Development of an infra-red spectroscopy tool for ISPM 15 compliance test

Workshop for Inspectors on tools available for inspections
National Agri-Food innovation Campus, Sand Hutton, York

2017-12-13/15
The French Agriculture and Forestry Department ask FCBA (French Institute of Technology for Forest-based and Furniture sectors) to develop a portable control tool for wood packaging was marked ISPM15 (HT).

Based on the Near Infra-Red Spectroscopy (NIRS) technology, FCBA work on the development of a prediction model based on NIR analysis spectrum to determine if the wood was correctly treated.
Global approach adopted to validate the feasibility

Constitution of a near infra-red spectrum database thanks to a laboratory heat treatment on pine and poplar

Development of a prediction model based on the statistical analysis of this database

Test of the prediction model on industrial pallets treated in compliance, or not, with ISPM15
Materiels and methods

- **2 groups of wood species**
  - Softwood with Maritime pine, Radiata pine and scots pine
  - Poplar with 2 different clones (light and heavy)

- **3300 samples (6 x 6 x 60 cm) for 66 different heat treatments (50 samples per treatment)**

- **3 variables for the treatment**
  - Treatment temperature (55, 60 and 70 °C)
  - Treatment time (15, 30, 60 and 120 min)
  - Gradient temperature rise (5, 7.5 and 10 °C/h)
Materiels and methods

✓ For each sample,
  • 1 measure before heat treatment and 1 just after treatment
  • 1 measure each month during half year with 3 different storages conditions (interior, outdoor, outdoor under cover)

→ 8 measurement points per sample with 3 repetitions for each point
→ 39600 spectrums per group
Materiels and methods

Storage conditions

interior  outdoor under cover  outdoor
Results

**Laboratory results**

<table>
<thead>
<tr>
<th></th>
<th>Pine</th>
<th>Poplar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By spectrum</strong></td>
<td>Reliability</td>
<td>70%</td>
</tr>
<tr>
<td><strong>With filter</strong></td>
<td>% classify spectrum</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>Reliability</td>
<td>80%</td>
</tr>
</tbody>
</table>

**Industrial results with laboratory model**

<table>
<thead>
<tr>
<th></th>
<th>Pine</th>
<th>Poplar</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By spectrum</strong></td>
<td>Reliability</td>
<td>68%</td>
</tr>
<tr>
<td><strong>By pallet with filter</strong></td>
<td>% classify pallet</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Reliability</td>
<td>72%</td>
</tr>
</tbody>
</table>
Conclusion

Feasibility?

One prediction model for all species?

Transferability from a laboratory model to an industrial use?

YES

NO: one model for each species (or group, like pine)

NO: not reliable enough to enable an effective control
Next step: development of a usable tool for ISPM15 compliance test

- Constitution of a spectrum database with industrially treated pallets
- Development of a prediction model based on this database
- Integration of prediction models into a software for instantaneous responses

What is needed to validate the prediction model for each species?
Next step: development of a usable tool

☑ This project can become a European project

- If European wood packaging producer support it through the National and European federations

- If the NPPO and EPPO support it to the European commission
Thank you

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