



**Tervetuloa PANK ry:n Menetelmäpäivään
torstaina**

**Ligniinin käyttö asfaltissa ja sen vaikutus asfaltin
kierrätysominaisuuksiin, esiselvitys**
**The use of lignin in asphalt and its effect on asphalt recycling
properties, preliminary study**

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Aalto University

Helsinki, 22 January 2026

Acknowledgement

- This project was funded by Väylävirasto and Peab
- Contact person: Dr. Leena Korkiala-Tanttu
- Management: Yuxuan Sun
- Laboratory work: Heli Nikiforow and Petri Peltonen

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22 January 2026, Helsinki, Finland

Outline

- Introduction
- Materials and methods
- Analysis and discussion
- Conclusions

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Introduction



SUSTAINABLE DEVELOPMENT GOALS



If there any renewable materials can be used to replace the conventional binders?

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Introduction

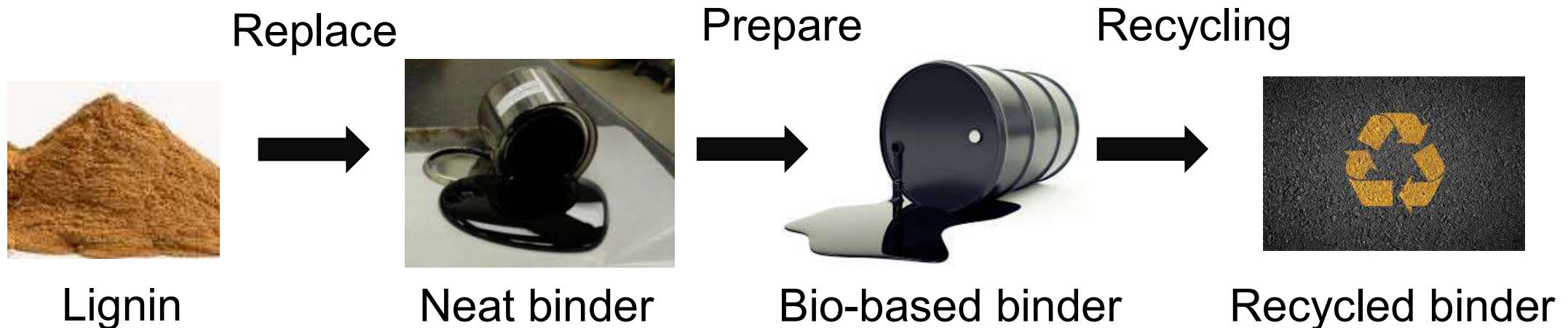
- **Forest resource in Nordic**
- **Coverage rate 73% in Finland, and 68% in Sweden**
- **18% of the Finnish export is associated with the forest industry**
- **Low-value treatment of by-products**



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Introduction

- Lignin: by-product of the kraft process
- Lignin comprises similar components with asphalt
- Lignin can modify the properties of the binders
- If lignin can still work after recycling



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Materials

- 70/100 pen-grade neat binder, reference
- Three lignin powders, Lignova, Micro Na-salt, and Micro Protonated
- 15% content of lignin in binder



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Methods

- **Penetration and softening point – Physical properties**
- **Fourier transform infrared (FTIR) spectroscopy – Chemical properties**
- **Dynamic shear rheometer (DSR) – Rheological properties**
- **Multiple stress creep recovery (MSCR) – Rutting resistance**
- **Linear amplitude sweep (LAS) – Fatigue resistance**
- **Bending beam rheometer (BBR) – Low-temperature properties**

Samples

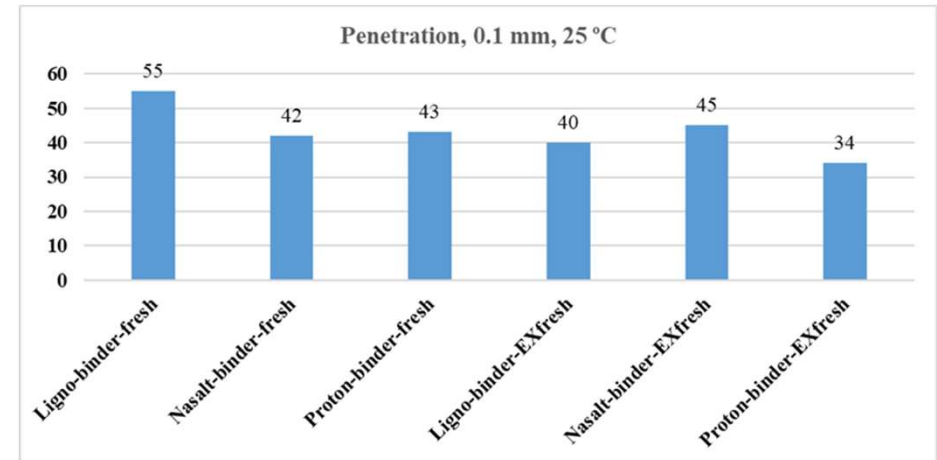
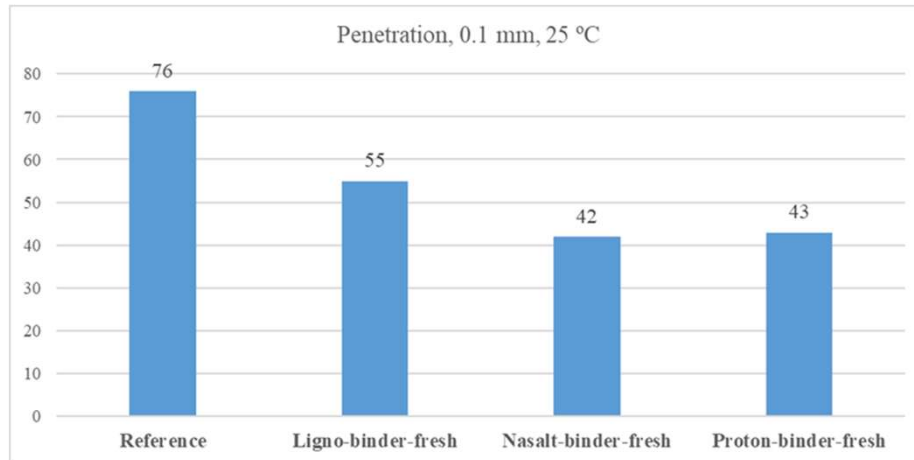
- **Reference binder**
- **Lignin-modified binder**
- **Recycled binder after short-term aging (135 °C and 170 °C)**

Outline

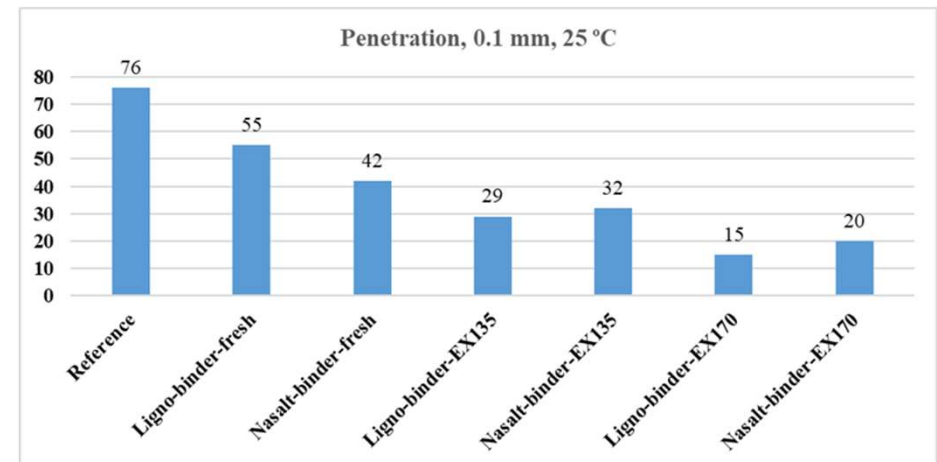
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Results and discussion

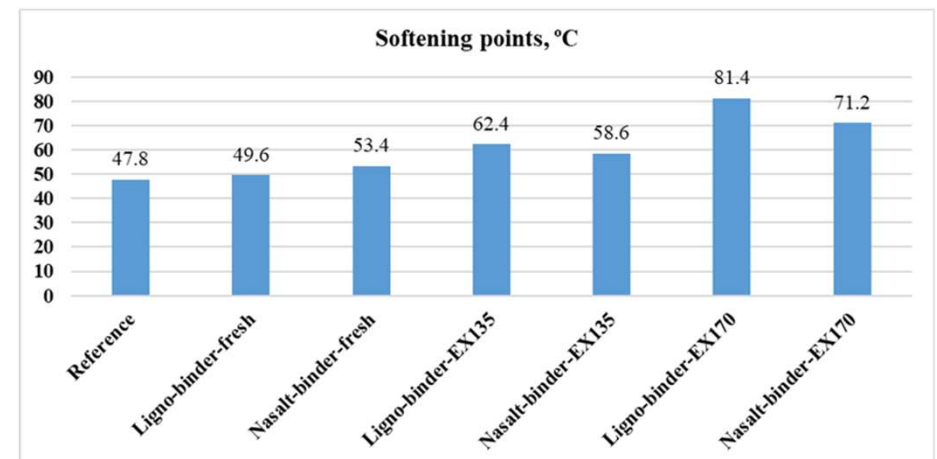
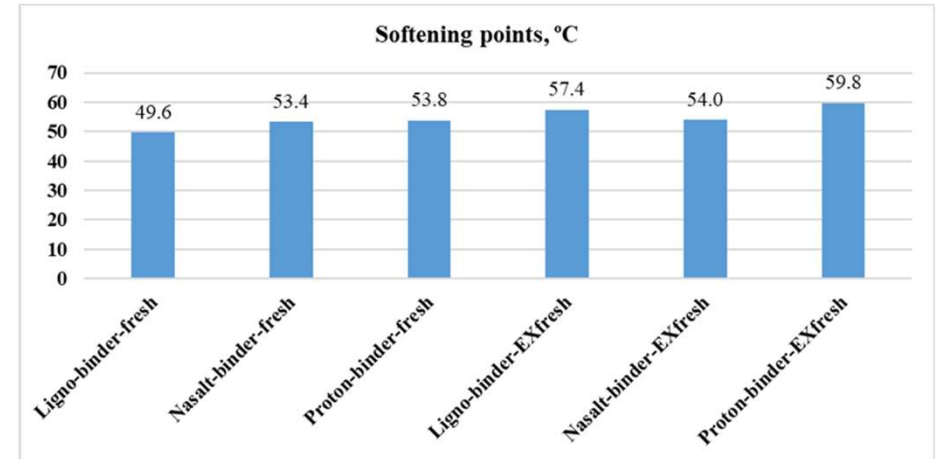
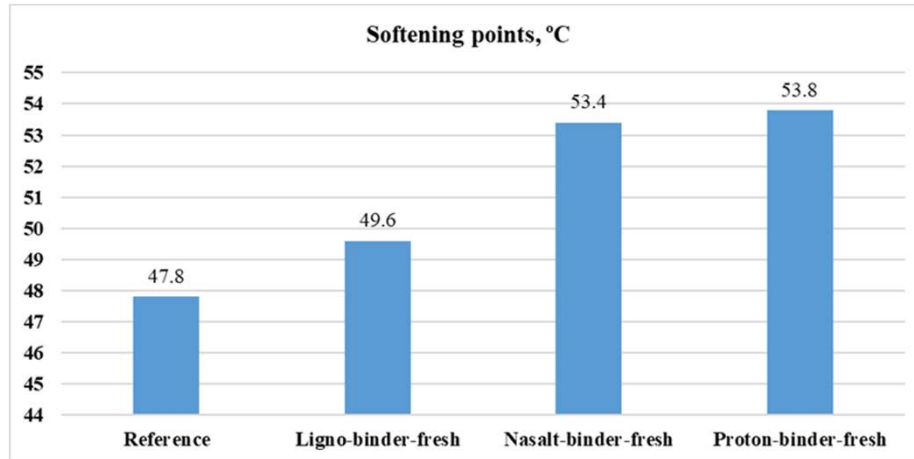


- Penetration reduced after adding lignin
- Penetration reduced after heating



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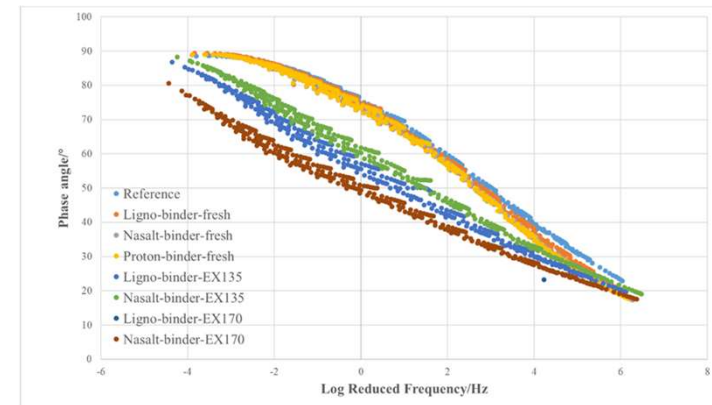
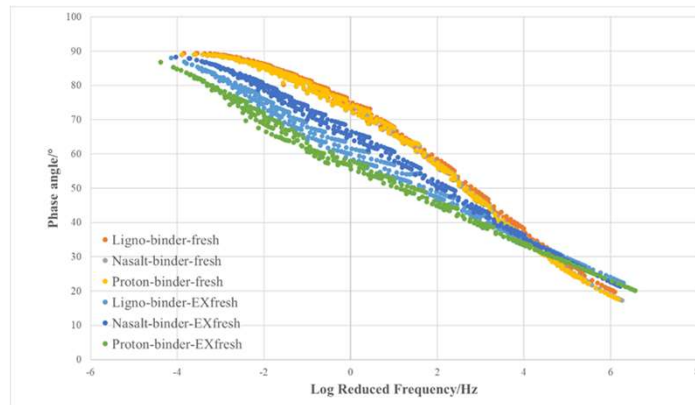
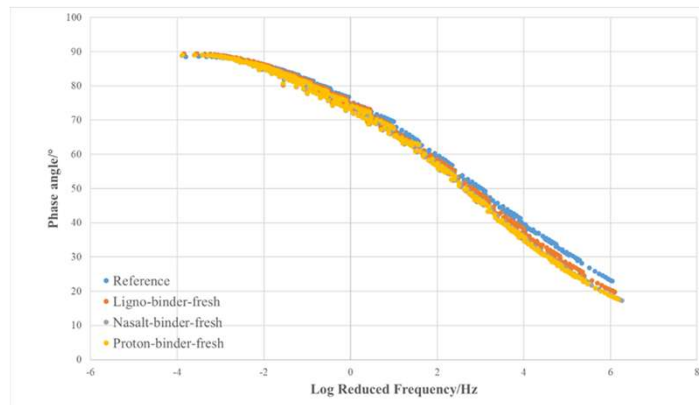
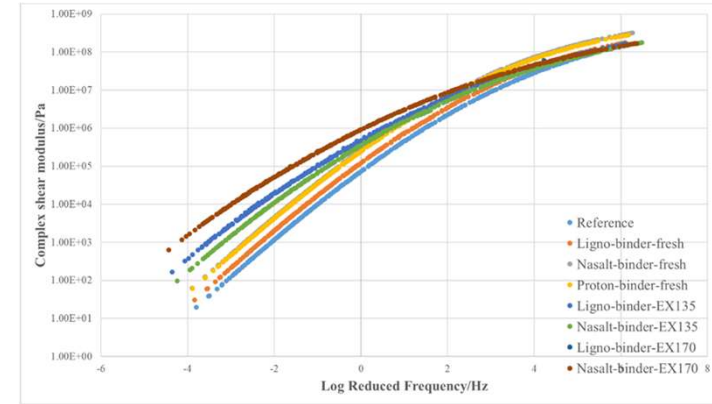
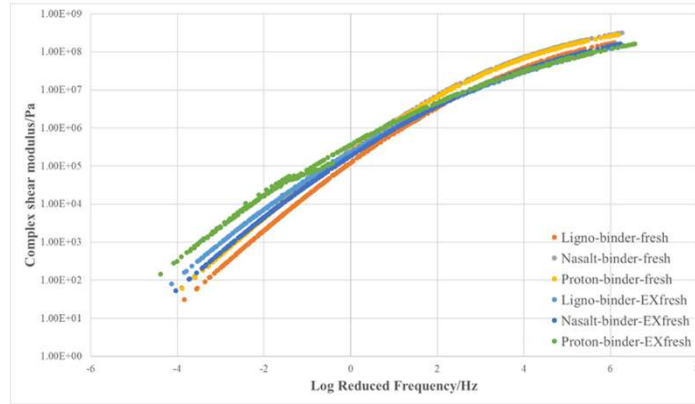
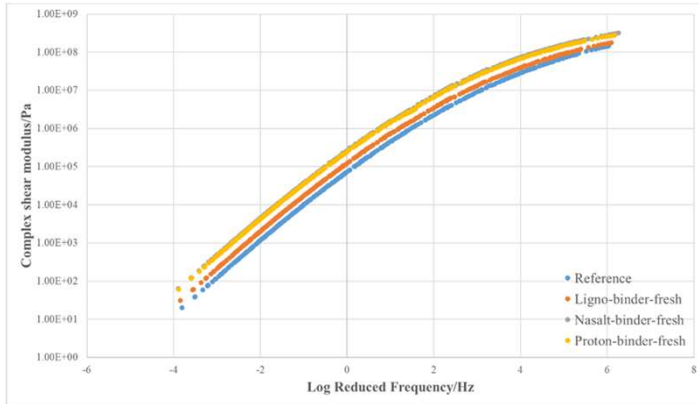
Results and discussion



- Softening point increased after adding lignin
- Softening point increased after heating

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Results and discussion

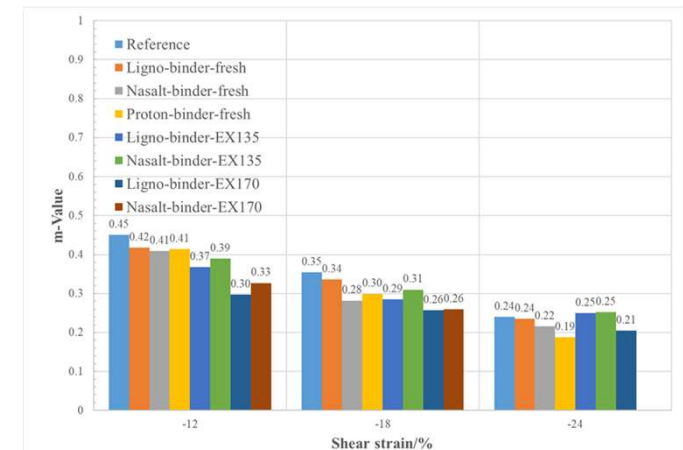
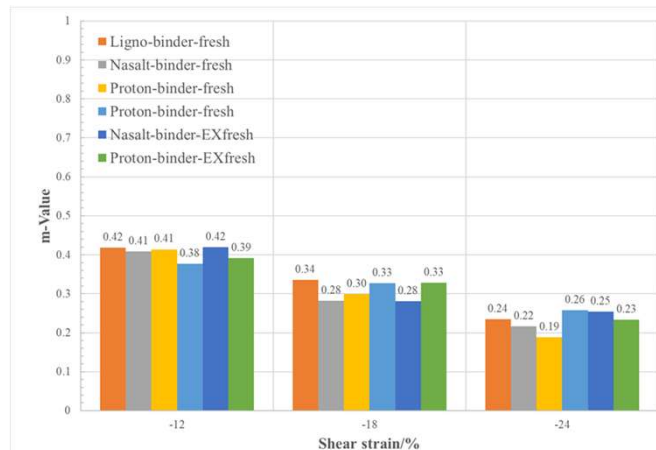
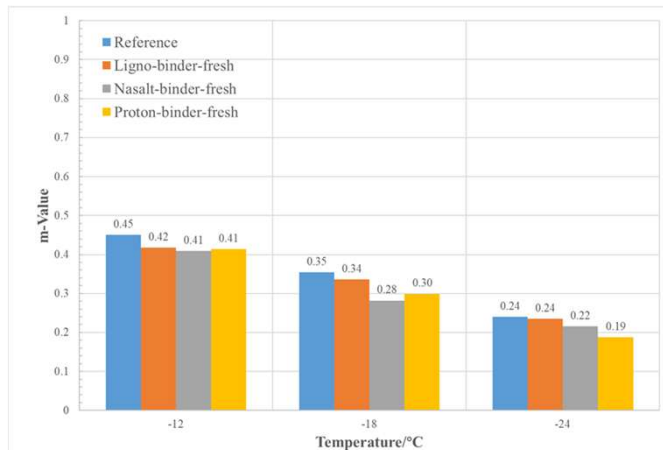
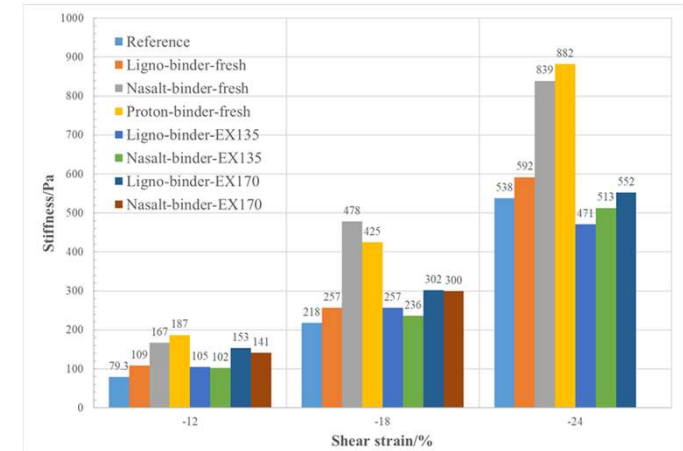
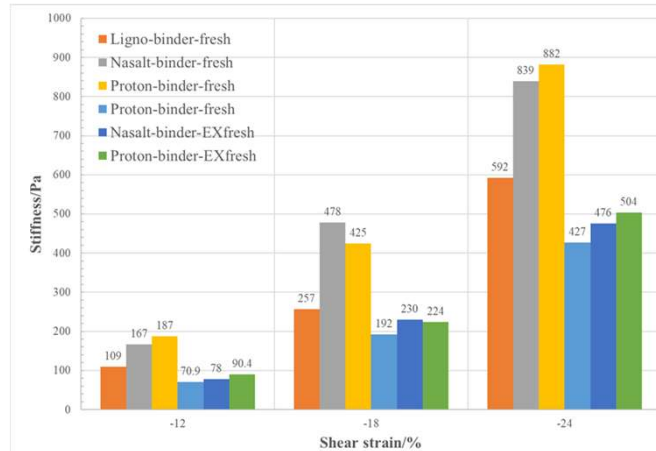
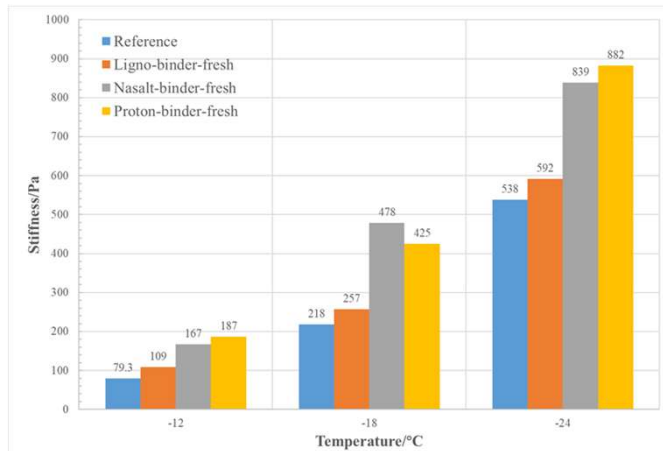


- **More elastic components, and better high-temperature performance**

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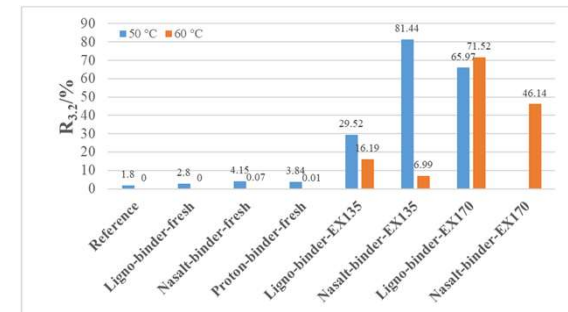
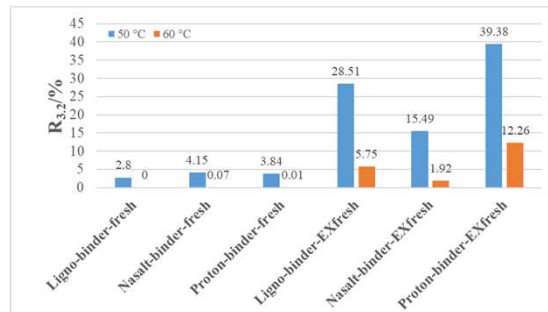
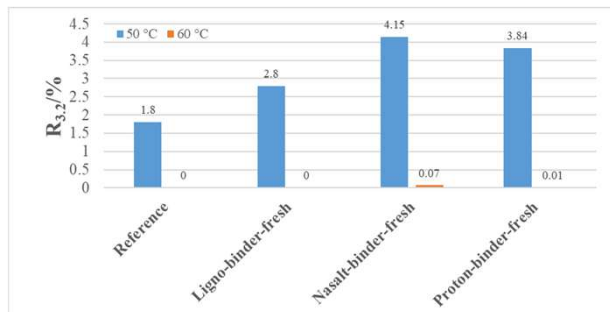
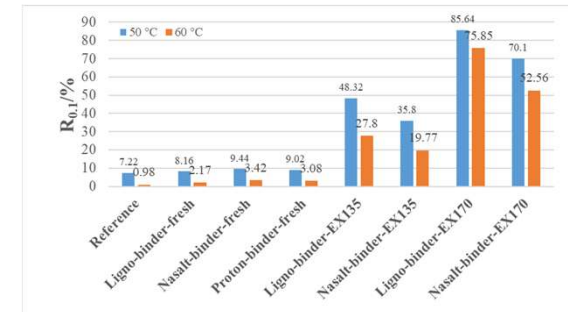
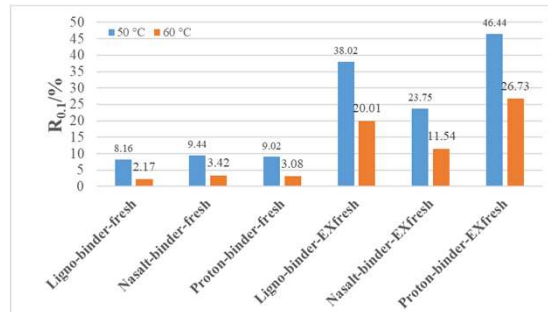
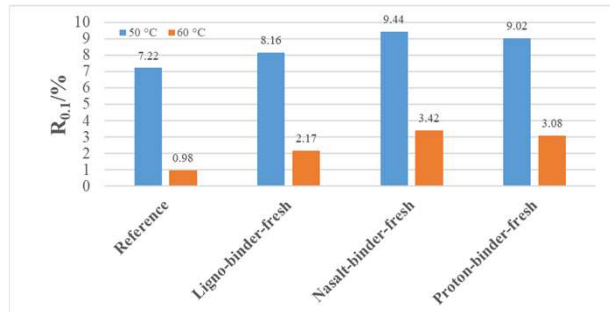
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Results and discussion



- **Worse low-temperature performance after addition of lignin, but better after mixing**
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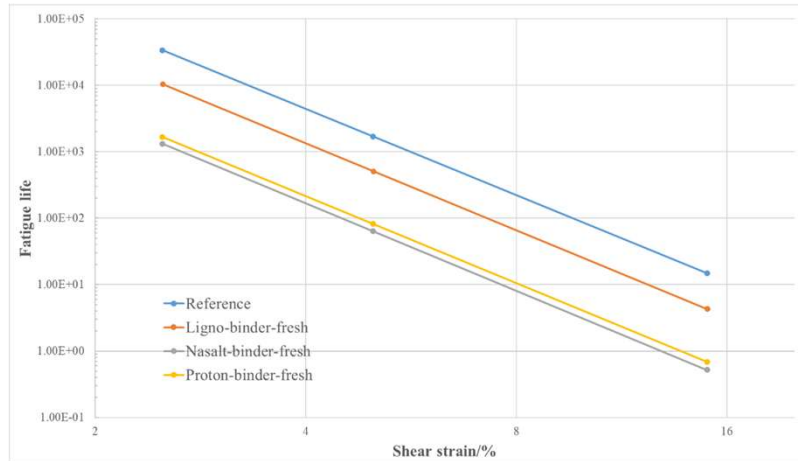
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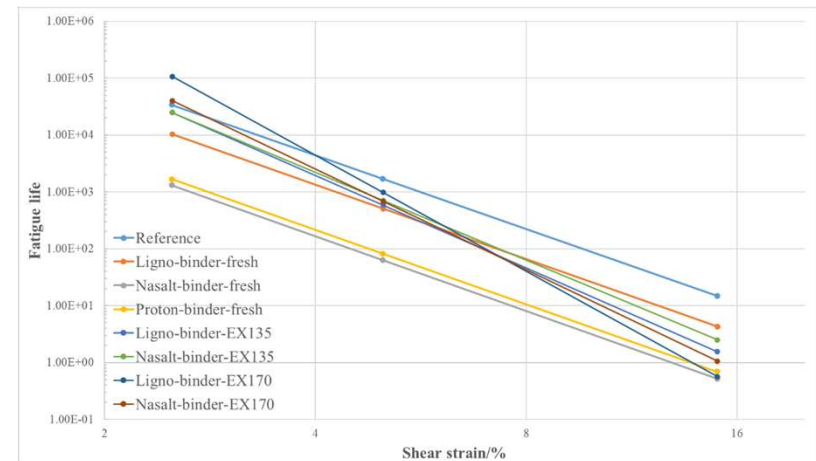
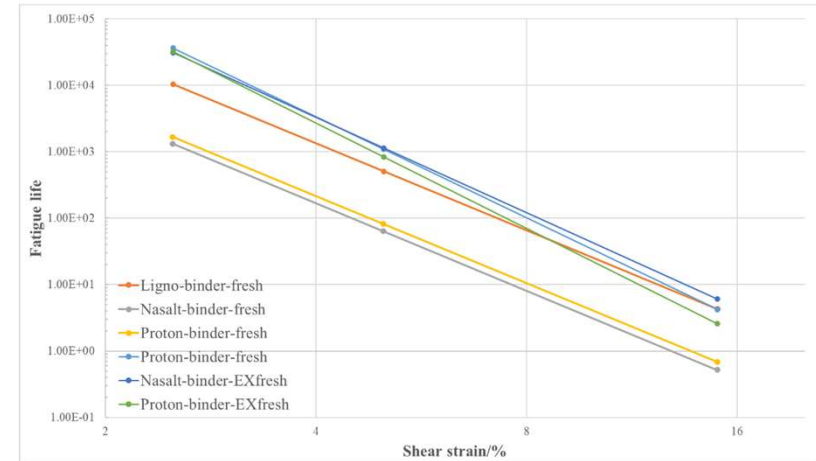
- Higher recovery after addition of lignin and after mixing
- Higher recovery after heating, especially at 170 °C
- Better high-temperature performance

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Results and discussion



- Fatigue life reduced
- The mixing process can increase fatigue resistance



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Conclusions

- **Lignin modified showed more elastic responses, resulting better high-temperature performance and better rutting resistance**
- **Some materials such as rubber can be used together to modify asphalt to improve the low-temperature and fatigue performance.**
- **Lignin can still work well after recycling**
- **The long-term performance should be focused on in future study**



Thank you for your attention!

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