Plan Overview

A Data Management Plan created using DMPonline

Title: Sustainable Dyes and Fibers for the Fashion Industry

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Template: DCC Template

Project abstract:

The textiles industry and textiles dying process is one of the worst water polluting industries. The aim of this project is to develop novel textiles fibres manufacturing process and natural dyes based dyeing process. This project will offer excellent solution to significantly reduce the water pollution caused by the textiles and dying process used by textiles and fashion industry. The cellulose and natural fibre manufacturing and dyeing process developed in our lab can offer an excellent solution to sustainable textiles produce textiles for the fashion industry. Furthermore, the fibre manufacturing process can be used to combine natural dyes such as curcumin, Indigo, pomegranate juice extract for eco-textiles or sustainable textiles for fashion industry. The student will learn the following techniques/skills - Natural polymer Textiles manufacturing, fibre spinning process -Textiles dying using natural dyes -Mechanical testing and performance testing of natural fibres -Use of the sustainable textiles for fabric design and fashion design. Fees and Funding

ID: 165392

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Sustainable Dyes and Fibers for the Fashion Industry

Data Collection

What data will you collect or create?

Type of Data:
The research will generate data from experimental processes, including the manufacturing of textile fibers, application of natural dyes, 3D printing of textile samples, and spray dyeing techniques. This data will include:

Experimental Data- Measurements related to the physical and chemical properties of the materials used (e.g., tensile strength, elasticity, biodegradability).

- Process parameters for advanced manufacturing techniques (e.g., temperature, pressure, 3D printer settings, coating/spraying parameters, SEM analyses, Rheology test, spinning speed and AI files).
- Output recordings related to the effectiveness and efficiency of the manufacturing processes.
- Volume:Approx. 10-50 GB depending on the number of experiments and the complexity of data.
- Formats: ‘csv’, ‘xls’, ‘tif’, 'Ai',or ‘log’.

Type and Coverage: Numerical and textual data recorded from sensors, manual observations, and automated systems. Covers a wide range of variables for each experiment, providing comprehensive insight into each manufacturing stage.
Experimental Photographs:- Photographs of raw materials (e.g., Dyes and prototypes), intermediate products, and final textiles/fibres.

- Images of the equipment setup during 3D printing, dye spraying, coating, and wet fibre spinning processes, dyeing process.
- Micrographs showing the structure and quality of the fibres/textiles at various stages.
- Volume: Approx. 500 MB.
- Formats: ‘tif’, ‘jpg’, or ‘xcf’.

Experimental Video: Videos of the manufacturing processes (3D printing, spraying, Dyeing, spinning) to document the procedure and capture details not easily recorded in still images.

- High-speed camera videos to quantify the behaviour of materials during manufacturing processes.
- Volume: Approx. 2-16 GB depending on the length and resolution of the videos.
- Formats: ‘MP4’.
- Type and Coverage : High-resolution images documenting different stages and materials in the experimental setup, from raw to final products.

Sketches / Graphs: Graphs showing the performance of different materials and manufacturing processes.

- Annotated drawings and diagrams of equipment setups or material structures.
- Volume: Approx. 100-300 MB.
- Formats: ‘tif’ or ‘jpg’.
- Type and Coverage:
- Visual data representations that provide insights into data trends, equipment configurations, and structural analysis.

Metadata: Metadata related to the experimental data, photographs, videos, and documents, including timestamps, descriptions, and other relevant details.

- Volume: Approx. 10 MB.
- Formats: ‘txt’.
- Type and Coverage:
- Descriptive text data that provides context for other datasets

Reuse of Existing Data:
Existing datasets, including open-access studies on textile properties, natural dyes, and sustainable manufacturing processes, will be referenced where relevant to complement experimental data.

- Justification of Formats:
  - CSV/Excel: Universal formats for numerical data analysis and interoperability.
  - JPEG/PNG: Widely accepted formats for high-quality images.
  - MP4/AVI: Standard formats for capturing and sharing videos of experimental techniques.
  - PDF/Word: Reliable formats for archiving and disseminating research findings.

Storage, Backup, and Access:
Data will be stored on Cranfield University’s secure, managed storage systems with automatic daily backups. Fieldwork data will be transferred securely to these systems using encrypted connections (e.g., VPN). The chosen formats ensure compatibility with data analysis tools and ease of collaboration. Data security and accessibility will align with university policies and ISO 27001 standards to

ensure compliance and long-term usability.

How will the data be collected or created?

Standards and Methodologies

Data Collection and Creation:
Research data will be generated using established methodologies in textile research, natural dye chemistry, and material testing. Key processes include:

- Instrument Calibration: All instruments (e.g., rheometer, spectrophotometers, tensile testing machines) will be calibrated before use to ensure accuracy.
- Consistency Validation: Repeat sampling for dye application, mechanical testing, and SEM analysis will verify reliability.
- Standardized Tools: Data capture will use standardized templates and software (e.g., Excel for numerical data, high-resolution imaging for SEM analysis, and controlled parameters in 3D modeling software).
- Community Standards: Relevant standards in sustainable textiles and material science will be referenced where applicable.

Folder and File Structure

- Data will be systematically organized using clear folder and file naming conventions:
  Folders: Categorized by project phases, e.g., "Dye Formulations," "Rheology Data," "SEM Analysis," "Mechanical Testing," "3D Printing Data," and "Spray Dyeing Trials."
- Files: Named to reflect content, date, and version, e.g., `Rheology_Curcumin_2025-01-15_v1.csv` or `SEM_Analysis_Fiber_Surface_2025-01-15.tif`.

Versioning
Version control will be maintained by appending version numbers (e.g., v1, v2) or dates to filenames. A detailed change log will document updates, modifications, and revisions.

Quality Assurance Processes

- Instrument Calibration and Validation: Equipment (e.g., rheometer, SEM, tensile testing machines) will undergo calibration before each use, with repeated measurements to ensure reliability.
- Standardized Protocols: Detailed protocols will be followed for each process, including rheological testing, SEM imaging, dyeing, fiber spinning, 3D printing, and mechanical testing.
- Data Validation: Numerical data will be checked for accuracy using software validation functions.
- Peer Review: Critical datasets will be reviewed by supervisors and collaborators to ensure adherence to research standards.
- Controlled Vocabularies: Consistent terminology will be used for data annotations, aligned with established standards in sustainable textiles research.

Documentation

- Data directory: An interdisciplinary standard outline folder structures, file naming conventions, and workflows.
- Experiment Documentation: Detailed step-by-step protocols for data collection will include instrument settings, conditions, and any protocol deviations.
- Experiment Logs: Logs will record environmental conditions, observations, and deviations from planned methodologies to ensure comprehensive documentation of all research activities.

Documentation and Metadata

What documentation and metadata will accompany the data?

Metadata and Documentation Plan

- **Information Needed for Future Interpretation**:
  To ensure the data can be accurately read and interpreted in the future, the following information will be documented:
  - **Dataset Details**: Title, description, date of creation, and associated project details.
  - **Creators and Contributors**: Names, roles, and affiliations of individuals or teams involved in generating the data.
  - **Methodology**: Comprehensive descriptions of the methods, including experimental setups, instrument specifications (e.g., rheometer and SEM), procedural details, and protocols.
  - **Data Context**: Definitions of variables, units of measurement, and assumptions used during data collection and analysis.
  - **Conditions and Access**: Details on licensing, terms of use, and any restrictions for secondary users.
  - **Formats and File Types**: Specifications of data formats (e.g., CSV, JPEG, STL), including software compatibility and requirements for viewing or reusing the data.

- **Capturing and Creating Documentation and Metadata**:
  - **Metadata Standards**: The Dublin Core Metadata Initiative (DCMI) will be employed for general metadata elements like title, creator, date, and rights. For discipline-specific metadata, the standards in textile and material science research will be reviewed and applied where relevant.
  - **Documentation Tools**:
    - Spreadsheets (e.g., Excel) for maintaining structured metadata tables.
    - Text-based documentation (PDF/Word) for detailed experimental methodologies and procedural records.
    - Instrument-specific logs (e.g., rheometer and SEM settings files) to ensure reproducibility.
    - Ai for visual presentations
  - **Storage**: Documentation will be stored alongside corresponding datasets in a centralized repository, ensuring accessibility and context for all data files.
- **Metadata Standards and Rationale**:
  - **Dublin Core (DCMI)**: Provides a flexible, widely accepted structure for general metadata and ensures compatibility across research disciplines.
  - **Textile and Material Science Standards**: Any available community standards will be referenced for specific variables, such as dye performance metrics, fiber properties, or rheological parameters, ensuring uniformity and interpretability.
- **Capturing Process**:
  - Metadata will be created at the time of data generation, ensuring accuracy and minimizing loss of contextual details.
  - Procedural details will be recorded in real-time during experiments, with updates incorporated into a master documentation file.
  - Variables, assumptions, and methodologies will be reviewed and validated by supervisors or peers to maintain quality.
- **Recording Locations**:
  - Metadata and documentation will be stored in a project-specific data repository.
  - Experimental logs and protocol documents will be maintained in both physical lab records and digital formats.
  - Metadata files will be linked to their respective datasets through unique identifiers.

Ethics and Legal Compliance

How will you manage any ethical issues?

Ethical Considerations for Data Preservation and Sharing

- **Consent for Data Preservation and Sharing**
  - As this research does not involve human participants, consent for data preservation and sharing is not applicable.
  - All experimental data will be preserved and shared in compliance with institutional guidelines and data management policies.
- **Identity Protection and Anonymisation:**
  - No personal or identifiable data is involved; therefore, anonymisation is not required.
  - Any third-party or pre-existing datasets used will be appropriately credited and cited.
- **Handling of Sensitive Data:**
  - Experimental results and analyses will be treated as intellectual property and stored securely on encrypted institutional servers with restricted access.
  - Data will be transferred using secure methods such as password-protected files or institutional platforms.
  - Regular encrypted backups will ensure data integrity and prevent loss.
- **Ethical Awareness and Compliance:**
  - Research methodologies adhere to institutional ethical standards and are regularly reviewed to ensure compliance.
  - While formal ethical approval is not required, all procedures align with best practices for environmental and material science research.
- This approach ensures secure data management, ethical compliance, and proper sharing of research outputs within professional and institutional frameworks.

How will you manage copyright and Intellectual Property Rights (IPR) issues?

Ownership, Licensing, and Restrictions on Data Sharing

- Data Ownership:
  - For PhD research conducted at Cranfield University, the copyright and intellectual property rights (IPR) for data generated will typically belong to Cranfield University, as per the institution's policies.
  - The student researcher will have rights to use the data for academic purposes, including thesis submission and publication, in line with university agreements.
- Licensing for Reuse:
  - Data will be licensed under a Creative Commons Attribution license or other suitable licenses approved by Cranfield

University to facilitate reuse while ensuring proper attribution.
  - For proprietary methods or sensitive findings, data sharing will follow Cranfield’s data-sharing policies or specific agreements with collaborators.
- Restrictions on Reuse of Third-party Data:
  - Any third-party data used in the research will comply with licensing or usage restrictions set by the data owner.
  - Permissions for reuse will be obtained prior to integration into the research, and appropriate acknowledgments will be included.
- Postponement or Restrictions on Data Sharing:
  - Data sharing may be temporarily restricted to enable the publication of research findings or the filing of patents.
  - Any embargo periods or restrictions will adhere to Cranfield University's policies, and such limitations will be clearly communicated in the data management plan.
- This approach ensures compliance with Cranfield University’s regulations, ethical standards, and legal frameworks while supporting the integrity and accessibility of research outputs.

Storage and Backup

How will the data be stored and backed up during the research?

Research data will be stored on secure, managed university IT systems with automatic daily backups. Additional copies will be maintained on encrypted cloud storage compliant with institutional policies and on an encrypted external hard drive updated weekly. During fieldwork, data will be stored temporarily on encrypted devices and synchronized with the primary system promptly. Sensitive data will be encrypted during storage and transfer, with access restricted to authorized personnel. Backup and recovery will be managed by the university IT team, adhering to ISO 27001 standards and best practices from the UK Data Service and DataONE.

How will you manage access and security?

To ensure data security during research, all data, including confidential or sensitive information, will be stored on secure university IT systems with automatic daily backups. Access will be restricted to authorized personnel through password-protected accounts and two-factor authentication. Collaborators will be granted secure access via encrypted sharing platforms compliant with institutional policies. All the data will be stored on the equipment's network, and every member of staff and student can access it.

During fieldwork, data will be stored temporarily on encrypted devices and securely transferred to the primary system using VPN and encrypted connections. The main risks, such as unauthorized access or data loss, will be mitigated through encryption, regular audits, and adherence to institutional data security policies.

The research will comply with ISO 27001 standards and follow best practices outlined by the UK Data Service and DataONE to ensure data integrity and security throughout the project.

Selection and Preservation

Which data are of long-term value and should be retained, shared, and/or preserved?

Data with long-term value, such as key experimental results, validation datasets, and visual documentation (e.g., dye performance metrics, SEM images, and 3D printing data), will be retained for a minimum of 10 years in compliance with Cranfield University policies and research funder requirements. Mandatory data, required for legal or regulatory purposes, will be preserved according to specific obligations. Data with potential for future research or teaching will be archived in Cranfield’s research data repository, converted to open formats (e.g., CSV, PDF, JPEG) for long-term access. Data preparation for sharing may require additional resources, including format conversion and metadata updates, ensuring the data remains usable for validation, future studies, and educational purposes.

What is the long-term preservation plan for the dataset?

The dataset will be preserved in Cranfield University's research data repository, ensuring secure long-term storage and adherence to university policies and research funder requirements. The repository is designed to provide ongoing access, with a retention period of at least 10 years. There are no direct costs associated with archiving the data within the university’s repository; however, the time

and effort required for data preparation—including format conversion, metadata documentation, and compliance with data-sharing standards—have been factored into the project timeline. This preparation ensures the data will be fully accessible for future research, reuse, and validation, while maintaining the integrity and usability of the dataset beyond the lifetime of the grant.

Data Sharing

How will you share the data?

The data will be shared through Cranfield University’s research data repository, ensuring long-term access and discoverability via its search functionality, supported by comprehensive metadata. Access will be granted to researchers, collaborators, and educators, with potential restrictions for sensitive data, which will be minimized through anonymization or aggregation. The data will be made publicly available as soon as possible, with a possible embargo period if necessary. A DOI will be obtained for the dataset to provide a persistent identifier, facilitating reliable discovery, citation, and reuse. The data will be formatted and documented to support future research, ensuring broad academic and professional utilization.

Are any restrictions on data sharing required?

While data sharing will be prioritized, certain restrictions may apply due to confidentiality concerns, intellectual property rights (IPR). To minimize these restrictions, strategies such as anonymization or aggregation will be employed where possible or needed. Regardless of any embargo or restricted access to the data, the metadata describing the dataset will be made publicly available to facilitate discovery. Exclusive use of the data will be required for an initial period of up to 12 months to complete analysis and publication, after which the data will be made publicly accessible. A data sharing agreement may be required to protect sensitive or proprietary information, ensuring compliance with legal and ethical obligations. Access will be granted to the academic community, collaborators, and industry partners, with appropriate controls in place. A DOI will be automatically assigned to the dataset by the repository to ensure reliable discovery and citation, promoting its reuse in future research.

Responsibilities and Resources

Who will be responsible for data management?

I, as the PhD student, will be responsible for implementing and revising the Data Management Plan (DMP) in collaboration with my academic supervisor. My responsibilities include data capture, ensuring quality and accuracy, producing metadata, and managing data storage and backup in Cranfield University's secure repository. I will also oversee data sharing and archiving, ensuring compliance with university guidelines. For Future collaborative projects, roles will be outlined in the consortium agreement, with clear responsibilities for data collection, analysis, and sharing assigned to each partner. Data ownership and management responsibilities will be explicitly defined in the agreement to ensure compliance with legal and ethical standards.

What resources will you require to deliver your plan?

To implement the Data Management Plan (DMP), the following resources will be required:

1. **Expertise and Training**: I will need training in metadata production and using research data repositories. This will be sourced from Cranfield University's research support services or external workshops.
2. **Hardware and Software**: Additional software for data analysis and visualization (e.g., specialized imaging or statistical tools) may be required, which will be either provided by Cranfield or procured as needed. Storage will primarily be managed through Cranfield's secure cloud infrastructure, with additional space budgeted if necessary.
3. **Repository Charges**: Costs for data deposit and long-term storage at repositories may apply. These will be confirmed and incorporated into the project budget.
4. **Technical Support**: Cranfield’s IT services will provide ongoing support for data backups, security, and infrastructure.

These resources will be accounted for in the project budget to ensure compliance and successful data management.