The use of esterified lignin for synthesis of durable composites

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Outline

Background

- Aim of study

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- Reaction methods and procedure

Result and Discussion

- Carachterization of lignin ester
- Evaluation of the composite properties

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- Concluding remarks

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- Ongoing and future work

Background

Reference: www.ri.se (18th November 2011)

Background

Aim of the study:

To decrease the use of fossil based raw material in plastic products by using biobased materials, such as lignin, and synthesizing durable composites by using LDPE and esterified lignin (LAP).

Reference: www.polyline.com, www.mistra.org (18th November 2011)

Experimental

Principle of the study:

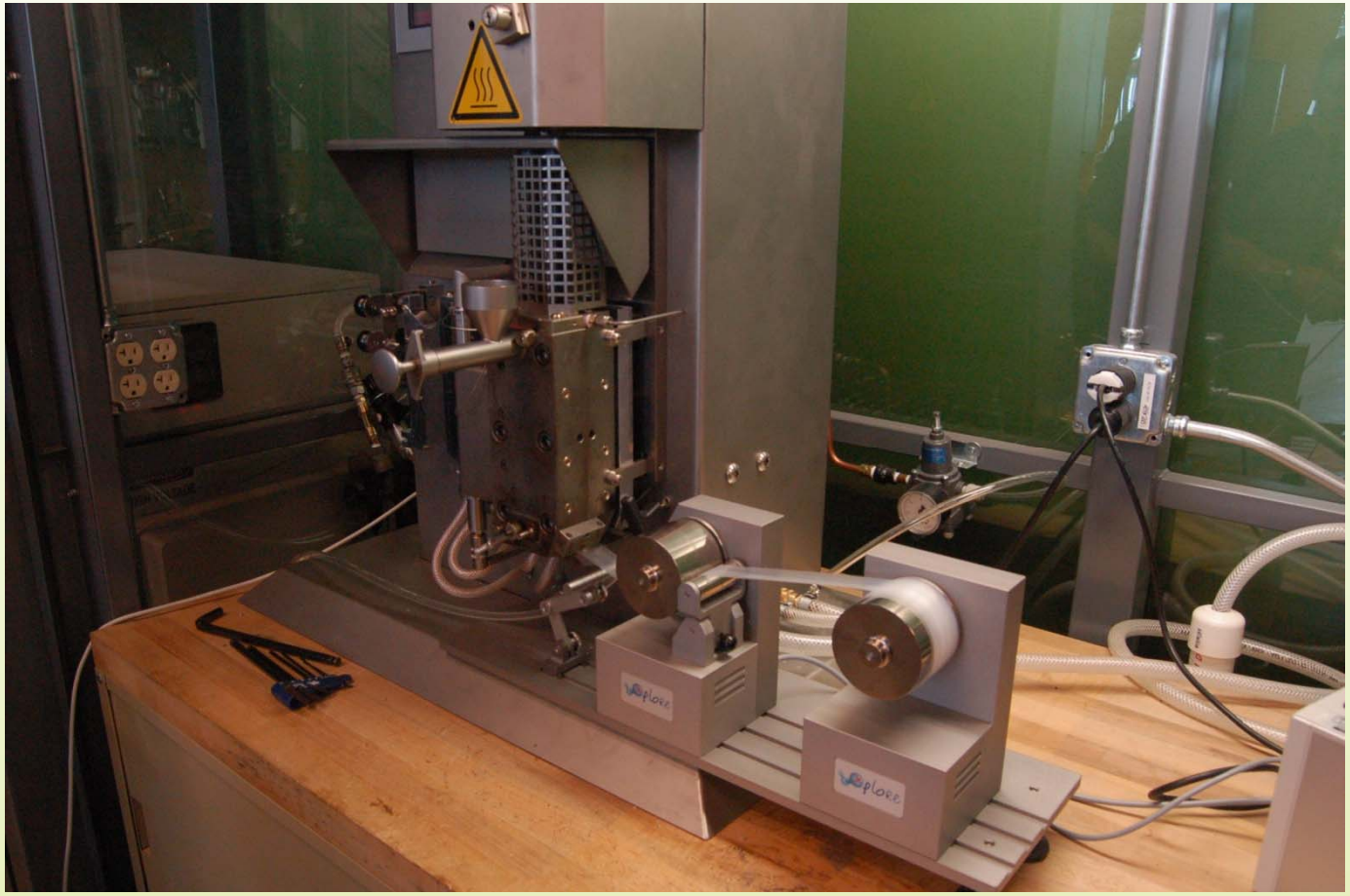
Esterify lignin, by reaction with acetic and propionic anhydride, for processing with LDPE into composite.

Reaction temperature: 80°C
Reaction time: 1,5 hours

Product was analyzed using FTIR.

Experimental

Extrusion



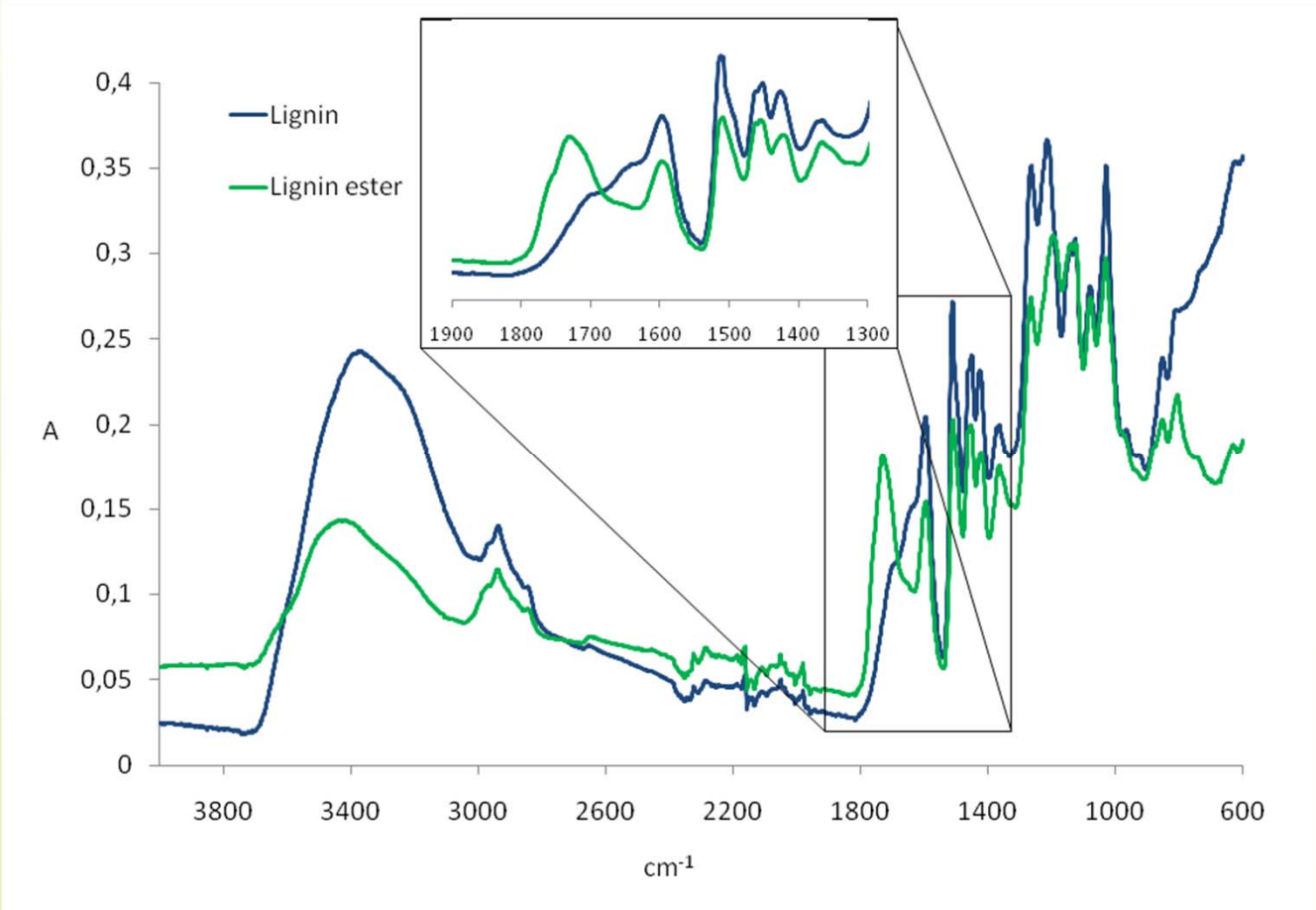
Experimental

Extrusion

Name	Composition and extrusion temperature
LDPE	Pure LDPE, 160°C
LAP150	10% LAP and 90% LDPE, 150°C
LAP160	10% LAP and 90% LDPE, 160°C
LAP170	10% LAP and 90% LDPE, 170°C
LAP150p	10% LAP and 90% LDPE, pre-compounded (50/50), 150°C

Results and Discussion

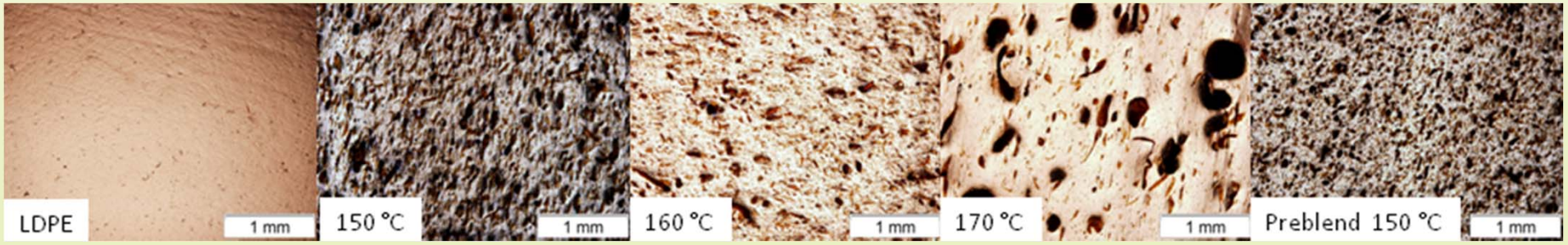
Confirmation of esterification using FTIR



Results and Discussion

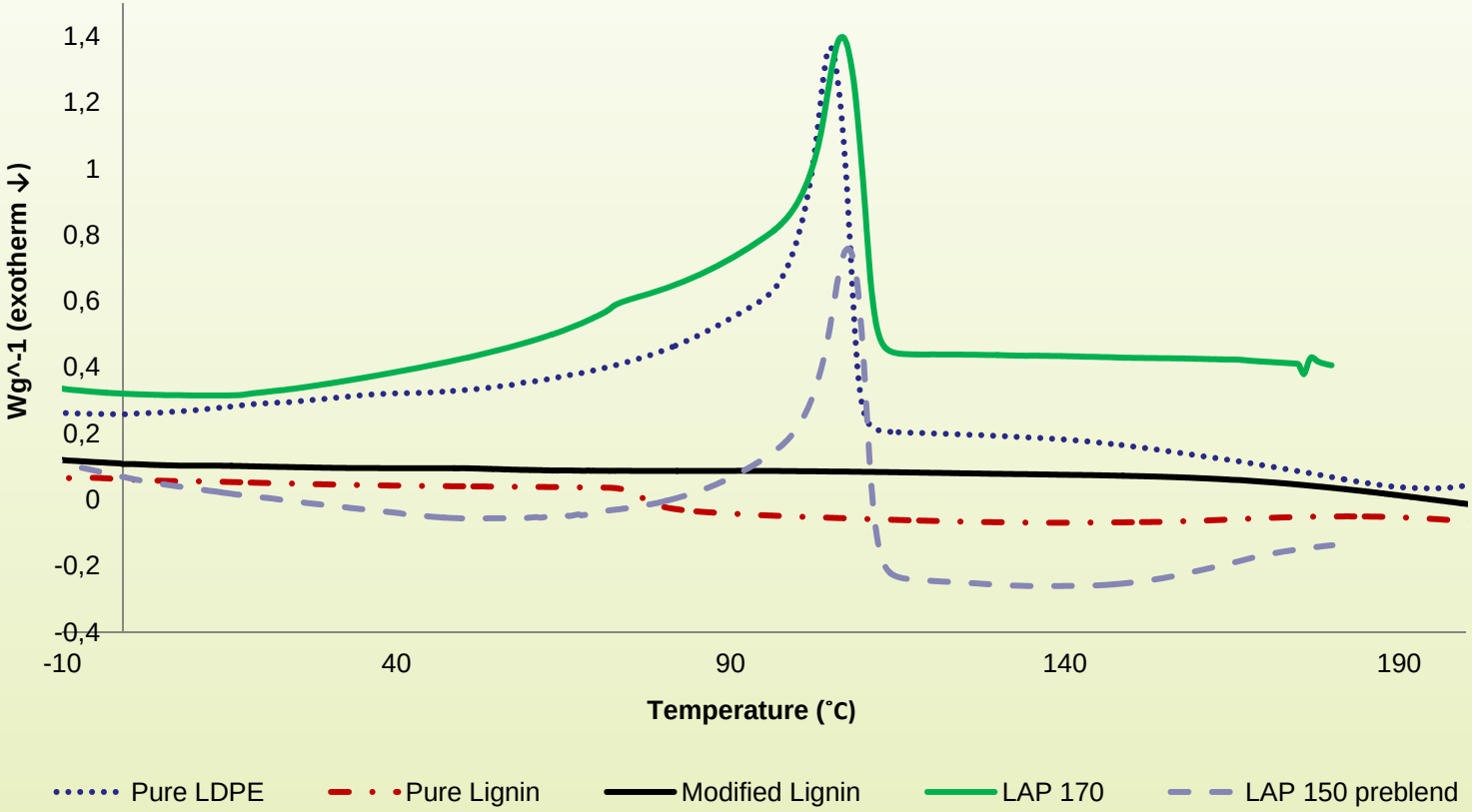
Evaluation of composite properties - Optical microscope

LDPE LAP150 LAP160 LAP170 LAP150p



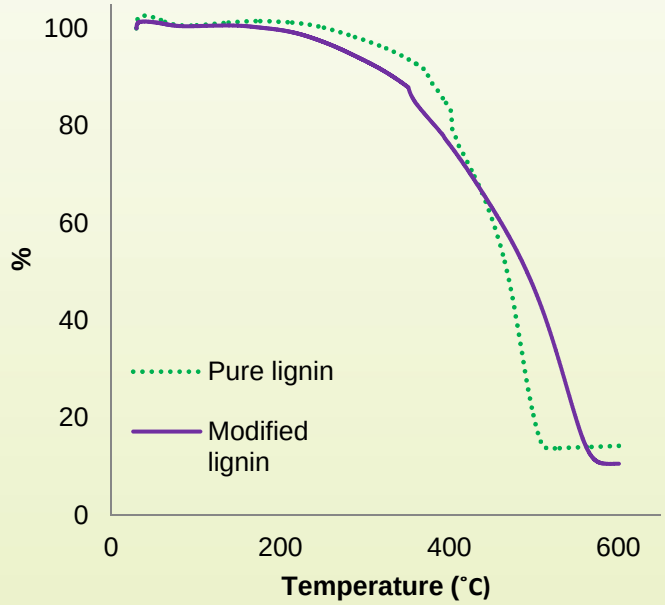
Results and Discussion

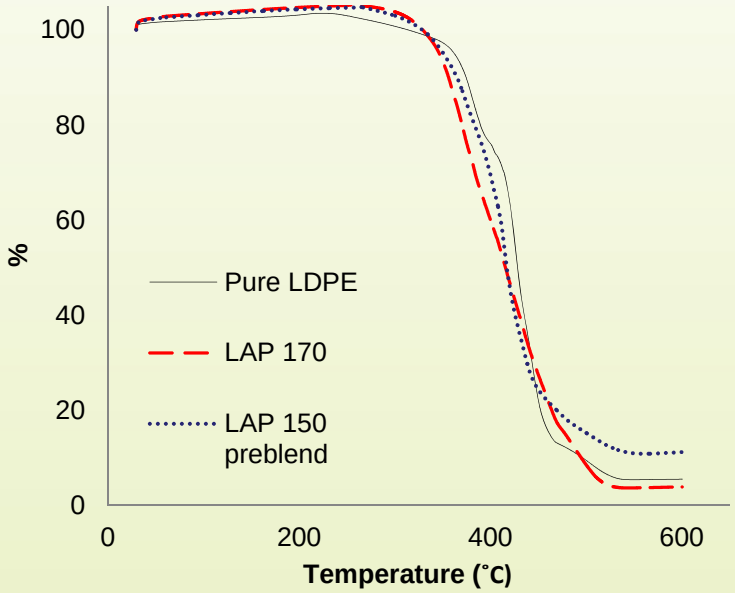
Evaluation of composite properties - DSC



Results and Discussion

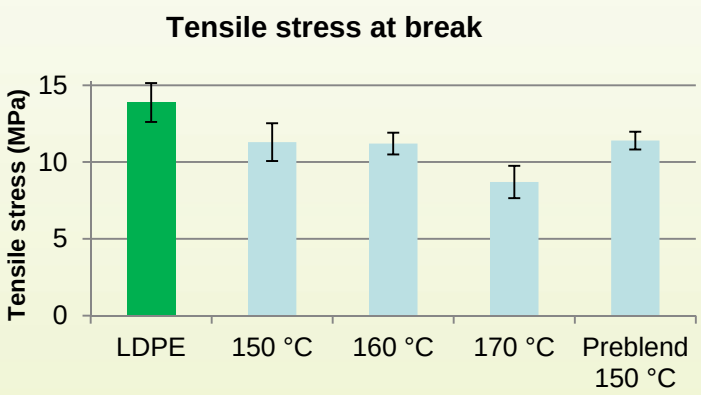
Evaluation of composite properties - TGA

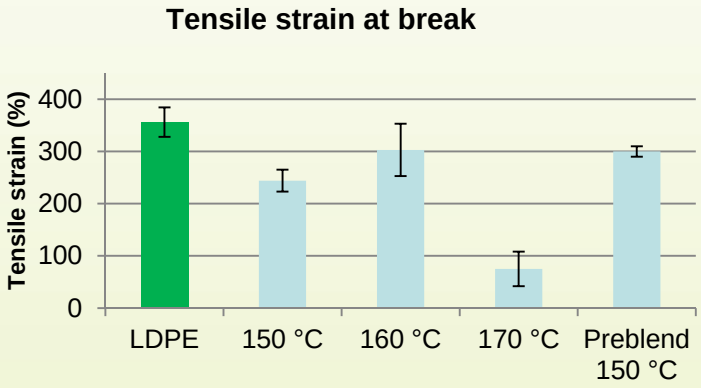


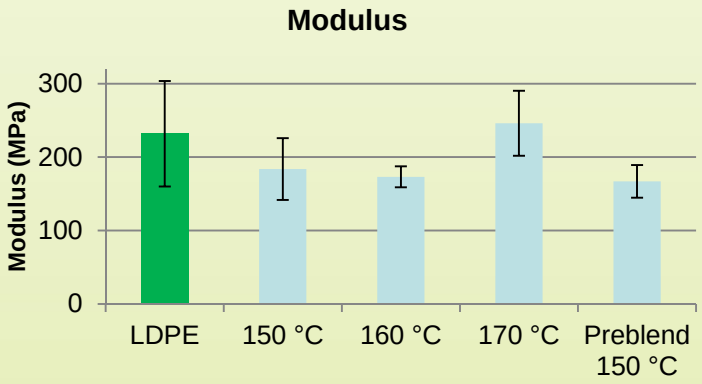


Results and Discussion

Evaluation of composite properties – Tensile test







Conclusion

- The FTIR spectra show that esterification of lignin is possible
- The LAP used did not blend well with the LDPE and is in this case to be considered as a filler material
- At a processing temperature of 170°C the LAP formed larger aggregates which caused uneven films and crack initiations when mechanically tested

Future work

- Using higher reaction temperature
- Using different molar ratios of the anhydrides
- Using the anhydrides separately
- Using other anhydrides
- Try to add even more lignin
- Use as bio-matrix for WPC

Acknowledgements

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Thank you for listening!

Questions?