# Programme IRC 2013 // Mercredi 20 Mars

### Afternoon: Parallel Sessions / Après-midi : Sessions Parallèles

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker/Conférencier invité</th>
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</table>
| 14.00 - 14.40 | **Theme 2**  
Processing, Optimization of Processes  
Techniques de Transformation et Optimisation des Procédés | Guest speaker / Conférencier invité  
Prof. Dr.-Ing. Andreas LIMPER, Member of the Management Board, HARBURG-FREUDENBERGER Maschinenbau GmbH, (Germany)  
New angles in mixing of rubber compounds |
| 14.40 - 15.00 |  
Rheological behavior of NR by LAOS analysis in relation with postharvest and processing parameters | F. DEME - LRCCP  
J. SAINTE-BEUVE - CIrAd (France) |
| 15.00 - 15.20 |  
Efficiency énergétique & réduction des pertes matière lors de la fabrication des articles moulés en caoutchouc | J-L. MAIRE - DESMA ELASTOMERTECHNIK (Germany) |
| 15.20 - 15.40 |  
Industrial compoundings of elastomers with nanofillers | M. CHARMAN - EMAC (France) |
| 15.40 - 16.00 |  
Continuous rubber recycling using a co-rotating twin screw extruder | A. GALLO - F.LLI MARIS (Italia) |
| 16.00 - 16.20 |  
Pause and visit of the exhibition | |
| 16.20 - 16.40 |  
Elastomer network investigation by solid NMR | B. GABRIELLE - E. GOMEZ - HUTCHINSON (France) |
| 16.40 - 17.00 |  
Rubber to metal bonded assemblies  
Characterization of the adhesion for different formulas of elastomers, metals and bonding agents.  
Correlation between kinetic crosslinking of rubber compounds and bonding agents | F. BRUNO - LRCCP (France) |
| 17.00 - 17.20 |  
How to reduce fatigue life dispersion starting from the study of 3D distribution of ZnO agglomerates by computed X-ray microtomography | K. LE GORJU - HUTCHINSON (France) |
| 17.20 - 17.40 |  
Electron Beam Irradiated Natural Rubber-Polyaniline Dodecylbenzenesulfonate Blends | Y. KOK-CHONG - MALAYSIAN RUBBER BOARD (Malaysia) |
| 16.00 - 16.20 |  
Noxite® High Performance High Temperature Acrylate Rubbers (HT-ACM) Improved media resistance in fuels and new highly additized engine and transmission oils - A comprehensive study | K. ZOUMIS - UNIMATEC CHEMICALS EUROPE (Germany) |
| 16.40 - 17.00 |  
Identification des facteurs de variabilité du caoutchouc naturel pour développer des nouveaux grades à variabilité réduite et contrôlée destinés aux applications antivibratoires - Projet collaboratif CANAOPT | J. SAINTE-BEUVE - CIrAd  
J-F. PILARD - UNIVERSITE DU MAINE (France) |
| 17.00 - 17.20 |  
HT-ACM XP - The Winning Combination of Processing and Performance for High-Temperature, Oil Resistant Hose | P. ABRHAM - ZEON CHEMICALS EUROPE (England) |
| 17.20 - 17.40 |  
GUAYULE / HEVEA latex glove comparison | S. PALU - CIrAd (France)  
M.DORGET-CTTM (France)  
D.GUERIN-PIERCAN (France) |
GUAYULE / HEVEA latex glove comparison

M. DORGET, CTTM
A. AMOR, CTTM/CIRAD
S. PALU, CIRAD
D. PIOCH, CIRAD
E. TARDAN, CIRAD
D. GUERIN, PIERCAN
C. MOURTON-GILLES, ANSM
Hevea plantation,

Guayule field, Spain (El Molinar)
WHY AN ALTERNATIVE SOURCE OF NR SUPPLY?

- *HEVEA*, only commercial source of NR (93% of world production in Asia),

- Growing demand from emerging countries (China, India, Brazil),

- NR prices have rocketed upward,

- Threat by *Microcyclus ulei* (SALB) (only in South America). The risk to spray in Asia/Africa exists. When? How?

- Price of NR and SR linked with oil (Brent), volatile price
WHY AN ALTERNATIVE SOURCE OF NR SUPPLY?

- Proteins in Hevea latex cause life-threatening, IgE-latex allergy. Guayule latex hypoallergenic,

- Tendency for replacement rubber plantations by palm oil plantations,

- World climatic changes, more frequent weather woes.

- Rubber tapping laborious, social aspects (NGO), Guayule can be mechanized,

- Hevea, Guayule, TKS, Polyisoprene cis 1-4, High Mw,
# Latex Properties

<table>
<thead>
<tr>
<th></th>
<th>HEVEA latex</th>
<th>Commercial GUAYULE latex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid content (%)</td>
<td>61.4</td>
<td>55.6</td>
</tr>
<tr>
<td>Viscosity (Cp)</td>
<td>48</td>
<td>53</td>
</tr>
<tr>
<td>pH</td>
<td>9.6</td>
<td>10.9</td>
</tr>
</tbody>
</table>

Similar wet characteristics
DRY CHARACTERISATION

Drying procedure:
• 2 weeks at ambient condition
• 2h. at 110°C

1. concentration
2. deformation
3. coalescence

No additive, no vulcanisation
The HEVEA film behaves like a “thermoset” polymer.

The Guayule film behaves like a “thermoplastic” polymer.
• HEVEA film behaves like a “solid” film as far as 200°C
• GUAYULE film behaves like a “liquid” film since 100°C

Very different dry characteristics
GLOVES PRODUCTION

1. coagulant surface treatment
2. latex surface coagulation
3. compaction

Coagulant surface treated

free particles

coagulated particles

surface coagulation process

with additives and vulcanisation
quality progress after formulation and process adaptations
# Gloves Properties

<table>
<thead>
<tr>
<th></th>
<th>Hevea Latex</th>
<th>Commercial Guayule Latex</th>
<th>Eu-Pearls Guayule LP Latex</th>
<th>Eu-Pearls Guayule HP Latex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid content (%)</td>
<td>61.4</td>
<td>55.6</td>
<td>37.7</td>
<td>15.5</td>
</tr>
<tr>
<td>Sleeve thickness (mm)</td>
<td>0.32</td>
<td>0.28</td>
<td>0.14</td>
<td>-</td>
</tr>
<tr>
<td>Hand thickness (mm)</td>
<td>0.37</td>
<td>0.31</td>
<td>0.14</td>
<td>-</td>
</tr>
</tbody>
</table>

Guayule ≈ Hevea gloves thickness if solid contents (DRC) are the same.
# Gloves Properties

GUAYULE and HEVEA gloves mechanical properties are similar after slight formulation and process adaptations.

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<th>Hevea Latex</th>
<th>Commercial Guayule Latex</th>
<th>EU-Pearls Guayule LP Latex</th>
<th>EU-Pearls Guayule HP Latex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vulcanising dispersion ratio</td>
<td>27</td>
<td>54</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>Stress at break (Mpa)</td>
<td>17</td>
<td>7.0</td>
<td>13.3</td>
<td>-</td>
</tr>
<tr>
<td>Strain at break (%)</td>
<td>810</td>
<td>860</td>
<td>808</td>
<td>-</td>
</tr>
</tbody>
</table>
Analysis of protein extracts from films and gloves produced with hevea and guayule latex

C. MOURTON-GILLES, M. DANIAU, G. OLIVIER
A. SOUVERAIN, S. PALU, D. PIOCH, E. TARDAN
M. ROSSIGNOL, S. HEM

ANSM
CIRAD
INRA-Protéome
Scientific context

Latex allergy is due to the présence of hevea proteins in rubber goods (cleaning gloves, nipples, toys,...) and medical devices (gloves, catheter, syringe,...).

Latex allergy is a real health problem
Up to 17% of health care workers suffer from type I hevea allergy
Up to 16% of intra-operative shock are due to this allergy
Presence of cross allergy with some fruits (banana, kiwi,...)

A solution to this problem could be to develop devices with a non allergenic latex: GUAYULE LATEX

Objective
Collaborative study between CIRAD and National Health product Agency
To compare protein content of Guayule and Hevea device extracts
Proteins quantity in guayule films are 115 times lower than in hevea films and 9 times than in medical gloves (1)

Gloves made with commercial guayule latex contain less proteins than hevea prototype gloves (2)

Commercial guayule latex was provided by YULEX for the EU-PEARLS project
DETERMINATION OF ALLERGENS CONTENT FILMS AND GLOVES

- Dosage of allergens
  *Elisa sandwich*  
  *FITKit*  
  *ICOSAGEN*  
  *(Acm, ABTS)*

- Allergen Hev b1 is present in the hevea films but in small amount in guayule extracts from films and gloves

*Commercial guayule latex was provided by YULEX for the EU- PEARLS project*
Allergen Hevb 3 is present in the hevea films and in small amount in medical and guayule gloves made with commercial latex.

Commercial guayule latex was provided by YULEX for the EU-PEARLS project.
DETERMINATION OF ALLERGENS CONTENT FILMS AND GLOVES

- Dosage of allergens
  Elisa sandwich
  FITKit ICOSAGEN (Acm, ABTS)

➢ Allergen Hev b 5 is present in the hevea films

Commercial guayule latex was provided by YULEX for the EU- PEARLS project
Allergen Hev b 6.01 is present in the hevea films but also in guayule gloves film in smaller quantity.

Commercial guayule latex was provided by YULEX for the EU- PEARLS project.
Identification of proteins in guayule films extracts

Using Western Block and labelling with anti-hevea Mabs (Hevb1, Hevb3, Hevb5 and Hevb6.02) and using LC ESI MS/MS mass spectrometry with INRA:

- Some hevea allergens were identified in guayule films
  - Rubber elongation factor Hevb1
  - Glucan endo1,3 beta glucosidase: Hev b2
  - Hevamin A: Hev b14
  - Pro-Hevein: Hev b6.01

- Proteins in guayule films extracts, Hevb1 and Hevb6.01 were detected.

- Allergen Hevb 6.01 is present in hevea films and gloves but also in guayule film and gloves

- Protein quantity in guayule films is about 100 times lower than in hevea films

- Only Hevb1 and Hevb6.01 were detected in guayule films using Fit Kits
CONCLUSIONS

- For wet characterization, HEVEA and GUAYULE latex are very similar,

- For dry characterization, HEVEA latex behaves as “solid” film, GUAYULE latex as “liquid” film. With higher molar mass (Mw) of the polyisoprene, GUAYULE films have similar or even better behavior than HEVEA films.

- For gloves production, slight formulation and process adaptations bring close mechanical properties and process behaviors for both latex.

- Preliminary results on latex allergenic of Hevea & Guayule latex, show that proteins concentration of guayule film is 100 fold lower than for HL film.

- Guayule latex has a lower content of allergenic proteins than Hevea latex.

- Guayule latex is an alternative source very useful in medical applications to avoid allergenic reactions of patients for Type I latex allergy.
THANK YOU