CENTRE TECHNIQUE
DU BOIS
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Short-Term Scientific Mission

Innovative technologies for identifying and sorting contaminated wood from recovered wood waste

Mission Report

September, 2005

Applicant	Host institution
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Financial support : the International Research Group on Wood Preservation

Keywords : C&D, wood, waste, arsenic, copper, XRF, stain, sorting, field

Acknowledgements

I would like to warmly thank Prof. Helena Solo-Gabriele (Department of Civil, Architectural and Environmental Engineering, University of Miami), for the week spent with her, shared with her team (1) and her colleagues (2) in Florida. Their welcome is unforgettable. They were very patient with my English and efficient instructors. Their research about wood waste management is very relevant, and the exchange of information extremely useful for my work.

I would also like to thank the IRG for their financial support, Jöran Jermer for facilitating this mission and Gerard Deroubaix for giving me that opportunity.

(1)

- Amy Omae, Graduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami
- Colleen Block, Undergraduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami
- Gary Jacobi, Graduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami
- Tomoyuki Shibata, Research Assistant, Department of Civil, Architectural and Environmental Engineering, University of Miami

(2)

- Anadi Mistra, Graduate Student, Department of Environmental Engineering Sciences, University of Florida
- Brajesh Dubey, Graduate Research Assistant, Department of Environmental Engineering Sciences, University of Florida
- Chang-Yu Wu, Associate Professor, Department of Environmental Engineering Sciences, University of Florida
- John Schert, Executive Director, Florida Center for Environmental Solutions, University of Florida
- Harvey Schneider, President, Florida Wood Recycling
- Lora Fleming, Professor, Department of Epidemiology & Public Health and Marine Biology & Fisheries, University of Miami School of Medecine and Rosenstiel School of Marine and Atmospheric Sciences
- Timothy Townsend, Associate Professor, Department of Environmental Engineering Sciences, University of Florida

1. Objectives of the mission

The objectives of the mission were :

- To learn about some technologies to detect heavy metal contained in the wood waste particularly :
    - Colorimetric identification methods with some chemical stains
    - X-ray fluorescence spectroscopy (XRF)
- To experiment how to use these technologies in the field of sorting wood waste,
- To document the treated wood characteristics,
- To discuss about other technologies,
- To take part in the Florida sorting study in progress, and if possible, to participate to the technical Awareness Group meeting,
- To discuss about strategy for characterizing and sorting contaminated wood from construction and demolition (C&D) waste.

2. Description of the tour

Monday, August 15

Environmental Laboratory, University of Miami

Person contacted : Amy Omae, Graduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami
Subject : Arsenic-specific stain

Work done :

- How to make the stain (a combined reagent with ammonium molybdate and stannous chloride)
- How to use it in the lab (dissolution method, whole wood application and wiping)
- Which results to expect (color, reaction time, detection limit, interferences)

Important observations :

+ :

- proportional quantitative reaction (blue color)
- arsenic specific reaction
- low detection limit : < 10 ppm
- for the CCA, without phosphate sensitivity
- inexpensive

- :

- reaction time : 25 min
- interference with dirt and water
- difficultly for use in the field

References :

- This subject was presented at the TAG meeting and the PowerPoint presentation can be seen at http://www.ccaresearch.org/tag17/powerpoint.htm
- Solo-Gabriele, H., Townsend, T. (2005) Technologies for the management of wood waste containing metals-based preservatives. Proceedings of the 6th International Symposium “Environment and Wood Preservation” of the International Research Group of Wood Preservation, IRG/WP 05-50224:16, p. 1-19.

Person contacted : Gary Jacobi, Graduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami

Subject : PAN indicator (copper-specific stain)

Work done :

- How to make the stain (dissolution of 1-(2-pyridylazo)-2-naphthol in methanol at 0.05% by weight)
- How to use it in the lab (whole wood application)
- Which results to expect (color, reaction time, interferences)

Important observations :

+ :

- Easy to see : red color
- fast reaction (< 1 min)
- inexpensive

- :

- qualitative reaction
- interference with dirt and water
- limited use in the field

References :

- This subject was presented at the TAG meeting and the PowerPoint presentation can be seen at http://www.ccaresearch.org/tag17/powerpoint.htm
- Blassino, M., Solo-Gabriele, H., Townsend, T. (2002) Pilot scale evaluation of sorting technologies for CCA. Waste management & Research ISSN 0734-242X, 290-301.

Tuesday, August 16

Environmental Laboratory, University of Miami

Person contacted : Tomoyuki Shibata, Research Assistant, Department of Civil, Architectural and Environmental Engineering, University of Miami

Subject : Arsenic exposure

Work done :

- presentation of his research
- visit of playgrounds to collect data

Important observations :

For the waste topic, the data about mulch can be compared to the data of French crushed C&D wood waste.

References :

- This subject was presented at the TAG meeting and the PowerPoint presentations can be seen at http://www.ccaresearch.org/tag17/powerpoint.htm
- Hemond, H., Solo-Gabriele, H. (2004) Children's Exposure to Arsenic from CCA-treated Wooden Decks and Playground Structures. Risk Analysis, Vol. 24, No. 1, P. 51-64

Persons contacted : Colleen Block, Undergraduate Student, Department of Civil, Architectural and Environmental Engineering, University of Miami

Subject : hand-held XRF

Work done :

- Principles
- How to use the unit
- Results

Important observations :

+ :

- quantitative results
- good value in 6 seconds
- low detection limit : 10 ppm (in more time)
- good correlation between XRF unit and atomic absorption analyze
- several metal analyzed in the same shoot
- difference between CCA and copper (like ACQ) can be made
- coat metal (like Pb) can be detected
- no interference with dirt and water
- hand-help, easy for use in the field
- could be used in an automatic picking line
- calibration is done by the maker, who supplies a specific CCA calibration
- In France, there are 2 main distributors

Fortex ingénierie (Innov-X Systems unit)
Jean-Marc Frezouls
03 29 58 99 26
Fortexing@aol.com

Fondis électronic (Niton unit)
Joël Le Chevalier
01 34 52 10 41
j.le.chevalier@fondiselectronic.com

- :

- equipment is expensive (from 20 to 40 k$)

References :

- This subject was been presented at the TAG meeting and the PowerPoint presentation can be seen at http://www.ccaresearch.org/tag17/powerpoint.htm
- Blassino, M., Solo-Gabriele, H., Townsend, T. (2002) Pilot scale evaluation of sorting technologies for CCA. Waste management & Research ISSN 0734-242X, 290-301.
- Solo-Gabriele, H., Townsend, T., Hahn, D. (2001) On-Line Sorting Technologies for CCA-Treated Wood. FDEP Innovative Recycling Grants Program, draft submitted on September 30, 2001, 119 pages.
- Solo-Gabriele, H., Townsend, T., Hahn, D., Moskal, T., Hosein, N., Jambeck, J., Jacobi, G. (2004) Evaluation of XRF and LIBS technologies for on-line sorting of CCA-treated wood waste. Waste Management 24, P. 413-424.

Wednesday, August 17

Florida Wood Recycling, Medley

Persons contacted :
Brajesh Dubey, Graduate research assistant, Department of Environmental Engineering Sciences, University of Florida
Harvey Schneider, President, Florida Wood Recycling
Timothy Townsend, Associate Professor, Department of Environmental Engineering Sciences, University of Florida

Subject : wood sorting in a C&D waste facility

Work done :

- visual sorting
- checking with XRF
- time, number of pieces of wood and weigh control

Important observations :
It was extremely hot !
Visual sorting is very much dependent on the technicians.
Most results (efficiency and cost) about sorting experiences were presented at the TAG meeting.

Thursday, August 18

Medley Town Hall

Persons contacted :
John Schert, Executive Director of Florida Center of solid and hazardous waste management, University of Florida
Speakers

Subject : Joint TAG Meeting

Agenda :

Introduction

1. Greeting	Wolfe
2. Welcome and organization of joint meeting	SoloG/Wu
3. Brief History of Florida CCA Research	SoloG/Townsend

Florida Center for Solid and Hazardous Waste Sponsored Research (FCSHWM) — Schert

4. Background Information Concerning FCSHWM and FCES

Leaching of Treated Wood

5. Comparison of environmental impact of CCA and three different arsenic free preservatives under several use and disposal scenarios — Townsend/Dubey

6. Results from Field-Scale Deck Study (Sponsored by NIEHS-FIU Arch Center) — Shibata/SoloG

7. Impact of Iron Oxidants on Leaching From Mulch, Recently Completed — Shibata

Disposal of Treated Wood

8. Research Plan and Progress Focusing on an "Evaluation of Thermal Processes for CCA Wood Disposal in Existing Facilities" — Wu/Townsend/Mistra

9. Guest Speaker: Initiatives in France for Disposal of Treated Wood Waste — Cornillier

10. Review of Mulch Characterization Study, Recently Completed — Jacobi

Identification and Sorting

Town of Medley Innovative Recycling Grant

11. a. Results from "Augmented Sorting of Recovered Wood Waste Using Stain and X-Ray Technologies" — Block/Jacobi
    b. Sorting Recovered Wood from the Recyclers Perspective — Schneider

12. Progress on "Year 9" Newly Funded Project Focusing on "An Arsenic Specific Stain for CCA-Treated Wood" (Sponsored by the FCSHWM) — Omae/SoloG

Playground Study

13. Pilot Epidemiologic Study Evaluating Potential As Exposures to Children from CCA-treated Playgrounds (Sponsored by Rutgers, U.Miami and NIEHS) — Fleming

Important observations :

There were about forty participants, researchers, students, waste management companies, preservative suppliers (OSMOSE and CSI), supporters and environmental authorities.

Every Powerpoint presentations can be seen at
http://www.ccaresearch.org/tag17/powerpoint.htm

Friday, August 19

Visit of Miami and open discussion with Prof. Helena Solo-Gabriele

Important observations :

The current program "Augmented Sorting of recovered Wood Waste Using Stain and X-Ray Technologies, supported by Innovative Recycling Grant will be completed in 2 months. The final report is due October 31, 2005 (http://www.eng.miami.edu/~hmsolo/medley/).

Futurs programs are planned. They are to begin by the end of 2005 or by the beginning of 2006.

Prof. Helena Solo-Gabriele offered to put on loan a XRF unit to CTBA to test it.

On the site http://www.ccaresearch.org, you will also find some publications and information about CCA treated wood research.

3. Conclusions and further prospects

The exchange information has been excellent and highly beneficial.

X-Ray technology shows considerable potential for separating large quantities of CCA-treated wood and maybe wood with coat containing heavy metals, in the field using an on-line sorting system.

This technology is about to be tested in France to improve wood waste management.

2 CTBA studies will be completed by the end of the year. The first one calls on the pressure treated wood waste management system and the second one aims at a characterization of C&D wood waste.

A future project on recovered wood waste sorting should be set up by CTBA, integrating X-ray technology and the background contribution of Prof. Helena Solo-Gabriele's team and her colleagues.

A collaboration between University of Miami and CTBA in their future projects would be desirable and could concern wood waste management.

In other respects, the hand-held XRF could be interesting for other CTBA activities like quality control for certified treated wood products.