

# Reduction of Phenol-Formaldehyde Resin Content in Dry-Processed Fibreboards by Adding Hydrolysis Lignin



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The aim of this study is to investigate the possibility of substitution of phenol-formaldehyde resin by industrial technical hydrolysis lignin and to analyze the effect of concentration of the adhesive system on the properties of dry-processed fibreboards.

## Materials and methods

It was used industrial wood-fiber pulp, produced by the Asplund thermo-mechanical refining method. The pulp was provided by “Welde Bulgaria”. The pulp was composed of 60% beech (*Fagus Silvatica* L.), 20% Turkish oak (*Quercus Cerris* L.) and 20% poplar (*Populus alba* L.). The moisture content of pulp was 11%. Phenol-formaldehyde resin manufactured by “Dynea – Romania” was used.



Technical hydrolysis lignin from the hydrolysis plant was used in this investigation. The industrial technology process was based on the high temperature diluted sulphuric acid hydrolysis of sawdust and softwood and hardwood chips to sugars, which were further subjected to yeast fodder production.



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The target density of the panels was 850 at 6 mm thickness of fibreboards. The press factor was 90 s.mm<sup>-1</sup> and the temperature of hot-pressing was 200° C.

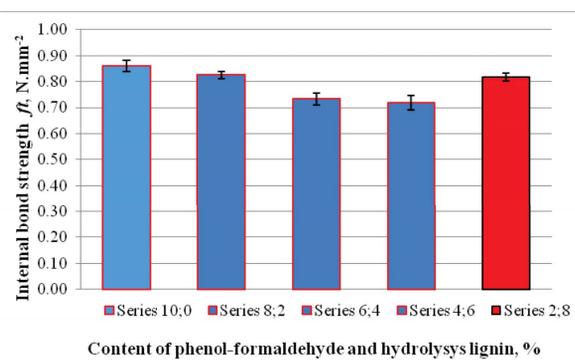
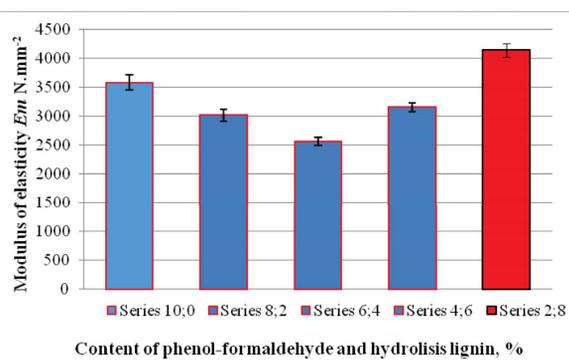
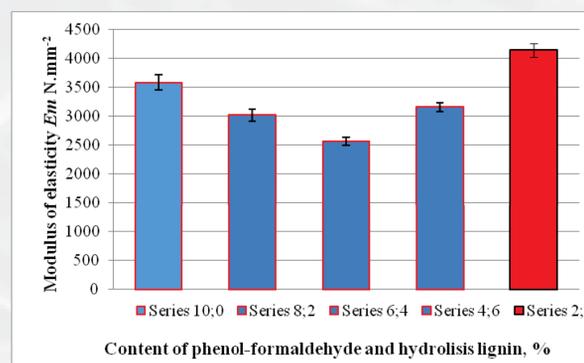
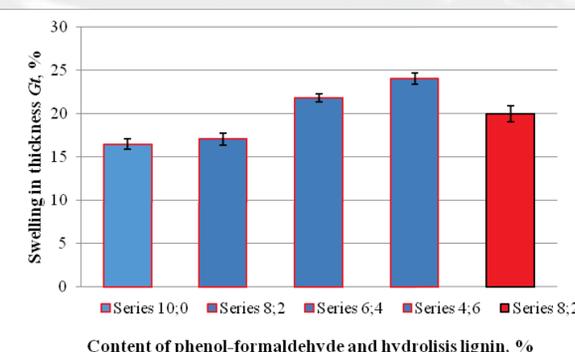
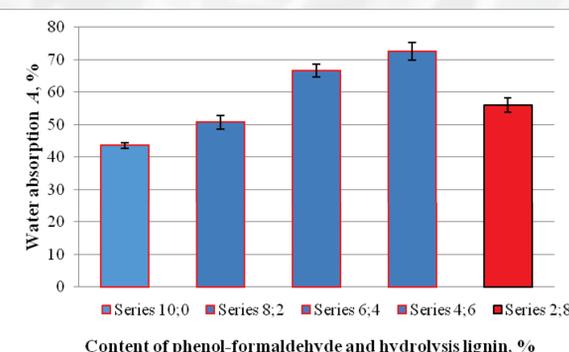
## Results and Discussion

Characteristics of the technical hydrolysis lignin from the diluted sulphuric acid hydrolysis plant

Lignin, %	Cellulose, %	Ash content, %	C, %	S, %	H, %	N, %
72.6	25.5	2.8	55.54	0.74	7.10	0.26

Density of dry-processed fibreboards at various content of phenol-formaldehyde resin and hydrolysis lignin

Series №	Content of phenol formaldehyde resin P, %	Content of hydrolysis lignin L, %	Density $\rho$ , kg.m <sup>-3</sup>
1.	10	0	858±7.72
2.	8	2	851±9.36
3.	6	4	848±9.80
4.	4	6	847±10.73
5.	2	8	883±11.63



## Summary and Conclusions

The produced dry-processed fibreboards with adhesive system from phenol-formaldehyde resin and hydrolysis lignin meet the requirements of the relevant EN standards.

A main difficulty in the dry-processed fibreboards production with participation of hydrolysis lignin is the homogeneous introduction of lignin into the wood-fibre mass. Due to the rapid sorption of the water by the lignin and, respectively, its swelling, at concentration of 30% and lignin content of more than 6%, its injection through a nozzle is impossible. This problem is solved with reduction of the suspension concentration to 10%. This also becomes possible due to the relatively high hot pressing factor.

At concentration of phenol-formaldehyde resin and lignin of 30%, with increase of the substitution of phenol-formaldehyde resin with hydrolysis lignin, deterioration in all properties of the boards is observed, except for a relative improvement of elasticity of boards having been established in case of a lignin content of more than 40% in the adhesive system.

The dilution of the adhesive suspension to 10%, allows, at 80% substitution of the resin with lignin, to achieve properties higher than those obtained with use of phenol-formaldehyde resin only. The positive result may be explained with the more homogeneous distribution of the hydrolysis lignin, as well as with the lignin plasticization and activation as a result of the increased moisture content in the press material and in the lignin itself. Prolongation of the press factor is necessary in order to separate the gas-vapour mixtures from the press material.

## Acknowledgements

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