FEEDSTOCK SUPPLY CHAIN ANALYSIS - MSW

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TABLE OF CONTENTS

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LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

C&D	construction and demolition debris
MSW	municipal solid waste
MRF	material recycling (recover) facility
GIS	geographical information systems
RIN	Renewable Identification Number
Boiler MACT	maximum achievable control technologies
SPORL	Sulfite Pretreatment to Overcome the Recalcitrance of Lignocelluloses

EXECUTIVE SUMMARY

The NARA project focused on utilizing wood wastes, or woody biomass, that had little or no value or markets. The predominate emphasis of the NARA project was placed upon forest residuals, however, the wood waste generated in our MSW streams also provides a potential biorefinery feedstock. To realize the potential of utilizing wood waste from our MSW network, understanding how much is available, where the feedstock is located, and how the material performs during conversion to a sugar or fuel are crucial parameters to address. The analysis was limited to the NARA region of the Northwest section of the U.S.

Our work provided a comprehensive summary of wood waste available in our C&D MSW stream networked through local MRFs. The C&D waste stream was identified as the most accessible source of wood in our MSW stream. This accessibility allows for earlier adoption of this material and an accurate assessment of currently available materials. The data was inventoried and mapped using GIS, which not only allowed for a visual presentation of the wood volumes, but also allowed for interpretation of the data for economic and logistics modeling.

We also performed an analysis of wood wastes derived from 3 NW based MRF's. Representative samples were collected by our collaborating MRFs, and a physical characterization along with enzymatic evaluation was performed on pretreated materials. Results showed substantial variation among the MRFs and a lower sugar yield that would be associated with virgin wood materials. Inhibitors, such as furans and acetic acid, were also present in the C&D wood waste, which may have caused a decrease in enzymatic activity.

The EPA's Renewable Fuels Standard II allows for RINs credits on selective woody biomass. One consistent restraint is that the biomass cannot originate on national forest lands. This becomes an issue for utilizing wood waste from C&D since there is not an established accounting or tracking method to determine if wood used during construction was from timber on national forest lands. Therefore, the ability to obtain RINs credits at this time is unlikely. Within the proposed biorefinery, the operating and capital expenditures capture much of the costs, while RINs credits account for the biomass supply. At this time, a zero cost of biomass still will yield a negative rate of return on investment without the assistance of RINs credits.

However, there have been precedent petitions that have been approved by the EPA for an MRF that recycles lingo-cellulosics from the residential MSW stream. The EPA approved the petition, and the MRF can apply for RINs credits. This paves the way for NARA regional MRFs to petition their process to produce viable woody feedstocks that are applicable for RINs credits.

With the addition of RINs credits, the economics for woody biomass from MRFs looks to be quite promising. The cost of wood waste from C&D streams is quite low in comparison to forest residuals. Local MRFs provide hog fuel to industries from $5-35/ton, which is less than half of what is estimated for costs of forest biomass. The low cost, location near primary transportation arteries, and reasonable quality make C&D wood waste a potential option for a sugar market for bio-based chemicals and resins.

INTRODUCTION

Our solid waste disposal system provides a viable source of woody biomass that is easily accessible and has the potential to be a viable feedstock for conversion into liquid fuels and other non-traditional wood products, such as; resins, specialty chemicals, activated carbon to name a few. The removal of wood from residential or "curbside" disposal methods is quite difficult and yields a lower amount of wood products. However, our construction and demolition (C&D) disposal process does yield a high volume of wood wastes and is currently an accessible source. Material Recycling/Recovery Facilities (MRFs) are commonly found in many metropolitan areas and provide the service of material recovery, separation and preparation into an intermediator feedstock. Much of the wood recovered at MRFs go into hog fuel throughout the NARA region and is sold anywhere from \$5-35/ton. MRF woody biomass can also be a viable option for the pulp and paper industry and a feedstock for wood composites when the quality is at specification and the transportation logistics are feasible.

In looking at where the average MRF wood supply is derived from, the largest contribution is from demolition of residential and nonresidential buildings, with renovation also contributing a large percentage of woody biomass (Figure MWS-Intro.1). Much of the incoming wood materials are framing lumber and more increasingly engineered wood products (U.S. Environmental Protection Agency, 2009).

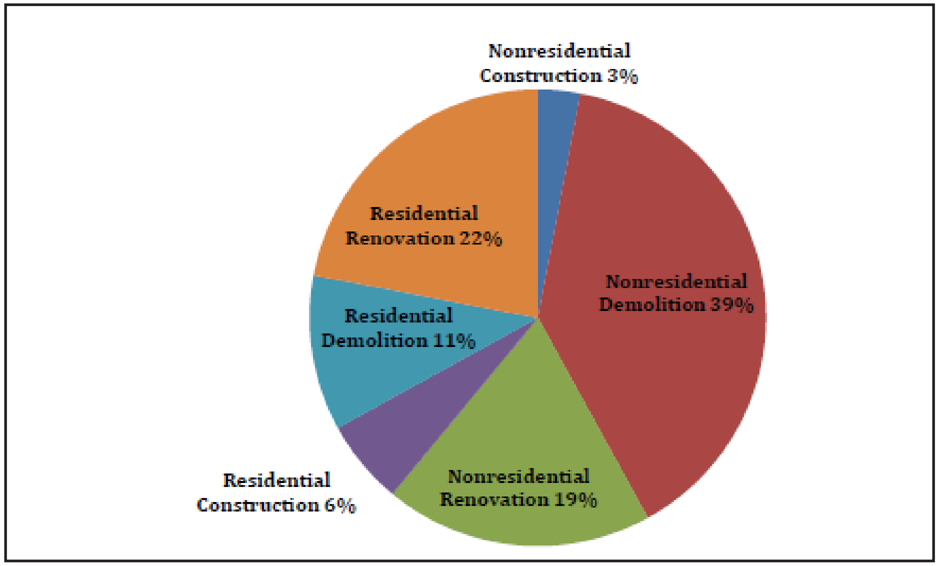

Figure MWS-Intro.1. Source of incoming wood products into MRF facilities throughout the U.S. Note: adapted from "Estimating 2003 Building-Related Construction and Demolition Materials Amounts", by the U.S. Envi-ronmental Protection Agency (EPA), (2009, March). Retrieved from https://www.epa.gov/sites/production/files/2015-11/documents/cd-meas.pdf

The image in Figure MWS-Intro.2 provides a snapshot of a NW regional MRF incoming woody biomass collection. One of the major hurdles for any MRF is the removal or separation of contaminates from the woody biomass to an acceptable level for the intended market. The EPA Boiler MACT procedures require wood for use in commercial or industrial boilers to be free of all non-wood materials and residual paints, lead, and chemically treated wood (U.S. Environmental Protection Agency, 2016). The Boiler MACT guidelines provide an existing baseline for contaminate removal that can be applied to future biofuel feedstock production.

Figure MWS-Intro.2. Image of a typical composition of wood waste in a NW regional MRF.

Assessing the amount of wood waste in our C&D and MSW streams is somewhat controversial. The DOE National Renewable Energy Labs (NREL) utilized the work performed by Wiltsee, 1998 to determine wood waste volumes from the MSW. The research to support the wood/person was based upon data derived from 30 metropolitan regions, which was used to develop the regression analysis (Wiltsee, 1998). Recent research by Powell et al. (2016) and Harran et al. (2010), have shown the Wiltsee equation to provide a low estimation of MSW volumes. In the study by Powell et al. (2010), data was analyzed from operating landfills and estimates came out over double the amount of MSW material than reported in Wiltsee's work. Harran et al. (2010) looked at the data derived from each state and they also found a significantly higher volume of material in our MSW stream. The contradictions found in these sources indicate that inventory of wood waste in a MSW stream needs to be within the region of evaluation. Also, obtaining inventory of wood that is currently available through MRFs is the most accessible material to obtain.

Although C&D wood wastes have been extensively used in boiler applications, their use in enzymatic fuel production has been limited. Jafari et al. (2011) evaluated wood composites and wastes for their ability to be converted to sugars using phosphoric acid pretreatments and baker's yeast to convert to ethanol with some success. Other research (Lesar et al., 2016) has had varying levels of success in using wood wastes with a variety of pretreatment, hydrolysis and fermentation techniques. However, there is limited information on C&D wood wastes utilizing a SPORL pre-treatment similar to the NARA biorefinery approach.

In order to consider MSW/C&D wood wastes as a feasible feedstock for a potential biorefinery in the NARA region, two primary objectives will need to be addressed; 1) Develop a complete inventory of available wood waste in the region C&D wastestream, 2) Evaluate the quality of selected MRF feedstocks for their use in an en-zymatic conversion to a biofuel. Wood waste derived from MRFs that recycle C&D waste streams will be considered since this supply chain currently exists and there is a need for new markets for their woody biomass inventories.

TASK 1: DEVELOP MSW/C&D WOODY BIOMASS INVENTORY IN NARA REGION

Task Objective

In this Task, our objective is to utilize the state and regional MRF databases to ascertain a inventory of wood within the regional MSW supply chain, specifically the wood waste derived from C&D related MRFs.

Methodology

Initial data for determining the inventory of wood waste available in the region was derived from generated spreadsheets that were acquired from the state solid waste divisions within the NARA region. Both WA and OR have yearly inventory reports that disclose the amount of wood waste in their MSW and C&D waste streams. Empirical estimates provide the amounts of wood in the MSW, while C&D streams are estimated through both empirical estimates and reports from MRFs where available. Idaho and MT did not have data reported on a state level and only had a few local community or county data available, generally in higher population centers.

Although WA and OR provided comprehensive state data for wood inventories, the location of the source and the amount of wood actually available was not detailed in these reports. We therefore located all the regional MRFs, isolated the ones that dealt with woody biomass, obtained their inventories and identified their location. This data was collected through questionnaires via a phone call (IRB exempt) then entered into a GIS database for future analysis of feedstock logistics.

Results

Within the NARA region we contacted a majority of the MRFs to ascertain their wood volumes, location(s), and primary markets (Table MWF-1.1). The types of MRFs var-ied significantly in their accounting of their incoming and outgoing wood materials, which makes some of the numbers provided being rough estimates. Throughout the NARA region, we estimated that a total of 646,800 tons of wood diverted and utilized primarily as a low-value hog fuel or in small quantities as reclaimed timber. The tons reported were on as-is moisture content, which adds another layer of uncertainty on exact wood volumes.

Many of the MRFs contacted sold their wood as hog fuel, which can be a volatile and competitive market. The need for another market with more consistent inventory needs would be greatly appreciated by many MRFs who are currently selling their wood materials from $5-35/ton delivered.

To provide a graphical representation of the data and to allow for further analysis, GIS databases were developed. In Figure MWF-1.1., a complete NARA regional map of the locations and volume of wood per year for the representative MRFs is

Table MWF-1.1. Overview of MRF data collected in the NARA region.

State	Total Known MRFs	Total MRFS with Data Unknown	Total MRFs with Volume Data Unknown	Estimated MRF Wood Quantities (tons/year)	Recycled Wood Majority Market
Idaho	4	0	0	45,000	Reclaim Timber
Montana	7	1	2	6,800	Reclaim Timber
Oregon	18	3	6	100,000	HogFuel
Washington	24	2	8	495,000	HogFuel
Total	**53**	**6**	**16**	**646,800**	**Hog Fuel**

shown. As expected, most of the wood available through the MRF system is near high population areas.

When the NARA Supply Chain team began their investigation of the Mid Cascade to Pacific (MC2P) sub-region, GIS mapping of the included MRFs was completed as seen in Figure MWF-1.2. Generally, most of the MRF wood was found around Portland, OR with some scattering of MRF sites throughout WA and OR. These selected areas for accumulated waste products is often termed a "wasteshed."

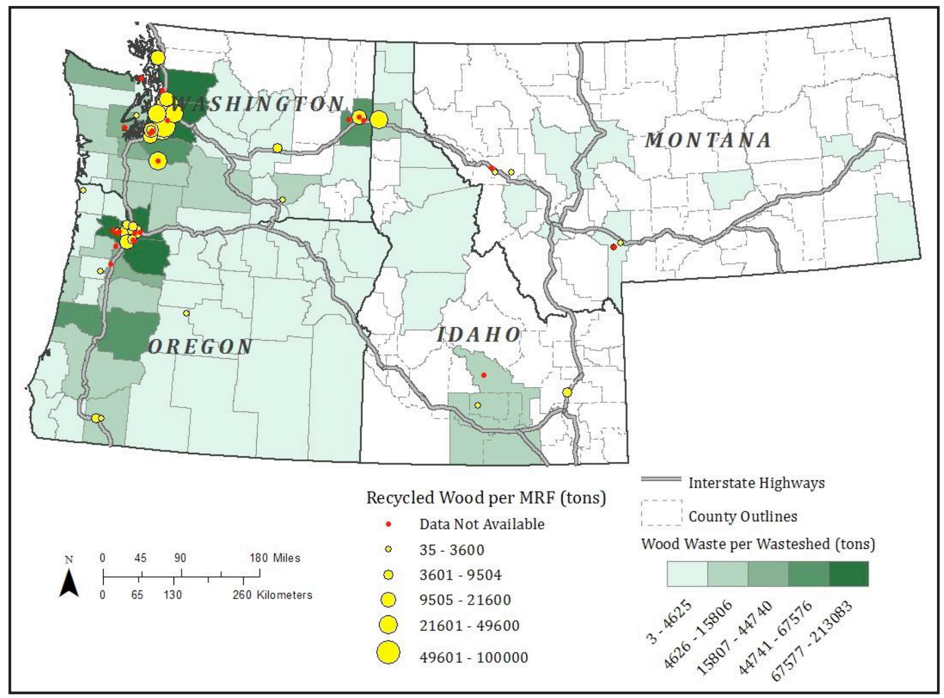

Figure MWF-1.1. NARA regional GIS map of MRFs and their wood volume outputs on an annual basis.

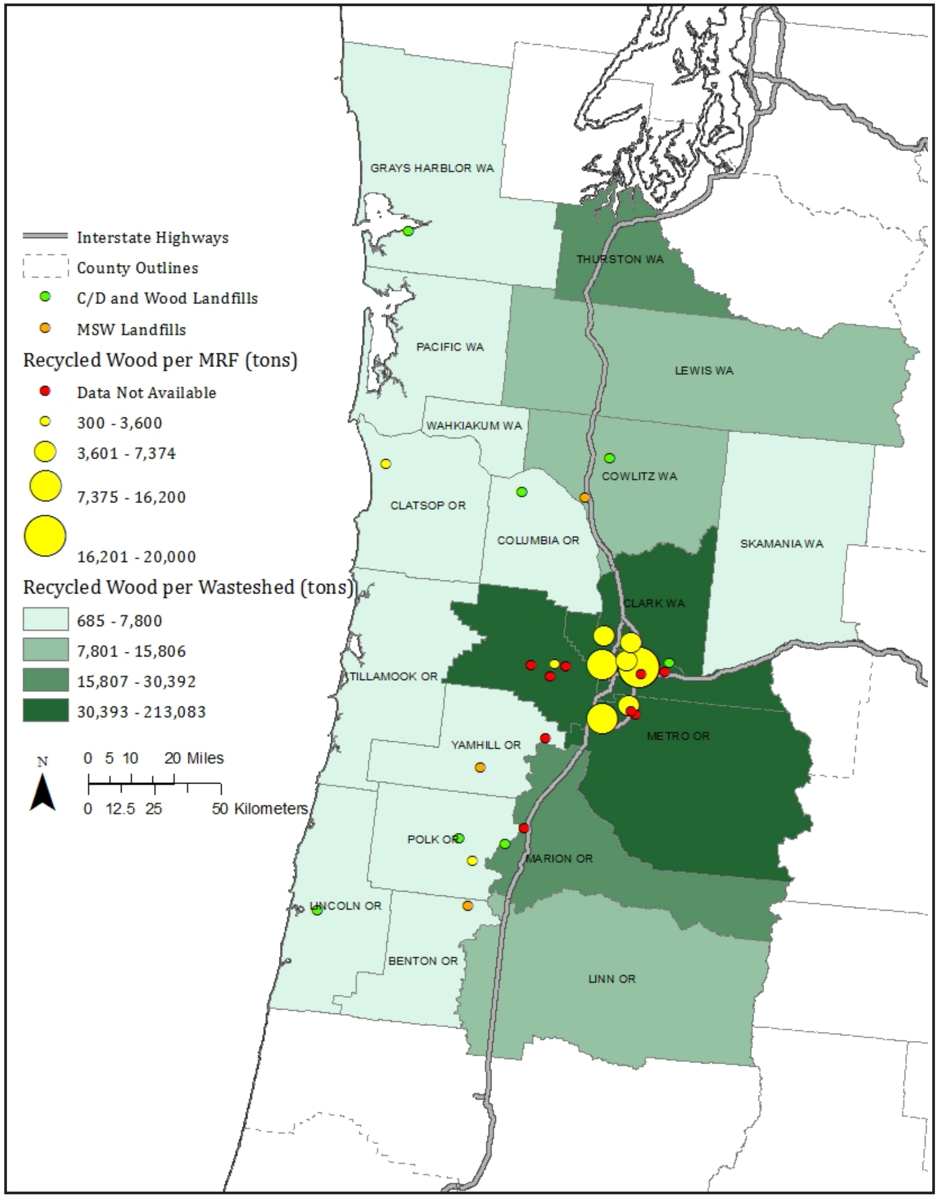

Figure MWF-1.2. Wasteshed of wood volumes within the specific NARA region C2P supply chain.

Conclusions/Discussion

The conclusion of *Task 1: Develop MSW/C&D woody biomass inventory in NARA region*, provided a graphical representation and a database with wood inventory values and location. This information can then be applied to any supply chain assessment. From the data represented in Task 1, there appears to be a substantial amount of wood that can be acquired from local MRFs if a biorefinery is located near an urban community. Most of the larger MRFs are located near rail and have easy highway access, so transport logistics are favorable. The cost for this material is also a positive attribute, where $5-35/ton is common. Although much of the wood from MRFs is entering hog fuel markets, there are often capped by demand and introduction of other markets, a biorefinery, in the region would likely encourage more recycling of wood and spur economic growth in the sector of demolition. The quality of the wood from MRFs is of concern and is addressed in *Task 2: Characterization of MRF wood waste for an enzymatic-based biorefinery*.

TASK 2: CHARACTERIZATION OF MRF WOOD WASTE FOR AN ENZYMATIC-BASED BIOREFINERY

Task Objective

Our objective is to evaluate the chemical and physical characteristics of representative wood specimens within the regional MRF supply chain.

Methodology

For a more complete overview of *Task 2: Characterization of MRF wood waste for an enzymatic-based biorefinery*, please reference Pelaez-Samaniego & Englund, (2016).

Sample characterization

Four samples of wood waste recycling (WWR) materials (varying from 5 to 9 kg) were collected at three regional MRFs (herein referred to as companies A, B, and C) in the NW United States. The first sample, herein referred to as "A.1", was provided by company A, located in the Seattle (WA) area. Two more samples, provided by Company B (also located in the Seattle area), have been identified by the company as mulch and hog fuel, and in this work they are referred to as "B.1" and "B.2", respectively. An additional sample, herein referred to as "C.1" was provided by a company located in Portland (OR) area (Company C) and is sold as hog fuel. Figure MWF-2.1 shows images of the four samples. Throughout this task section, all these materials will be referred to as WWRs.

After drying at room conditions for two weeks, a representative portion of each material (~500 g), without screening small particles, was subsequently subjected to a preliminary grinding process, using a granulator knife mill, equipped with a 6.35 mm screen. A portion of each resulting material (~60 g) was afterward subjected to a final grinding process using a laboratory knife mill equipped with a 40 mesh screen.

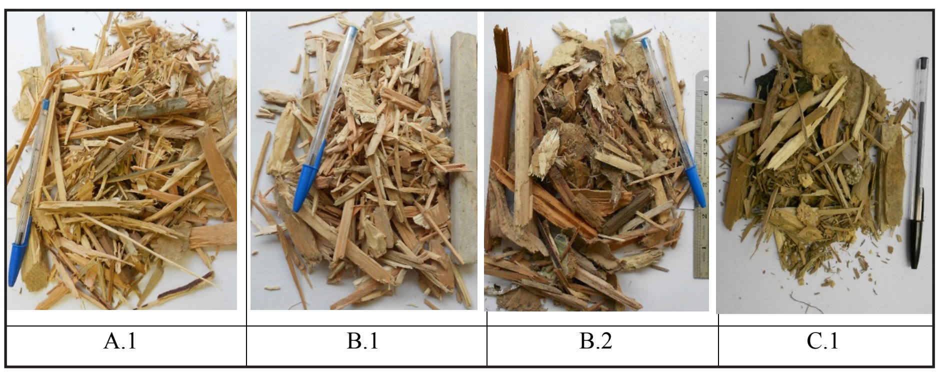

Figure MWF-2.1. Images of the WWR samples (as received) used for the study.

The characterization of WWR samples "as received" intended to determine ash content, immediate composition, elemental composition, and presence of metals and alkalines. In addition, two WWRs, two samples of "virgin" (clean) wood, ponderosa pine and sugar maple, described elsewhere (Pelaez-Samaniego et al, 2014 and Pelaez-Samaniego et al, 2012), were included to compare results of WWRs with those of clean wood samples. *Ash content* was determined following ASTM D1102 (ASTM, 2013), and *Elemental composition (CHN)* was determined using a LECO® TruSpec CHN instrument.

Sugar production

Pretreatment was based on the SPORL (Sulfite Pretreatment to Overcome the Recalcitrance of Lignocelluloses) process (Zhu et al., 2009). After the pretreatment, the prehydrolysate (pretreatment liquor) was collected and used for sugars content analyses using Ion Chromatography and the solid materials were washed with tap water. Enzymatic hydrolysis was conducted following previous works (ASTM, 2013). The enzymatic hydrolysis process was performed using 7.5 g of pretreated material (3-4% MC, passed through the 40 mesh screen) at 10% (w/w) solids concentration in 250 mL flasks, using a 50 mM buffer acetate, adjusted to pH 5 with sodium acetate, which was close to pH 5.5 (Zhang et al., 2015). The enzyme loadings were 5% w/w (dry pretreated wood basis) of CTec2 and 0.5% w/w (dry pretreated wood basis) of HTec2. After hydrolysis, an aliquot of each hydrolysate was collected in centrifuging tubes and, after sealing, heated at 95°C for 10 min using a dry bath for enzyme deactivation. The products were then centrifuged and the supernatant collected for sugars analysis.

Analytical methods

The carbohydrate content of the solid fraction remaining after the pretreatment process was determined following the NREL method (Sluiter et al., 2012). The prehydrolysate (pretreatment liquor), was tested for sugar oligomers content by means of Ion Chromatography (IC), using a Dionex ICS-300DC. A similar test was conducted to quantify the sugars content in the hydrolysate.

The production/presence of furan compounds (expected to be fermentation inhibitors) in the pretreatment liquor was determined using high performance liquid chromatography (HPLC). The equipment was a HPLC, coupled with a RI detector. The test was conducted using a HPX-87H Bio-Rad Aminex column (300 x 7.8 mm), which operated in an oven at 85°C. The flow rate was 0.6 ml min^{-1}. Calibration of the equipment was conducted using acetic acid, furfural, and 5-(Hydroxymethyl) furfural.

Results

The moisture content of the samples as received was 12.8±0.73%, 14.3±0.34, 25.2 ±0.46, and 8.6±0.45% for A.1, B.1, B.2, and C.1, respectively (Table MWF-2.1). Prior to further analysis, the samples were dried to roughly a 6% MC. Ash and ex-tractive contents were similar for all the specimens, with the exception of specimen B.2 which had an ash content that was more than 5 times as high as the other at 10.2%. However, after screening, the ash content was greatly reduced, indicating that proper classification can assist in making a cleaner or lignocellulosic-based feedstock.

Table MWF-2.1. Ash and extractives content of the three MRF WWR.

Sample	Ash (%) materials "as received"	Ash (%) materials for pretreatment	Extractives content (%)
A.1	1.21±0.10	1.16	4.22
B.1	0.83±0.14	0.64	3.79
B.2	10.08±1.69	3.39	3.12
C.1	2.01±0.18	2.53	3.50

The carbohydrates composition of the four WWRs, and the materials used for com-parison (i.e., ponderosa pine and sugar maple), are presented in Table MWF-2.2. The total carbohydrate content of the WWRs ranges from approximately 58% to 63%. These results are comparable to values of the composition of the wood species used as reference (i.e., 61.6% for sugar maple and 58.7% for ponderosa pine) and to values of other types of wood materials, such as loblolly pine and FS-10 Douglas-fir forest residues (i.e., 51.8% and 59.4%, respectively) (Zhu et al., 2015).

Table MWF-2.2. Carbohydrates and lignin composition (dry basis) of the pretreated materials.

Polymer sugars	A.1 (%)	B.1 (%)	B.2 (%)	C.1 (%)
Arabinan	0.80 (38.5) (**)	0.00	0.00	0.00
Galactan	1.40 (29.7)	0.44 (9.8)	1.23 (38.1)	1.22 (35.9)
Glucan	66.66 (91.5)	58.80 (85.1)	58.53 (82.3)	58.47 (78.5)
Xylan/Mannan	7.28 (27.8)	6.67 (25.7)	8.82 (35.7)	8.29 (32.2)
Total carbohydrates	**76.1**	**65.9**	**68.6**	**68.0**
Total carbohydrates recovery (%) (*)	95.4	82.4	87.3	82.5
Lignin	28.1	27.8	25.4	27.3

(*) Refers to the ratio, in percent, of the carbohydrates in pretreated materials to the carbohydrates in the corresponding feedstocks.

(**) The value in parenthesis refers to the percentage recovery of the corresponding sugar.

To determine the potential contaminates or inhibitors within the WWR feedstock that may interrupt the enzymatic fermentation or other steps within the biofuel process, the data from the ICP-MS (Figures MWF-2.2 and MWF-2.3) along with the furan and acetic acid concentrations (Table MWF-2.3) were evaluated.

Results of the ICP-MS tests show the most abundant mineral in all samples is cal-cium (Ca), likely resulting from the presence of Portland cement. Both B.2 and C.1 show the highest amount of this element. Another expected element witnessed was iron (Fe) in the WWRs, which could easily be derived from residual fasteners in the C&D mix and from processing equipment during particle reduction. Other identified metals include aluminium (Al) (in the order of up to 670 ppm) along with instances of nickel (Ni), copper (Cu) and zinc (Zn). The origin of these metals could likely be from fasteners or treated wood products. Presence of lead (Pb) has been identified in sample C.1, suggesting this specimen contained lead-based paints, which are considered hazardous wastes and should not be recycled. It is expected that the relatively low presence of Fe and other metals in WWRs will not affect acid pretreatment/enzymatic hydrolysis operations intending the production of sugars.

The presence of potential inhibitors of furans and acetic acid were addressed and results are shown in Table MWF-2.3. The values for furans was double that of speci-mens reported in the literature (Zhang et al., 2014). These inhibitors are likely higher in the WWR specimens due to the resins that are used in wood composites and the heat generated in the composites during processing. These two factors are the likely cause for the increase in furans and acetic acid.

Figure MWF-2.2. ICP-MS results showing the content of alkalines and metals in the WWR samples (as received). Ponderosa pine and sugar maple samples have been added for comparison purposes.

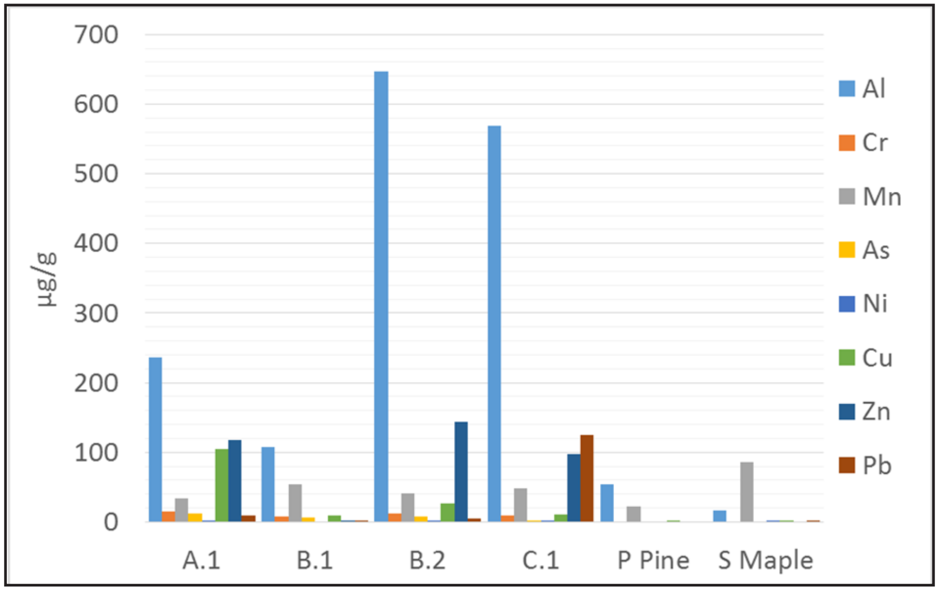

Figure MWF-2.3. ICP-MS results (cont.) showing the content of alkalines and metals in the WWR samples (as received). Ponderosa pine and sugar maple samples have been added for comparison purposes.

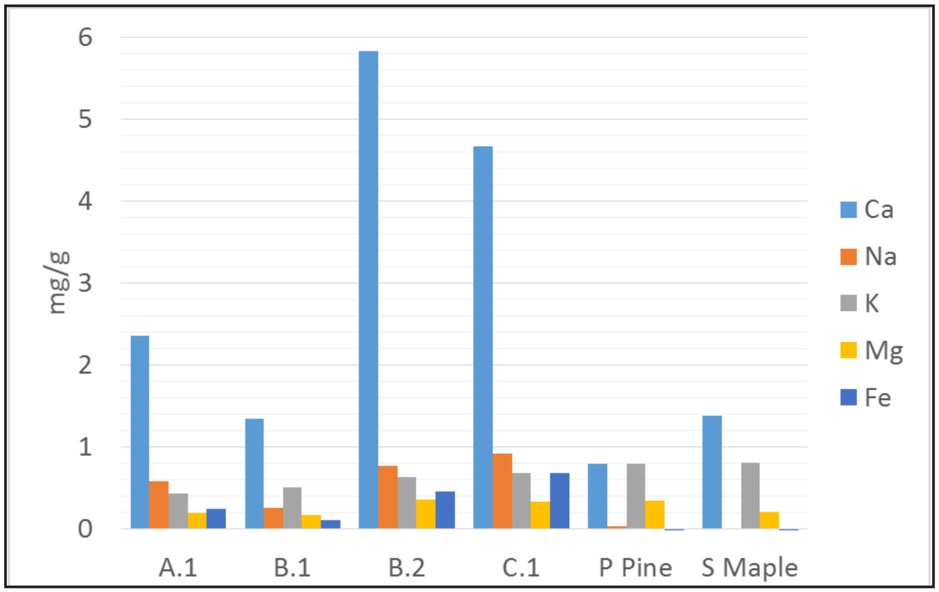

Table MWF-2.3. Furan and acetic acid concentration of the collected WWRs.

Potential Inhibitors	A.1 (%)	B.1 (%)	B.2 (%)	C.1 (%)
Furfural (g L^{-1})	3.67	5.36	3.30	4.31
HMF (g L^{-1})	5.05	7.25	1.74	10.90
Total furan (g L^{-1})	16.10	20.91	13.43	24.16
Acetic acid (g L^{-1})	7.38	8.30	8.40	8.95

The sugars content in the hydrolysates is presented in Table MWF-2.4. The total sugar yield of the whole process is presented as the sum of the sugars percent in the prehydrolysate and the sugars content in the hydrolysate. The sugar yields are relatively lower than values reported in the literature (Zhang et al., 2014) where yields can exceed 75%. The lower yields in the WWR material may be in part due to the amount of resinated or coated wood in composites or painted wood. The role of furan and acetic acid may have also caused disruptions in the enzymatic process resulting in lower sugar yields.

Table MWF-2.4. Total sugar yields in the WWR specimens (monomeric sugars).

	A.1 (%)	B.1 (%)	B.2 (%)	C.1 (%)
Sugars in prehydrolysate	6.29	5.33	6.11	6.21
Sugars in enzymatic hydrolysate	49.43	60.28	53.84	52.25
Total recovery (%)	55.72	65.61	59.95	58.46

Conclusions/Discussion

The use of wood waste from the C&D streams of the NARA region can be a viable source of raw materials for an enzymatic-based biorefinery. However, there are some hurdles to overcome, but there are also quite a few advantages. The presence of furans, acetic acid and other contaminates in the wood waste streams may cause a lower sugar yield and reduce process efficiencies. On the positive side, low costs and easy transportation logistics compared to forest residuals create a strong case for their use as a lignocellulosic feedstock.

Another factor to consider is the uncertainty of applying for RINs credits. According to the EPA, all bio-based sources of feedstocks for a biorefinery must not originate from US National Forest land (See email thread in Appendix). In discussions with the EPA and local MRFs, there is not really a viable procedure for MRFs to follow to track their wood waste from where they originated. So as the standards are interpreted now, RINs are not viable for wood wastes from C&D sources unless the wood can be tracked back to their origin.

However, there has been a precedent petition that was submitted to EPA by Fiberight of Blairstown LLC for the "Separation of Recyclable Material from Municipal Solid Waste" (U.S. Environmental Protection Agency, 2012). Within this petition, Fiberight requested RIN credits for lingo-cellulosics removed from MSW streams. This petition was submitted to the EPA on Dec 9, 2011. A ruling in favor of Fiberight was posted by the EPA in June of 2012. The ruling indicated that

> *Separated MSW developed in accordance with the Plan qualifies as renewable biomass, and Fiberight may use it to produce RIN-generating renewable fuel pursuant to a pathway in 40 CFR 80.1426 that allows use of separated MSW as feedstock. This approval applies uniquely to Fiberight's Separation Plan and any further approvals will be done on a case by case basis, based on individual plans submitted.*

Based upon this ruling, individual MRFs can potentially apply for RINs credit approv-al to designate their wood waste as a renewable feedstock. The Fiberight petition covers primarily MSW wastes, which commonly includes more paper and cardboard feedstocks and little amount of wood

NARA OUTPUTS

Poster

Schneider, GA and KR Englund. Wood Waste Assessment within the Construction and Demolition Industry. International Wood Composite Symposium. Seattle WA 4/3/13.

Refereed Journal Article

Pelaez-Samaniego MR, and KR Englund 2016. Construction and demolition wood waste for sugars production via enzymatic hydrolysis. Waste and Biomass Valorization. DOI 10.1007/s12649-016-9652-8

Presentation

Pelaez Samaniego, MR, Englund KR, and G Schneider. Wood waste from MSW/C&D as a biofuel feedstock 2nd Northwest Wood-Based Biofuels + Co-Products Conference. Seattle, WA May 3-4, 2016.

NARA OUTCOMES

Change in knowledge from the tasks associated in this work resulted in a published refereed journal article and a Master's thesis. The published paper was related to assessing the woody biomass from a MRF and measured the performance in an enzymatic process. The master's thesis detailed the GIS mapping of the inventory and location of MRF's and their current wood supply for the NARA region.

A *change in action* and *change in condition* can be seen in the perception of what we consider a waste that can be potentially a valuable resource. We see this throughout the NARA project where materials we have traditionally thrown away or discard-ed (forest slash) can be used to create a value-added product. This is also true for the wood derived from our C&D and MSW streams. The work within the tasks of this section provide the information to change the perceptions of researchers, com-mercial and governmental entities, and the general public on our current "waste" stream and that what we are throwing away has value and can be used as a viable source of energy and fuel, along with co-products, such as resins, specialty chemi-cals, and activated carbon.

FUTURE DEVELOPMENT

Future work should consider how to improve the quality and sugar yields of the wood derived from MRFs. With the increased amount of wood composites or processed wood being utilized in modern construction, a higher amount will be integrated into the MRF wood stream. How these products at higher levels will influence the sugar yield and the increase of potential inhibitors should be addressed and solutions to improve yields should be considered.

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Email thread to the EPA's Terrence Edwards*:*

Karl,

I apologize for the late reply. Please note that the EPA does not have a recommended procedure for this process. Please also note that there is no additional information regarding C&D waste other than the information provided within my response from April 25, 2016.

I will resolve this support request ticket. If you require additional support on this issue, please reply to this message to re-open the ticket. For new issues, please send an email with all relevant details to support@epamts-support.com.

Best Regards,

On Tue, Jul 19, 2016 12:22:08 PM, englund@wsu.edu wrote:
Terrence (or ??),

I sent you the email below quite some time ago and I have not gotten any response. Is there someone I can talk to about applying for RINs for C&D wood waste?

Regards

Karl Englund

From: Englund, Karl Richard
Sent: Monday, April 25, 2016 1:58 PM
To: 'support@epamts-support.com' <support@epamts-support.com>
Subject: RE: [RT #125046] KEnglund (Washington State University): Rins credit for wood waste within MSW/C&D stream

Terrence;
Thanks much for your reply, the info was quite helpful, however I am curious how a material recycling facility would be able to track the source of where their wood materials originate? Their wood wastes are a comingled waste of primarily demolition debris, likely from residential or commercial structures that are quite old, prior to any tracking mechanisms were in place. Does EPA have a recommended method or procedure for this process?

Thanks
karl

From: Edwards, Terrence via RT [mailto:support@epamts-support.com]
Sent: Tuesday, April 19, 2016 9:29 AM
To: Englund, Karl Richard <englund@wsu.edu>
Subject: [RT #125046] KEnglund (Washington State University): Rins credit for wood waste within MSW/C&D stream

Karl,

Based on EPA guidance, in order for the wood waste from construction and demolition streams (e.g. lumber from construction sites) to be considered renewable biomass and fall into an existing pathway, the wood would have to be tracked to the exact forestry source.
For a list of all of the approved pathways, please refer to §80.1426 (Table 1).
§80.1426 (Table 1):

http://www.ecfr.gov/cgi-bin/text-idx?node=se40.17.80_11426&rgn=div8

Please note that you can also review the approved pathways on EPA's webpage below:

https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel

Please also review the renewable biomass definition from §80.1401.

§80.1401:

Renewable biomass means each of the following (including any incidental, de minimis contaminants that are impractical to remove and are related to customary feedstock production and transport):
(1) Planted crops and crop residue harvested from existing agricultural land cleared or cultivated prior to December 19, 2007 and that was nonforested and either actively managed or fallow on December 19, 2007.
(2) Planted trees and tree residue from a tree plantation located on non-federal land (including land belonging to an Indian tribe or an Indian individual that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that was cleared at any time prior to December 19, 2007 and actively managed on December 19, 2007.
(3) Animal waste material and animal byproducts.
(4) Slash and pre-commercial thinnings from non-federal forestland (including forestland belonging to an Indian tribe or an Indian individual, that are held in trust by the United States or subject to a restriction against alienation imposed by the

United States) that is not ecologically sensitive forestland.
(5) Biomass (organic matter that is available on a renewable or recurring basis) obtained from within 200 feet of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire.
(6) Algae.

http://www.ecfr.gov/cgi-bin/text-idx?node=se40.17.80_11401&rgn=div8

Please let me know if there are any further questions or concerns.

Best Regards,

On Wed, Apr 13, 2016 1:47:49 PM, englund@wsu.edu wrote:

I am working on a USDA funded project, NARA, evaluating wood waste as a feed-stock for biofuels. My part of the project deals with assessing the use of wood waste derived from local municipal solid waste (MSW) streams, specifically in the Construction and Demolition (C&D) sector. I am in the process of pulling together a document for Material Recycling Facilities (MRFs) that outlines the steps needed to take to get their wood waste from construction and demolition streams to be used as a feedstock for a biofuel refinery.

I was hoping to get the necessary steps outlined on how RINS credits would be established or obtained for this material and was looking for some assistance in this area. Is there anyone that I can chat with or e-mail related to this subject area?

Thanks much for your support

Karl Englund

Washington State University
Composite Materials and Engineering Center
Ph: (509) 335-6259

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Terrence Edwards
EPA Fuel Programs Support
SRA International Inc., A CSRA Company
Contractor to US EPA

To send paperwork to EPA's Office of Transportation and Air Quality, use the following addresses:

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Washington, DC 20004