DEVELOPMENT AND VALIDATION OF A NUMERICAL MODEL FOR TORREFACTION OF COFFEE GROUNDS FOR ENERGY PRODUCTION IN SMALL HOUSEHOLDS

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Project abstract:
The increasing energy demand worldwide and the growing concerns regarding climate change pushes the energy production towards alternative fuels, such as biomass. However, the major shortcomings of biomass that limit its wider utilization as fuel are mainly a low energy density and high moisture content. As a result, biomass needs to be pretreated to improve its characteristics to be used as a fuel. The leading pretreatment technology for this is torrefaction. However, most of the torrefaction research focusses on woody biomass and other potential fuels are underexploited. Hence, the aim of this project is to study the possibility to use coffee grounds as biomass for torrefaction as it is widely available worldwide. Moreover, it can be used by individual households as an alternative to wood combustion in stoves or fireplaces, which is the main application targeted in this project.

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RESEARCH DATA SUMMARY

List and describe all datasets or research materials that you plan to generate/collect or reuse during your research project. For each dataset or data type (observational, experimental etc.), provide a short name & description (sufficient for yourself to know what data it is about), indicate whether the data are newly generated/collected or reused, digital or physical, also indicate the type of the data (the kind of content), its technical format (file extension), and an estimate of the upper limit of the volume of the data.

Dataset name / ID	Description	New or reuse	Digital or Physical data	Data Type	File format	Data volume	Physical volume
		Indicate:	Indicate:	Indicate:		Indicate:	

		***N**(ew data) or **E**(xisting data)*	**D**(igital) or **P**(hysical)				
				Audiovisual		<1GB	
				Images		<100GB	
				Sound		<1TB	
				Numerical **T**extual		<5TB	
				Model		>5TB	
				SOftware		NA	
				Other (specify)			
Numerical models of the torrefaction process	Detailed numerical models to predict the temperature and species concentration in the torrefaction reactor	N	D	Numerical	Native Ansys fluent files, Tecplot files	<5TB	
Characterisation of spent coffee ground	Measurement of the composition of different coffee ground samples in Ethiopia	N	D	Text	Text files and Excell tables	<1GB	
Building and testing of a physical torrefaction reactor using solar energy	a torrefaction rector to be used by local households in Ethiopia	N	P	Model			up to 50L

If you reuse existing data, please specify the source, preferably by using a persistent identifier (e.g. DOI, Handle, URL etc.) per dataset or data type:

NA

Are there any ethical issues concerning the creation and/or use of the data (e.g. experiments on humans or animals, dual use)? If so, refer to specific datasets or data types when appropriate and provide the relevant ethical approval number.

- No

Will you process personal data? If so, please refer to specific datasets or data types when appropriate and provide the KU Leuven or UZ Leuven privacy register number (G or S number).

- No

Does your work have potential for commercial valorization (e.g. tech transfer, for example spin-offs, commercial exploitation, …)? If so, please comment per dataset or data type where appropriate.

- Yes

The physical torrefaction reactor could be commercialised by a spin-off company or by KU Leuven and Bahir Dar University.

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material or Data transfer agreements, Research collaboration agreements)? If so, please explain in the comment section to what data they relate and what restrictions are in place.

- No

Are there any other legal issues, such as intellectual property rights and ownership, to be managed related to the data you (re)use? If so, please explain in the comment section to what data they relate and which restrictions will be asserted.

- No

DOCUMENTATION AND METADATA

Clearly describe what approach will be followed to capture the accompanying information necessary to keep data understandable and usable, for yourself and others, now and in the future (e.g. in terms of documentation levels and types required, procedures used, Electronic Lab Notebooks, README.txt files, codebook.tsv etc. where this information is recorded).

The developed numerical model of the proposed reactor is going to be published in scientific journals. README.txt files are going to accompany every simulation campaign that will be conducted. Inside the .txt file all the necessary details (version of the model, changes made and results expected) are going to be covered. Appropriate file naming will be used and all the relevant data for a dataset will be included together in the same directory.

Will a metadata standard be used to make it easier to find and reuse the data?
If so, please specify which metadata standard will be used.

If not, please specify which metadata will be created to make the data easier to find and reuse.

- No

NA

DATA STORAGE & BACK-UP DURING THE RESEARCH PROJECT

Where will the data be stored?

- OneDrive (KU Leuven)
- Personal network drive (I-drive)
- Other (specify below)

Physical external harddiscs

How will the data be backed up?

- Personal back-ups I make (specify below)

Physical external harddiscs will be used for backup

Is there currently sufficient storage & backup capacity during the project?

If no or insufficient storage or backup capacities are available, explain how this will be taken care of.

- Yes

How will you ensure that the data are securely stored and not accessed or modified by unauthorized persons?

Credentials are needed to access the work stations and OneDrive data storage
The physical hard discs will be kept in the lab which has only access to authorised persons

What are the expected costs for data storage and backup during the research project? How will these costs be covered?

For storing in KU Leuven's datacenter --> € 104,42 / TB / year and for purchasing an external hard drive of 5 TB the cost is approximately 150 €. Both costs can be covered by the researcher's bench fee.

DATA PRESERVATION AFTER THE END OF THE RESEARCH PROJECT

Which data will be retained for 10 years (or longer, in agreement with other retention policies that are applicable) after the end of the project?

In case some data cannot be preserved, clearly state the reasons for this (e.g. legal or contractual restrictions, storage/budget issues, institutional policies...).

- All data will be preserved for 10 years according to KU Leuven RDM policy

Where will these data be archived (stored and curated for the long-term)?

- Other (specify below)

All the data will be stored in the workstation of the AFAA research group and in external hard drives.

What are the expected costs for data preservation during the expected retention period? How will these costs be covered?

No extra costs are needed

DATA SHARING AND REUSE

Will the data (or part of the data) be made available for reuse after/during the project?
Please explain per dataset or data type which data will be made available.

- Yes, as open data

All data will be shared upon request

If access is restricted, please specify who will be able to access the data and under what conditions.

NA

Are there any factors that restrict or prevent the sharing of (some of) the data (e.g. as defined in an agreement with a 3rd party, legal restrictions)?

Please explain per dataset or data type where appropriate.

- No

Where will the data be made available?

If already known, please provide a repository per dataset or data type.

- Other (specify below)

The data will be send to individuals who as for it

When will the data be made available?

- Other (specify below)

Upon request

Which data usage licenses are you going to provide?

If none, please explain why.

- Other (specify below)

NA

Do you intend to add a persistent identifier (PID) to your dataset(s), e.g. a DOI or accession number? If already available, please provide it here.

- No

What are the expected costs for data sharing? How will these costs be covered?

No costs are expected.

RESPONSIBILITIES

Who will manage data documentation and metadata during the research project?

During the project, the data will be managed by the PhD student and the (co)supervisors

Who will manage data storage and backup during the research project?

The PhD researcher and (co)supervisors.

Who will manage data preservation and sharing?

The supervisor of the PhD

Who will update and implement this DMP?

The supervisor of this PhD