}^{-3}$
- **moisture content** of boards: 7 % after conditioning
- **10 %** adhesive coating to particles in **surface** layers
- **6 %** of the adhesive coating to particles in **core** layer
- **paraffin emulsion**
- **pressing temperature**:  $220 \text{ }^{\circ}\text{C}$
- **compression factor** of  $8 \text{ s.mm}^{-1}$  was used

**- ratios of hemp shives and wood particles  
for the core layer:**

- 0 % of hemp shives – 100 % of particles
- 5 % of hemp shives – 95 % of particles
- 10 % of hemp shives – 90 % of particles
- 15 % of hemp shives – 85 % of particles
- 20 % of hemp shives – 80 % of particles
- 25 % of hemp shives – 75 % of particles
- 30 % of hemp shives – 70 % of particles

# Method of calorimetric determination of the heat

- **IKA® calorimeter C 5000 control** was used
- principle of the determination:
  - the complete combustion of the samples in pure oxygen in calorimetric pressure tank
  - the obtained experimental result is the **temperature change**
  - on the basis of  $\Delta T$  obtained (by means of software in the equipment) the calorific value was calculated

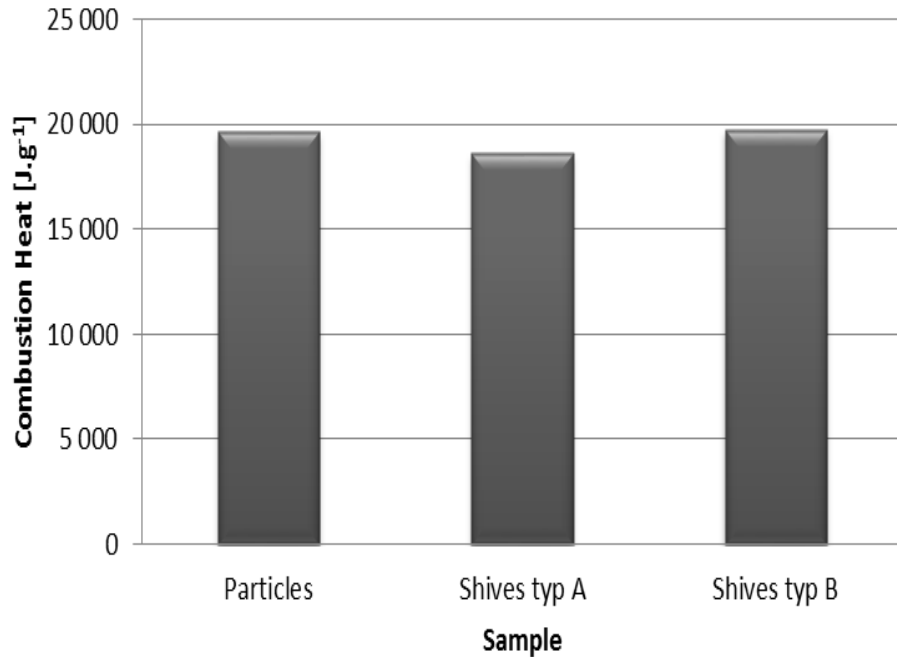
## Results and Analysis

- addition of hemp shives affects positively the static three-point bending strength of particleboard
  - tests of
    - modulus of elasticity in bending
    - tensile strength perpendicular to the board
    - plain
    - swelling after 2 and 24 hours
    - moisture content
- were performed as well

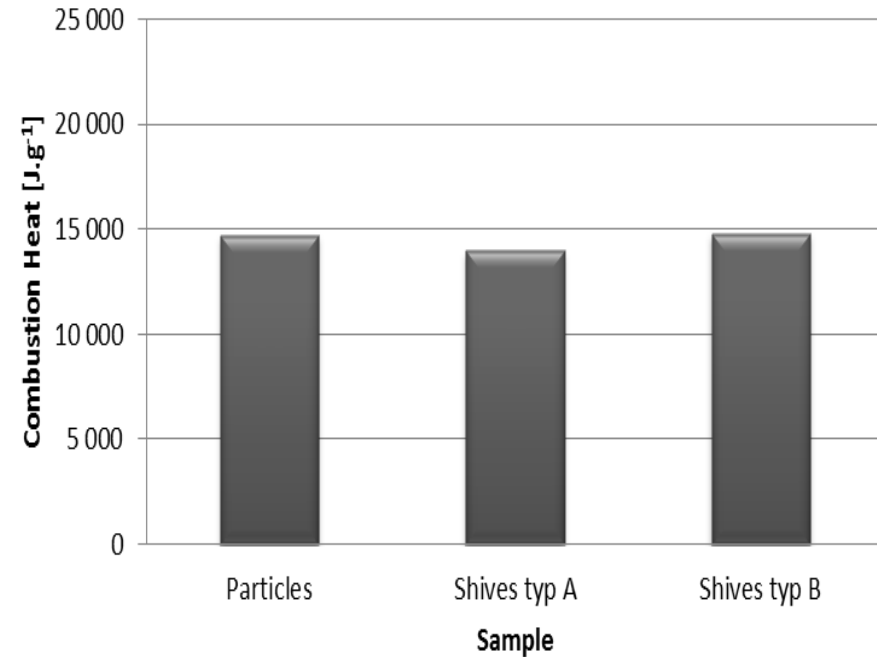


# Result of Combustion Heat

## Combustion Heat

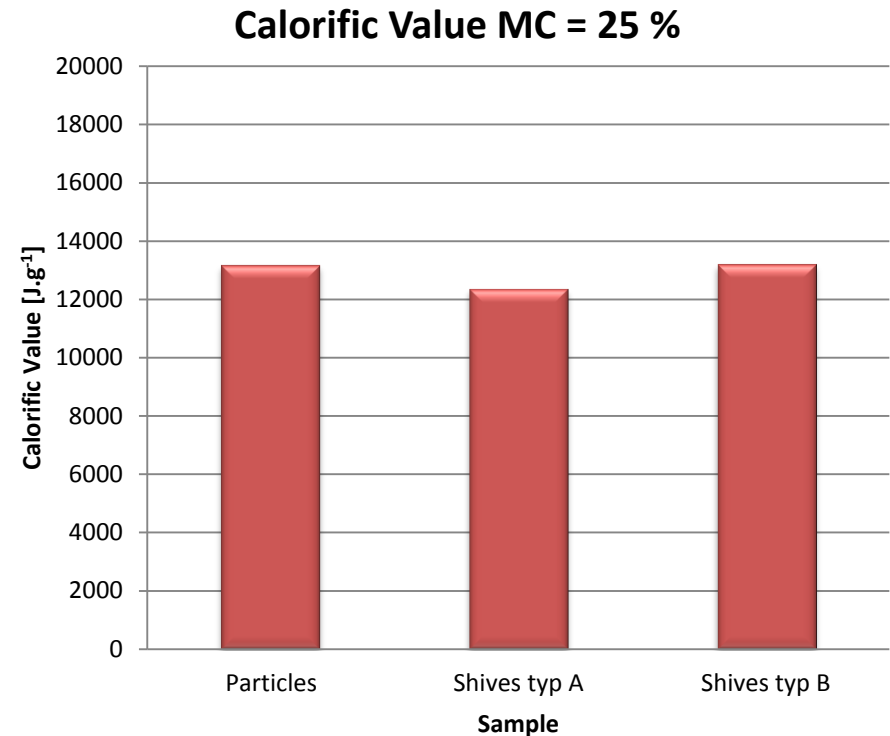
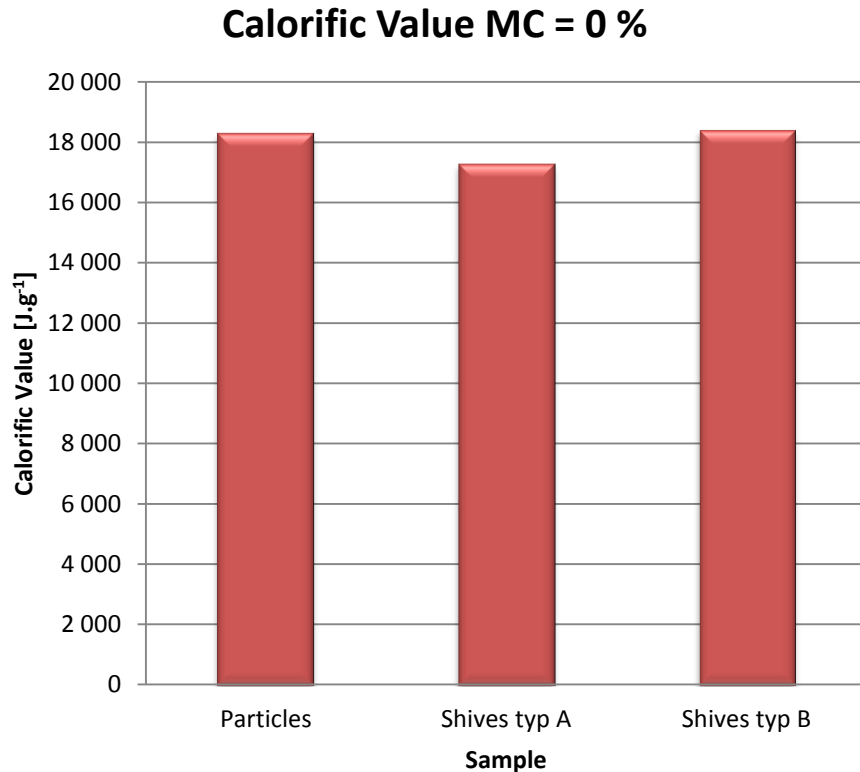


## Combustion Heat MC = 25 %



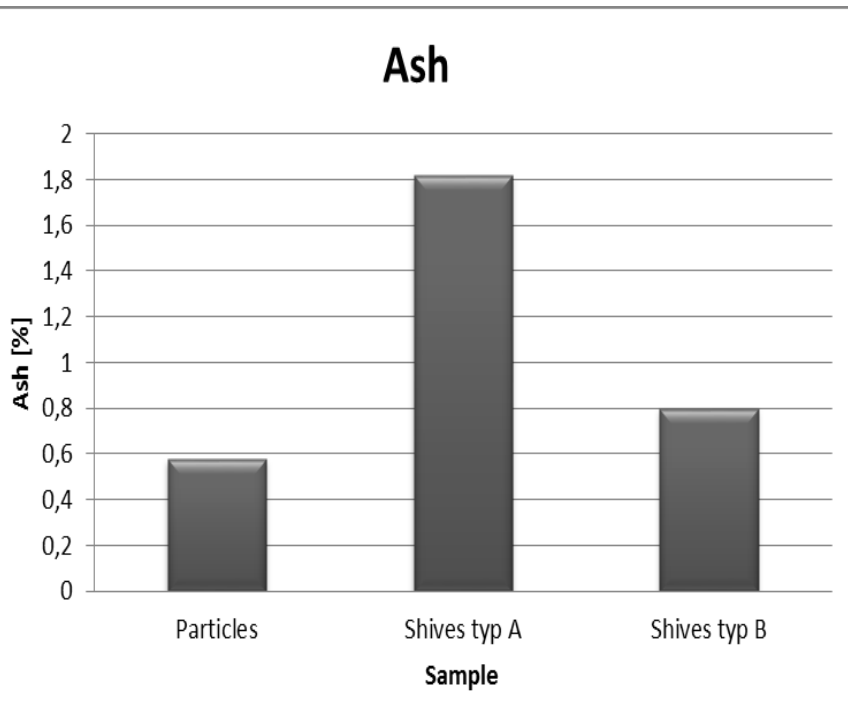
- combustion heat and calorific value of wood particles and hemp shives are about the same level
- result was confirmed in both mixtures
- fractional composition, was fully satisfied for the requirements of the particleboard manufacture

# Result of Calorific Value



- experiment was performed consequently with the mesh size fraction which is equal to 0.5 mm
- combustion heat and calorific value of wood particles compared with hemp shives were also in this case at a similar level

# Result of Ash Content



- hemp shives primary intended for animals bedding, is similar more to wood particles to than hemp shives that has been previously used for the production of hemp boards with the values of ash resulting from the test

- this fact can be consequently reflected in the determination of minerals content in the evaluation of the properties of ready-made particleboard
- increased content of minerals in the particleboard is undesirable in terms of blunting of cutting tools in the processing of particleboard for furniture or construction components

# Conclusions

- the worldwide shortage of wood intended for wood processing industry is the reason for searching of the opportunities to incorporate a certain proportion of hemp shives to the core layer of particleboard
- the addition of hemp shives to wood particles in the core layer of particleboard cannot influence the particleboard properties
- the aim of the research was therefore to prove the trouble-free presence of hemp shives in the core layer of particleboard also with the help of tests of heating value and energy efficiency

## **Conclusions**

- from the research follows that combustion heat and calorific value of wood particles and hemp shives intended for further manufacture of particleboard are about the same level
- hemp shives can be used as the partial substitute of wood particles in the production of particleboard without a substantial danger

**Thank you for your attention.**

