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Mail ID: a483c4715f8f4ed1bf4193aeabe30475

From: Jetter, James

To: jmagistro@peacecorps.gov; ccnaughton@gmail.com

Copy To: jm41@usf.edu; Mitchell, John; byronbattle@gmail.com; MossJE@state.gov

Delivered Date: 06/18/2013 11:40 AM EDT

Subject: RE: Carbon black emissions from shea smokers

Colleen,

I don't have any experience with wood-fired roasters/dryers, but Aprovecho does:
http://stoves.bioenergylists.org/stovesdoc/Still/CacaoDryer/Cacaodryer.html
This is a larger-scale dryer, but the same principles might be applied to smaller-scale dryers.

Here's an article on traditional dryers (but I think combustion could be improved):
http://www.backwoodshome.com/articles/hooker41.html

Hope this is helpful.

Regards,
Jim

From: Magistro, John [mailto:jmagistro@peacecorps.gov]
Sent: Friday, June 14, 2013 2:48 PM
To: Colleen Naughton
Cc: Jetter, James; Mihelcic, James; Mitchell, John; byronbattle@gmail.com
Subject: RE: Carbon black emissions from shea smokers

Colleen,
As I have not worked with driers (other than some very simple solar dryers long ago), I think Jim may be best positioned to address your technical concerns here. I imagine Aprovecho has done a fair amount of work with low cost solar drying technology, and there is a DC based group here, Solar Household Energy, who may have some experience and/or interest in your research problem as well. I'm copying Byron Battle here, who has worked with Peace Corps over the years and has a close affiliation with SHE. He may also be of assistance with your dryer versus roaster issue.

John

John Magistro, Ph.D.
NRM/Climate Change Adaptation Specialist
Office of OPATS - Overseas Programming and Training Support
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From: Colleen Naughton [mailto:ccnaughton@gmail.com]
Sent: Friday, June 14, 2013 2:40 PM
To: Magistro, John
Cc: Jetter, James; Mihelcic, James; Mitchell, John; Moss, Jacob E
Subject: Re: Carbon black emissions from shea smokers

Dear John and Jim Jetter,

Thank you for your continued dialogue on this matter. All very exciting. I was wondering what you both had in mind specifically for a drier compared to a roaster? Would this be like a solar drier?

Jim Jetter is spot on about the high thermal mass and poor combustion for the shea smokers. They waste a lot of fuel (about 10kg per 1 kg of shea butter produced) and the fires tend to smolder and smoke. They can't be good for the air quality.

Should I just e-mail all the testing centers about this to ask about similar technologies they may have researched that I could use to estimate emissions without infield measurements? I was thinking of bringing back some wood samples for moisture content as well.

Sincerely,

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On Thu, Jun 13, 2013 at 4:26 PM, Magistro, John <jmagistro@peacecorps.gov> wrote:
Jim, Colleen,
I'm quite interested in this discussion, thanks for sharing. This kind of traditional smoker is ubiquitous throughout West Africa, and quite commonplace where both Jacob and I served as PC Volunteers (Togo, Benin).

This would certainly merit attention in terms of an improved design. The socio-cultural and economic dimensions of traditional smoking versus drying would need to be examined closely before considering any design innovation. I wonder if
any of the institutional stove groups have explored this, I would assume they have, so might be worth making a contact. Jim or Jacob probably has the best lead on who is doing what with larger stove model design, ovens, smokers, etc.
I'm most familiar with InStove (http://instove.org/) , spin off from Aprovecho, who might have information or be interested in this particular issue.

John

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From: Jetter, James [mailto:Jetter.Jim@epa.gov]
Sent: Thursday, June 13, 2013 3:04 PM
To: Colleen Naughton
Cc: Mihelcic, James; Magistro, John; Mitchell, John; Moss, Jacob E
Subject: RE: Carbon black emissions from shea smokers

Colleen,

Thanks for the additional information. It sounds like the Shea nuts need to be heated/roasted (at a low temperature) and dried, not smoked. In the photo you sent (attached), it looks like the traditional smoker has a lot of thermal mass – this absorbs much of the heat from the fire – prevents the nuts from burning, but wastes a lot of fuel. Also, it looks like combustion is bad – the fire smolders, so it doesn't burn the nuts, but it produces a lot of smoke. I think there may be a great opportunity for reducing emissions and saving fuel by developing Shea nut driers – not smokers!

Jim

From: Colleen Naughton [mailto:ccnaughton@gmail.com]
Sent: Thursday, June 13, 2013 2:25 PM
To: Jetter, James
Cc: Mihelcic, James; Magistro, John; Mitchell, John
Subject: Re: Carbon black emissions from shea smokers

Dear Jim,

Thank you so much for the quick and detailed response! I am thinking I will contact the cookstove testing centers in Ghana and Senegal since shea butter is also made in those areas. There do not seem to be test centers close to Florida though in the US. In regards to the shea smokers, women either smoke the nuts or they boil and sun dry. In most parts of Mali, women smoke the nuts since shea nut harvest also corresponds to the rainy season and it is difficult to sun dry nuts. Smoking nuts introduces carcinogens into the butter and causes it to have a bad taste and odor but this is the traditional way of shea butter production used by the women.

Shea butter is produced across 5,000 km of sub-Saharan Africa (see map) where boiling and smoking of nuts are practiced. I would like to estimate the total emissions across this belt using geographic information systems and air pollution calculations. Though right now, development agents and the government are trying to promote boiling as an alternative to smoking the nuts; I think that it may be beneficial to design a better and more efficient smoker that both uses less wood and does not burn the nuts. Let me know what you think about this.

Sincerely,

Colleen Naughton

On Thu, Jun 13, 2013 at 1:43 PM, Jetter, James <Jetter.Jim@epa.gov> wrote:

Hi Colleen,

We reported emission factors for cookstoves in the Supporting Information of the ES&T publication: http://ehs.sph.berkeley.edu/krsmith/?p=1387

Our emission factors were included in the Stove Performance Inventory sponsored by the Global Alliance for Clean Cookstoves: http://www.cleancookstoves.org/resources_files/stove-performance-inventory-pdf.pdf

Emission factors for the 3-stone fire may be similar for the 3-stone fires used for boiling the Shea nuts. Sorry I don't know of any information specific to Shea nut smokers/driers.

Measuring air pollutant emissions in the field or in the lab requires specialized equipment and knowledge. Testing in the field is valuable, but it may be expensive, and the results often have large uncertainty and may be very specific to the local setting. Testing in the lab also has limitations, but lab testing can provide useful information on potential emission reductions. If you want to measure emissions, maybe you could partner with a cookstove testing center – list below, fyi.

Do the Shea nuts require smoking, or just drying? From the photo you sent, it looks like there could be a great opportunity to reduce emissions through better design – especially if smoking is not required.

Regards,
Jim (RPCV Fiji 82-84)

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Organization	Location	Point of Contact	E-mail Address
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Beijing University of Chemical Technology (BUCT)	Beijing, China	Guangqing Liu	guangqing.liu@gmail.com
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U.S. Environmental Protection Agency	Research Triangle Park, U.S.A.	Jim Jetter	jetter.jim@epa.gov
University of Illinois, Urbana Champaign	Urbana Champaign, U.S.A.	Tami Bond	yark@illinois.edu

From: Mihelcic, James [mailto:jm41@usf.edu]
Sent: Wednesday, June 12, 2013 4:51 PM
To: Jetter, James
Cc:ccnaughton@gmail.com
Subject: Carbon black emissions from shea smokers

Jim, Michal Ucsowitz (one of our Peace Corps Env Engrg graduate students) had introduced us by email a few months ago. I wanted to introduce you to a doctoral student of mine, who has worked in Mali the past 3 years as part of our Peace Corps graduate school partnership and through her doctoral research. She is heading back to Mali in about one week. She had a question I was wondering if you could help wtih. Thanks, Jim

My name is Colleen Naughton and I am a doctorate student at the University of South Florida in Civil Engineering under Dr. Mihelcic. My dissertation research is primarily based on Shea Butter (an edible oil and lotion made in sub-saharan Africa). I am looking at estimating black carbon emissions from shea nut smokers in Mali, West Africa (see picture of a typical smoker). I was wondering how I may go about estimating these emissions. I know the EPA is funding research

on Clean Cookstoves. I recently read the article in Environmental Science and Technology on "Pollutant Emissions and Energy Efficiency under Controlled Conditions for Household Biomass Cookstoves and Implications for Metrics Useful in Setting International Test Standards." This was very interesting though the methods involved for determining emissions seem quite extensive. I was wondering if there were emission factors from similar smokers/stoves that I could use to estimate the black carbon emissions from Shea nut smokers without having to go into detailed and expensive experiments?

I looked on the EPA website under AP 42 for emission factors and the closest were residential wood stoves. Where do I find the cookstove emission factors? I will also need this as women also boil the nuts on three stone fires instead of smoking them.

Also, are there any simple and cost efficient tests/measurements I could take in the field that would help make these estimates more accurate (wood moisture content, temperature of the nuts, etc)? I've already been weighing the wood, shea nuts, and shea butter to determine the amount of wood needed to dry enough nuts to make 1 kg of shea butter.

Thank you for your help and I look forward to your response.

Sincerely,

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