Combining innovative technologies to enhance powdered food safety and quality: mechanisms of radio frequency heating and nonthermal plasma

A Data Management Plan created using DMPonline.be

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Project abstract:

For many years, powdered food has been believed to be microbiologically safe due to its low water activity and moisture content. However, recent outbreaks in powders have evidenced that pathogens can survive in powders, evidencing the need for pasteurization treatments. Conventional (thermal) treatments negatively affect product quality, forming an issue for consumer acceptance. Therefore, nonthermal and mild heat processing technologies have emerged as an alternative to conventional heat treatments. Radio Frequency (RF) and Nonthermal Plasma (NTP) can improve powders pasteurization while maintaining quality. Nevertheless, since both individual technologies fail to acquire the necessary quality and safety, (RF, NTP) hurdle technologies are a promising alternative, although limited research has been conducted on this topic. The aim of this project is to develop efficient (RF, NTP) pasteurization processes, focusing on the best safety-quality relation. As a case study, milk and paprika powders are selected, together with *Listeria monocytogenes*, *Salmonella* Typhimurium and *Bacillus cereus* spores as target microorganisms. First, individual RF and NTP treatments will be optimized for powder treatment, with regard to RF frequency and NTP gas, respectively. Then, inactivation mechanisms of the individual technologies will be characterized. Finally, the knowledge on the inactivation mechanisms will be used to design optimal (RF, NTP) hurdle technology powder treatment strategies.

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DPIA

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Have you performed a DPIA for the personal data processing activities for this project?

- Not applicable

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GDPR

GDPR

Have you registered personal data processing activities for this project?

- Not applicable

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Application DMP

Questionnaire

Describe the datatypes (surveys, sequences, manuscripts, objects …) the research will collect and/or generate and /or (re)use. (use up to 700 characters)

During this project, data will be generated via experimentation. The experimental data will include (i) RF and NTP treatments effect on safety and quality in powdered foods (iii) inactivation mechanisms of RF and NTP treatments, (iii) hurdle technology protocol for an efficient RF and NTP combination for powdered food pasteurisation.

Specify in which way the following provisions are in place in order to preserve the data during and at least 5 years after the end of the research? Motivate your answer. (use up to 700 characters)

Data preservation during the project will be in charge of the candidate, then once the research project is finished, a new person will be assigned to keep the data. The data out of the results will be stored in the candidate's computer in the office of KU Leuven/BioTeC+ team. Also, a shared folder or cloud service (OneDrive) will be used to store the data. Additionally, as a backup, the data will be stored on a common external hard drive for at least 5 years.

What’s the reason why you wish to deviate from the principle of preservation of data and of the minimum preservation term of 5 years? (max. 700 characters)

The candidate is not willing to deviate from the principle of preservation of data and of the minimum preservation term of 5 years.

Are there issues concerning research data indicated in the ethics questionnaire of this application form? Which specific security measures do those data require? (use up to 700 characters)

NA

Which other issues related to the data management are relevant to mention? (use up to 700 characters)

NA

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FWO DMP (Flemish Standard DMP)

1. 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.

				Only for digital data	Only for digital data	Only for digital data	Only for physical data
Dataset Name	Description	New or reused	Digital or Physical	Digital Data Type	Digital Data format	Digital data volume (MB/GB/TB)	Physical volume
		Please choose from the following options: • Generate new data • Reuse existing data	*Please choose from the following options:* • Digital • Physical	*Please choose from the following options:* • Observational • Experimental • Compiled/aggregated data • Simulation data • Software • Other • NA	*Please choose from the following options:* • .por, .xml, .tab, .csv,.pdf, .txt, .rtf, .dwg, .gml, … • NA	*Please choose from the following options:* • <100MB • <1GB • <100GB • <1TB • <5TB • <10TB • <50TB • >50TB • NA	
Parameter optimization	Parameter testing for RF (different frequencies) and NTP (different type of gas) treatment	Generate new data	Digital	Experimental	.xml, .txt,	<100GB	
Microbial inactivation model data	Microbial counting, data processing and model fitting	Generate new data	Digital	Experimental	.xml, .txt,	<100GB	
Quality control	Final product quality parameters estimation	Generate new data	Digital	Experimental	.xml, .txt,	<1 GB	
Inactivation mechanisms	DNA and membrane damage assessment	Generate new data	Digital	Experimental	.xml, .txt,	<1GB	•

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)? Describe these issues in the comment section. Please refer to specific datasets or data types when appropriate.

- No

Will you process personal data? If so, briefly describe the kind of personal data you will use in the comment section. Please refer to specific datasets or data types when appropriate.

- 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.

- No

Do existing 3rd party agreements restrict exploitation or dissemination of the data you (re)use (e.g. Material/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

2. 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).

1. Data for parameter optimization and microbial inactivation data will be kept in three separate folders divided as RF, NTP and RF+NTP. Specific conditions for each experiment will be shown in the respective datafile. A readme file will be constructed for each group of experiments to describe in detail how the data fits into the total research project and how to use the data in the different files.
2. For the model fit data, all relevant model parameters will be visible in the Matlab file used for the model fit (which can also be opened as a txt.-file). A readme file will also be included in each folder to describe which microbial and temperature data were used for each model fit, with a clear coding to retrieve the respective files.
3. Quality control data will be kept in two folder divided by technology. A readme file will be constructed for each technology to describe in detail changes in quality parameters at the end of each experiment. The methodology and protocol will be describe in detail as well.
4. Inactivation mechanisms data will be kept in two folder divided by technology. A readme file will be constructed to describe in detail DNA and membrane damage for each technology. The methodology and protocol will be describe in detail as well.

Will a metadata standard be used to make it easier to find and reuse the data? If so, please specify (where appropriate per dataset or data type)

which metadata standard will be used. If not, please specify (where appropriate per dataset or data type) which metadata will be created to make the data easier to find and reuse.

- No

3. Data storage & back-up during the research project

Where will the data be stored?

Data is stored within a shared KU Leuven/OneDrive folder, initiated by promotor Jan Van Impe, only accessible by PhD candidate, promoter and co-promoter and any other member of the PhD Supervisory Committee when relevant. This drive is only accessible through the KU Leuven account of the folder members, of which the password is changed yearly.

How will the data be backed up?

The KU Leuven cloud storage solution used takes automatic backups (OneDrive)

Is there currently sufficient storage & backup capacity during the project? If yes, specify concisely.
If no or insufficient storage or backup capacities are available, then explain how this will be taken care of.

- Yes

KU Leuven/OneDrive allows to storage 2TB of data. Since the total estimated data for the project does not exceed 300GB, there will be no storage problems on OneDrive.

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

The project's KU Leuven/OneDrive is only accessible through the KU Leuven account of the folder members, of which the password is changed yearly.

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

OneDrive storage is free for KU Leuven researchers.

4. Data preservation after the end of the research project

Which data will be retained for at least five 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...).

Research data will be retained for 10 years after the end of the project.

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

The data will be stored on the aforementioned cloud-sharing services (with automatic back-up procedures) for at least 10 years, conform the KU Leuven RDM policy. The services will still be available through the KU Leuven account of supervisor Prof. Jan Van Impe. A selection of the most important research data will also be stored on external hard drives at the research group.

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

OneDrive storage is free for KU Leuven researchers.

5. Data sharing and reuse

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

- Other, please specify:

Data will be available on request after agreement with the project supervisor Prof. Jan Van Impe.

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

Data will be available to all researchers upon request. However, requests will be handled individually case-by-case.

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 in the comment section 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.

Data will be available on request after agreement with the project supervisor Prof. Jan Van Impe.

When will the data be made available?

Data will be available on request after the results have been published.

Which data usage licenses are you going to provide? If none, please explain why.

Data Transfer Agreement (restricted data)

Do you intend to add a PID/DOI/accession number to your dataset(s)? If already available, you have the option to provide it in the comment section.

- No

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

There are no expected costs related to data sharing.

6. Responsibilities

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

julian.espitiaperez@kuleuven.be

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

julian.espitiaperez@kuleuven.be

Who will manage data preservation and sharing?

jan.vanimpe@kuleuven.be

Who will update and implement this DMP?

julian.espitiaperez@kuleuven.be