



This project is funded by
the European Union



“Boosting Lignocellulosic Biomass Deconstruction with Designer Cellulosomes for Industrial Applications”

CellulosomePlus

Area NMP.2013.1.1-2: Self-assembly of naturally occurring nanosystems

Project number: 604530

Deliverable 10.2

Report on the state of standardization relevant to the project

Due date of deliverable: 31-07-2014

Actual date of submission: 25-07-2014

Start date of project: 01-11-2013

Duration: 48 months

Name of partner responsible for deliverable: AENOR, subcontracted for CSIC.

Authors: Iván MOYA ALCÓN

Project co-funded by the European Commission within the Seventh Framework Programme		
Dissemination Level		
PU	Public	
PP	Restricted to the other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	X

DISTRIBUTION LIST

Partner nº	INSTITUTION	PERSON IN CHARGE
1	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS, CSIC	Mariano Carrión Project Coordinator mcarrion@cajal.csic.es Oscar Salazar Project Manager oscar.salazar@cajal.csic.es
2	WEIZMANN INSTITUTE OF SCIENCE	Edward A. Bayer Group Head ed.bayer@weizmann.ac.il
3	LUDWIG.MAXIMILIANS UNIVERSITAET MUENCHEN	Hermann Gaub Chair for Applied Physics gaub@lmu.de Michael Nash Research Fellow michael.nash@lmu.de
4	INSTYTUT FIZYKI POLSKIEJ AKADEMII NAUK	Marek Cieplak Group Head mc@ifpan.edu.pl
5	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	Mirjam Czjzek Permanent researcher, DR2 of CNRS mirjam.czjzek@sb-roscoff.fr
6	UNIVERSITY OF LIMERCK	Damien Thompson Lecturer damien.thompson@ul.ie
7	DESIGNER ENERGY	Ely Morag CTO Designer Energy ely@designerenergy.net Alon Karpol alon@designerenergy.net
8	ABENGOA BIOENERGIA NUEVAS TECNOLOGIAS SA	Eva Sánchez R&D Engineer eva.sanchez@bioenergy.abengoa.com
9	BIOPOLIS SL	Marta Tortajada Biotechnology lab head. marta.tortajada@biopolis.es Beatriz Álvarez Molecular Biology lab Manager beatriz.alvarez@biopolis.es

Table of Content

1. EXECUTIVE SUMMARY	5
2. INTRODUCTION AND METHODOLOGY.....	5
2.1 Project Presentation Overview	5
2.2 Methodology of the document.....	5
2.3 Short introduction about standardization	6
2.3.1. ABBREVIATIONS AND ACRONYMS	8
4. STANDARDIZATION AREAS RELEVANT TO CELLULOSOMEPLUS PROJECT	9
5. STANDARDIZATION ON NANOTECHNOLOGIES.....	9
6. STANDARDIZATION ON BIOTECHNOLOGY	15
7. STANDARDIZATION ON BIOFUELS.....	15
8. STANDARDIZATION ON ORGANIC WASTE	16
9. STANDARDIZATION ON RELEVANT CHARACTERIZATION TECHNIQUES.....	20
9.1 X-RAY CRYSTALLOGRAPHY	20
9.2. ATOMIC FORCE MICROSCOPY.....	21
10. STANDARDIZATION ENVIRONMENTAL IMPACT ASSESSMENT	22
10.1. LIFE CYCLE ANALYSIS	22
10.2. SPECIFIC ENVIROMENTAL IMPACTS ASSESSMENT	23
Either as lone assessments or as part of the impacts included in the life cycle assessment, several environmental impacts are undertaken by standardization works.	23
10.2.1 GREEN HOUSE GAS EMMISSIONS ASSESSMENT.....	23
10.2.2 ENVIRONMENTAL IMPACT ON WATER	23
11. CONCLUSSIONS	24

Figures

Figure 1 – Possible tracks of standards adoption	8
Figure 2 – Example of identification of elements in the code of a standard	8

Tables

Table 1 – List of key concepts acting as start point for the identification of standardization areas .	5
Table 2 – Characteristics of different standardization documents.....	7
Table 3 – Published standards on nanotechnologies.....	10
Table 4 – Project standards on nanotechnologies.....	12
Table 5 – Published standards on nanotechnologies focused on electrotechnical issues	13
Table 6 – Project standards on nanotechnologies focused on electrotechnical issues.....	13
Table 7 – Published standards related to liquid biofuels.....	16
Table 8 – Project standards related to liquid biofuels	16
Table 9 – Published Standards on characterization of waste	17
Table 10 – Project standards on characterization of waste.....	19
Table 11 – Published standards on x-ray diffraction.....	20
Table 12 – Published standards related to atomic force microscopy	21
Table 13 – Project standards related to atomic force microscopy	21
Table 14 – Published standards on life cycle assessment.....	22
Table 15 – Published standards on green house gas emissions assessment of products	23
Table 16 – Published Standards on environmental impact on water.....	23
Table 17 – Project standards on environmental impact on water	23
Table 18 – Compilation of technical bodies related to CELLULOSOMEPLUS project and recommended actions	24

1. EXECUTIVE SUMMARY

The Spanish Association for Standardization and Certification (AENOR), as a European Standardization Body, has been subcontracted by CELLULOSOMEPLUS to provide support regarding the standardization tasks included in the project. In order to fulfil this commitment, this deliverable D10.2 'Report on the state of standardization relevant to the project' has been prepared to provide the partners with information about the relevant state of the art in standardization, including related standardization technical committees (TC), published standards, standards under development, etc, which can be interesting for the project objectives and development.

This deliverable should also provide CELLULOSOMEPLUS members basic information to help decide further steps in the standardization process of the project results.

2. INTRODUCTION AND METHODOLOGY

2.1 Project Presentation Overview

CELLULOSOMEPLUS project is co-funded by the European Commission's Seventh Framework Programme and started on 1st of November 2013; the project runs for four years. It brings together 9 partners, seven of which are European partners and two came from an associated country. With regard to the range of partner core activities, the consortium includes six academic partners and three industrial partners, two of which are SMEs. This composition represents a broad background and expertise.

CELLULOSOMEPLUS aims to design highly-efficient cellulosomes with high selectivity and activity (cost-effective) for conversion of cellulosic biomass, from the organic fraction of municipal solid waste, to fermentable sugars en route to the production of 2nd generation biofuels at the laboratory and preindustrial scales. The project tries to find an efficient saccharification process, which is the most difficult step in the process of obtaining energy in form of biofuels from plant fibers.

2.2 Methodology of the document

This document presents the standardization activity found relevant for the CELLULOSOMEPLUS project. In order to structure the search, a list of key concepts was elaborated by AENOR and checked by the project leader to acts a starting point for the identification of standardization areas.

Table 1 – List of key concepts acting as start point for the identification of standardization areas

Cellulosome, cellulosic, lignocellulose

Protein, production of proteins, self-assembled protein
Biomass, biofuel
Saccharification, cellulosic substrate degradation, enzymatic activity
Production of substrate
Nanomechanical studies
Structural characterization, x-ray crystallography, atomic force microscopy
Mechanical stability
Molecular dynamics, computational simulation
Life cycle assessment
Industrial pre-scale up
Organic fraction of municipal waste (composition, classification, treatment)
Industrial microbiology

The standardization study covers European standardization developed by the European Committee for Standardization (CEN) and International standardization developed by the International Organization for Standardization (ISO).

The study is structured in standardization areas for which relevant standardization technical committees (TCs) and other technical bodies within them, published standards and standards under development are referred. The relationship with the project found for each of the identified areas is explained.

Finally, possible actions regarding each of the standardization areas are detailed.

However, it should be clear that the standardization landscape may vary during the project lifetime and therefore a more detailed roadmap for future standardization activities of the project (what, how, where, etc) is not feasible at this initial stage, and will be assessed in deliverable D10.7.

2.3 Short introduction about standardization

Standards are voluntary technical documents that set out requirements for a specific item, material, component, system or service, or describes in detail a particular method, procedure or best practice. Standards are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others. These experts are organized in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) or Working Groups (WGs). These TCs are included in the structure of the Standardization Organizations (National, European and International, with the respective mirror committees) and work following their internal regulations.

The standardization bodies operate at National (AENOR, AFNOR, BSI, DIN, etc.), Regional (CEN, CENELEC, ETSI) or International (ISO, IEC, ITU) level. Sometimes there are different standardization bodies at the same level, but covering different fields. This is the case of

ISO (general), IEC (electrical) and ITU (telecommunications) at International level, or CEN, CENELEC and ETSI at European level in the same way.

There are also different kinds of standardization documents. The most widespread is the standard, which has a different code depending on the organization under it was developed. e.g. EN for European Standards, ISO for International standards. Other types of documents are Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (CWA). Further Amendments to the standards are identified by adding A1, A2, etc. at the end of the standard code.

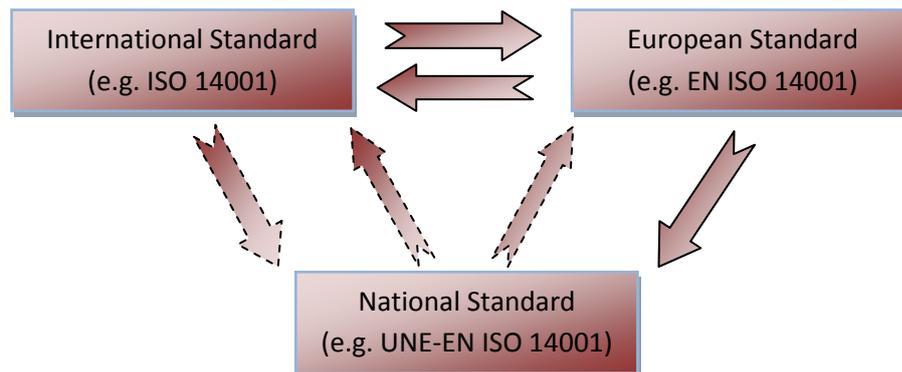
At European level, all the [members of CEN](#) shall adopt EN standards as national standards and have to withdraw any existing national standard which could conflict with them. A summary of the characteristics of the different standardization documents can be found in table 2.

Table 2 – Characteristics of different standardization documents

Type	International code	European code	National code	Main characteristics
Standard	ISO IEC	EN	UNE, NF, BS, DIN, etc When adopting: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc	<ul style="list-style-type: none"> • Elaboration: 3 years • 2 steps of member approval • European: compulsory national adoption • Revision: every 5 years
Technical Specification	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc	<ul style="list-style-type: none"> • Elaboration: 21 months • 1 step of member approval or internal approval in TC • European: optional national adoption • Revision: at 3 years (upgrading to EN or deletion)
Technical Report	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc	<ul style="list-style-type: none"> • Elaboration: free timeframe • Internal approval in TC • European: optional national adoption • No revision required
Workshop Agreement	IWA	CWA	Variable	<ul style="list-style-type: none"> • Elaboration: free timeframe (usually few months) • Internal approval in the Workshop • European: optional national adoption • Revision: at 3 years

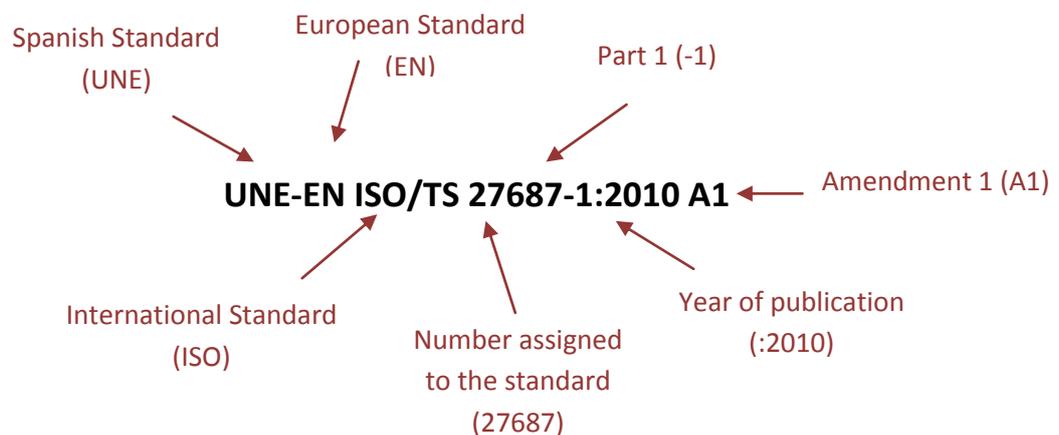
There is also an agreement established between European and International Organizations (e.g. CEN and ISO) in order to avoid duplication of efforts and promote global relevance of standards, which allows to adopt or develop in parallel each other's standards with the same content and code. National standards could also be proposed as a base for new European or International standards. The following figure 1 shows the possible tracks of the standards.

Figure 1 – Possible tracks of standards adoption



Therefore, the code of any standard is the combination of the above mentioned issues, and could be explained as shown in figure 2.

Figure 2 – Example of identification of elements in the code of a standard



2.3.1. ABBREVIATIONS AND ACRONYMS

Useful abbreviations related to standardization are listed next:

AENOR Spanish Association for Standardization and Certification

CEN European Committee for Standardization

CENELEC (CLC) European Committee for Standardization in the Electrical field

CWA	CEN or CENELEC Workshop Agreement
EN	European Standard
ISO	International Organization for Standardization; International Standard
NMC	National Mirror Committee
NSB	National Standardization Body
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
WG	Working Group

4. STANDARDIZATION AREAS RELEVANT TO CELLULOSOMEPLUS PROJECT

Based on the analysis of the CELLULOSOMEPLUS project objectives, working packages and context and linked to the key concepts listed above, a standardization study was performed to identify standardization areas that can be relevant for the project among all standardization sectors. The areas resulting are:

- ❖ **Nanotechnology**
- ❖ **Biotechnology**
- ❖ **Biofuels**
- ❖ **Organic waste**
- ❖ **Characterization techniques**
- ❖ **Environmental impact assessment**

For each of these areas, relevant technical bodies, standards published and standards under development (projects) are identified and detailed below.

5. STANDARDIZATION ON NANOTECHNOLOGIES

Cellulosomes act as nanocatalyst in the process of obtaining biofuels from lignocelluloses providing advantages versus traditional catalyst as the greater surface-to-volume ratio.

After development, nanocharacterization of this cellulosomes constitute a crucial step to achieve a high effectiveness and a efficient scale-up process.

Nanotechnologies represent a highly active standardization area covering measurement and characterization, material specification, terminology, sustainability, consumer and societal dimensions, health, safety and environmental aspects of nanotechnologies.

ISO/TC 229 "Nanotechnologies" and **CEN/TC 352 "Nanotechnologies"** address standardization on nanotechnologies at ISO and CEN level respectively.

In addition and in close cooperation with ISO/TC 229 and CEN/TC 352, a standardization on nanotechnologies specifically focused on electrical and electronic products and systems is addressed by the International Electrothechnical Commission through **IEC/TC 113 "Nanotechnology standardization for electrical and electronic product and systems"**.

The projects and standards of ISO/TC 229 and CEN/TC 352 are listed below. Subsequently, the same work is showed for IEC/TC 113.

Table 3 – Published standards on nanotechnologies

Reference	Document Title
ISO/TS 10797:2012	Nanotechnologies -- Characterization of single-wall carbon nanotubes using transmission electron microscopy
ISO/TS 10798:2011	Nanotechnologies -- Charaterization of single-wall carbon nanotubes using scanning electron microscopy and energy dispersive X-ray spectrometry analysis
ISO 10801:2010	Nanotechnologies -- Generation of metal nanoparticles for inhalation toxicity testing using the evaporation/condensation method
ISO 10808:2010	Nanotechnologies -- Characterization of nanoparticles in inhalation exposure chambers for inhalation toxicity testing
ISO/TS 10867:2010	Nanotechnologies -- Characterization of single-wall carbon nanotubes using near infrared photoluminescence spectroscopy
ISO/TS 10868:2011	Nanotechnologies -- Characterization of single-wall carbon nanotubes using ultraviolet-visible-near infrared (UV-Vis-NIR) absorption spectroscopy
ISO/TR 10929:2012	Nanotechnologies -- Characterization of multiwall carbon nanotube (MWCNT) samples
ISO/TS 11251:2010	Nanotechnologies -- Characterization of volatile components in single-wall carbon nanotube samples using evolved gas analysis/gas chromatograph-mass spectrometry
ISO/TS 11308:2011	Nanotechnologies -- Characterization of single-wall carbon nanotubes using thermogravimetric analysis
ISO/TR 11360:2010	Nanotechnologies -- Methodology for the classification and categorization of nanomaterials
ISO/TR 11811:2012	Nanotechnologies -- Guidance on methods for nano- and microtribology measurements
ISO/TS 11888:2011	Nanotechnologies -- Characterization of multiwall carbon nanotubes -- Mesoscopic shape factors
ISO/TS 11931:2012	Nanotechnologies -- Nanoscale calcium carbonate in powder form -- Characteristics and measurement

ISO/TS 11937:2012	Nanotechnologies -- Nanoscale titanium dioxide in powder form -- Characteristics and measurement
ISO/TS 12025:2012	Nanomaterials -- Quantification of nano-object release from powders by generation of aerosols
ISO/TR 12802:2010	Nanotechnologies -- Model taxonomic framework for use in developing vocabularies -- Core concepts
ISO/TS 12805:2011	Nanotechnologies -- Materials specifications -- Guidance on specifying nano-objects
ISO/TR 12885:2008	Nanotechnologies -- Health and safety practices in occupational settings relevant to nanotechnologies
ISO/TS 12901-1:2012	Nanotechnologies -- Occupational risk management applied to engineered nanomaterials -- Part 1: Principles and approaches
ISO/TS 12901-2:2014	Nanotechnologies -- Occupational risk management applied to engineered nanomaterials -- Part 2: Use of the control banding approach
ISO/TR 13014:2012	Nanotechnologies -- Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment
ISO/TR 13014:2012/Cor 1:2012	Nanotechnologies -- Guidance on physico-chemical characterization of engineered nanoscale materials for toxicologic assessment -- Technical Corrigendum 1
ISO/TR 13121:2011	Nanotechnologies -- Nanomaterial risk evaluation
ISO/TS 13278:2011	Nanotechnologies -- Determination of elemental impurities in samples of carbon nanotubes using inductively coupled plasma mass spectrometry
ISO/TR 13329:2012	Nanomaterials -- Preparation of material safety data sheet (MSDS)
ISO/TS 13830:2013	Nanotechnologies -- Guidance on voluntary labelling for consumer products containing manufactured nano-objects
ISO/TS 14101:2012	Surface characterization of gold nanoparticles for nanomaterial specific toxicity screening: FT-IR method
ISO/TR 14786:2014	Nanotechnologies -- Considerations for the development of chemical nomenclature for selected nano-objects
ISO/TS 16195:2013	Nanotechnologies -- Guidance for developing representative test materials consisting of nano-objects in dry powder form
ISO/TR 16197:2014	Nanotechnologies -- Compilation and description of toxicological screening methods for manufactured nanomaterials
ISO/TS 16550:2014	Nanotechnologies -- Determination of silver nanoparticles potency by release of muramic acid from Staphylococcus aureus
ISO/TS 17200:2013	Nanotechnology -- Nanoparticles in powder form -- Characteristics and measurements
ISO/TS 27687:2008	Nanotechnologies -- Terminology and definitions for nano-objects -- Nanoparticle, nanofibre and nanoplate
ISO 29701:2010	Nanotechnologies -- Endotoxin test on nanomaterial samples for in vitro systems -- Limulus amoebocyte lysate (LAL) test
ISO/TS 80004-1:2010	Nanotechnologies -- Vocabulary -- Part 1: Core terms
ISO/TS 80004-3:2010	Nanotechnologies -- Vocabulary -- Part 3: Carbon nano-objects
ISO/TS 80004-4:2011	Nanotechnologies -- Vocabulary -- Part 4: Nanostructured materials
ISO/TS 80004-5:2011	Nanotechnologies -- Vocabulary -- Part 5: Nano/bio interface
ISO/TS 80004-6:2013	Nanotechnologies -- Vocabulary -- Part 6: Nano-object characterization
ISO/TS 80004-7:2011	Nanotechnologies -- Vocabulary -- Part 7: Diagnostics and therapeutics for healthcare
ISO/TS 80004-8:2013	Nanotechnologies -- Vocabulary -- Part 8: Nanomanufacturing processes
IEC/TS 62622:2012	Artificial gratings used in nanotechnology -- Description and measurement of dimensional quality parameters

EN ISO 29701:2010	Nanotechnologies - Endotoxin test on nanomaterial samples for in vitro systems - Limulus amoebocyte lysate (LAL) test (ISO 29701:2010)
EN ISO 10801:2010	Nanotechnologies - Generation of metal nanoparticles for inhalation toxicity testing using the evaporation/condensation method (ISO 10801:2010)
EN ISO 10808:2010	Nanotechnologies - Characterization of nanoparticles in inhalation exposure chambers for inhalation toxicity testing (ISO 10808:2010)
CEN ISO/TR 11811:2012	Nanotechnologies - Guidance on methods for nano- and microtribology measurements (ISO/TR 11811:2012)
CEN ISO/TS 13830:2013	Nanotechnologies - Guidance on voluntary labelling for consumer products containing manufactured nano-objects (ISO/TS 13830:2013)
CEN ISO/TS 27687:2009	Nanotechnologies - Terminology and definitions for nano-objects - Nanoparticle, nanofibre and nanoplate (ISO/TS 27687:2008, Corrected version 2009-02-01)

Table 4 – Project standards on nanotechnologies

Reference	Document Title
ISO/NP TR 16196	Nanotechnologies -- Compilation and description of sample preparation and dosing methods for engineered and manufactured nanomaterials
ISO/DTR 17302	Nanotechnologies -- Framework for identifying vocabulary development for nanotechnology applications in human healthcare
ISO/DTS 17466	Use of UV-Vis absorption spectroscopy in the characterization of cadmium chalcogenide semiconductor -- Nanoparticles (Quantum dots)
ISO/WD TS 18110	Nanotechnologies -- Vocabularies for science, technology and innovation Indicators
ISO/AWI TR 18196	Nanotechnologies -- Measurement method matrix for manufactured nano-objects
ISO/AWI TR 18401	Plain language guide -- Explanation of core terms with examples
ISO/AWI TR 18637	General framework for the development of occupational exposure limits for nano-objects and their aggregates and agglomerates
ISO/AWI TS 18827	Nanotechnologies -- Electron spin resonance (ESR) as a method for measuring reactive oxygen species (ROS) generated by metal oxide nanomaterials
ISO/AWI TS 19006	DCFH-DA assay for evaluating nanoparticle-induced intracellular reactive oxygen species (ROS) production
ISO/AWI 19007	Modified MTS assay for measuring the effect of nanoparticles on cell viability
ISO/NP TR 19057	Nanotechnologies -- Use and application of cellular in vitro tests and methodologies to assess nanomaterial biodegradability
ISO/NP TS 19337	Characteristics and measurement methods of nano-object working suspensions required for validity evaluation of in vitro toxicity testing
ISO/NP TS 19590	Nanoparticles -- Detection and characterization using single-particle ICP-MS
ISO/NP TR 19601	Nanotechnologies -- Nano-object aerosol generators for inhalation toxicity studies
ISO/NP TR 19716	Nanotechnologies -- Characterization of cellulose nanocrystals -- Particle morphology, purity and surface properties
ISO/NP TR 19733	Matrix of characterization and measurement methods for graphene
ISO/TS 80004-1:2010/CD Amd 1	Nanotechnologies -- Vocabulary -- Part 1: Core terms -- Amendment 1
ISO/DTS 80004-2	Nanotechnologies -- Vocabulary -- Part 2: Nano-objects: Nanoparticle,

	nanofibre and nanoplate
ISO/DTS 80004-9	Nanotechnologies -- Vocabulary -- Part 9: Nano-enabled electrotechnical products and systems
ISO/DTS 80004-10	Nanotechnologies -- Vocabulary -- Part 10: Nano-enabled photonic components and systems
ISO/WD TS 80004-11	Nanotechnologies -- Vocabulary -- Part 11: Nanolayer, nanocoating, nanofilm, and related terms
ISO/WD TS 80004-12	Nanotechnologies -- Vocabulary -- Part 12: Quantum phenomena in nanotechnology
ISO/NP 80004-13	Nanotechnologies -- Vocabulary -- Part 13: Graphene and other two dimensional materials
IEC/CD TS 62607-2-1	Nanomanufacturing - key control characteristics for CNT film applications - Resistivity -- Part 2-1:
FprCEN ISO/TS 80004-1	Nanotechnologies - Vocabulary - Part 1: Core terms (ISO/TS 80004-1:2010)
FprCEN ISO/TS 80004-3	Nanotechnologies - Vocabulary - Part 3: Carbon nano-objects (ISO/TS 80004-3:2010)
FprCEN ISO/TS 80004-4	Nanotechnologies - Vocabulary - Part 4: Nanostructured materials (ISO/TS 80004-4:2011)

Standards and projects on nanotechnologies specifically focused on electrical and electronic products and systems is listed below.

Table 5 – Published standards on nanotechnologies focused on electrotechnical issues

Reference	Document Title
IEC PAS 62565-2-1:2011	Nanomanufacturing - Material specifications - Part 2-1: Single-wall carbon nanotubes - Blank detail specification
IEC TS 62607-2-1:2012	Nanomanufacturing - Key control characteristics - Part 2-1: Carbon nanotube materials - Film resistance
IEC 62607-3-1:2014	Nanomanufacturing - Key control characteristics - Part 3-1: Luminescent nanomaterials - Quantum efficiency
IEC TS 62607-4-1:2014	Nanomanufacturing - Key control characteristics - Part 4-1: Cathode nanomaterials for lithium ion batteries - Electrochemical characterisation, 2-electrode cell method
IEC TS 62622:2012	Nanotechnologies - Description, measurement and dimensional quality parameters of artificial gratings
IEC 62624:2009	Test methods for measurement of electrical properties of carbon nanotubes
IEC TR 62632:2013	Nanoscale electrical contacts and interconnects
IEC TR 62834:2013	IEC nanoelectronics standardization roadmap
IEC 62860:2013	Test methods for the characterization of organic transistors and materials
IEC 62860-1:2013	Test methods for the characterization of organic transistor-based ring oscillators

Table 6 – Project standards on nanotechnologies focused on electrotechnical issues

Reference	Document Title
IEC 62565-3-1 Ed. 1.0	Nanomanufacturing - Material specifications - Part 3-1: Graphene - Blank detail specification
IEC/IEEE 62659 Ed. 1.0	Nanomanufacturing - Large scale manufacturing for nanoelectronics

IEC/TS 62565-4-2 Ed. 1.0	Nanomanufacturing - Material specifications - Part 4-2: Luminescent nanomaterials - Detail specification for general lighting and display applications
IEC/TS 62607-3-2 Ed. 1.0	Nanomanufacturing - Key control characteristics - Part 3-2: Luminescent nanoparticles - Determination of mass of quantum dot dispersion
IEC/TS 62607-4-1 Ed. 2.0	Nanomanufacturing - Key control characteristics - Part 4-1 Nano-enabled electrical energy storage - Electrochemical characterisation of nanomaterials, 2-electrode cell method
IEC/TS 62607-4-2 Ed. 1.0	Nanomanufacturing - Key control characteristics - Part 4-2: Nano-enabled energy storage - Physical characterization of nanomaterials, density measurement
IEC/TS 62607-4-3 Ed. 1.0	Nanomanufacturing - Key control characteristics - Part 4-3: Nano-enabled energy storage - Contact and coating resistivity measurements for nanomaterials
IEC/TS 62607-5-1 Ed. 1.0	Nanomanufacturing - Key control characteristics - Part 5-1: Thin-film organic/nano electronic devices - Carrier transport measurements
IEC/TS 62844 Ed. 1.0	Guidelines for quality and risk assessment for nano-enabled electrotechnical products
IEC/TS 62876-2-1 Ed. 1.0	Nanotechnology - Reliability assessment - Part 2.1: Nano-enabled photovoltaic - Stability test
IEC/TS 80004-10 Ed. 1.0	Nanotechnologies - Vocabulary - Part 10: Nano-enabled photonic products and systems
IEC/TS 80004-9 Ed. 1.0	Nanotechnologies - Vocabulary - Part 9: Nano-enabled electrotechnical products and systems
ISO/TR 19733 Ed. 1.0	Matrix of characterization and measurement methods for Graphene
ISO/TS 80004-2 Ed. 1.0	Nanotechnologies - Vocabulary - Part 2: Nano-objects - Nanoparticle, nanofibre and nanoplate
ISO/TS 80004-8 Ed. 1.0	Nanotechnologies - Vocabulary - Part 8: Nanomanufacturing processes
PNW/TS 113-159 Ed. 1.0	ISO/TS 80004-11: Nanotechnologies - Vocabulary - Part 11: Nanolayer, nanocoating, nanofilm, and related terms
PNW/TS 113-172 Ed. 1.0	ISO/TS 80004-12: Nanotechnologies - Vocabulary - Part 12: Quantum phenomena in nanotechnology
PNW/TS 113-218 Ed. 1.0	ISO/IEC TS 80004-13: Nanotechnologies - Vocabulary - Part 13: Graphene and other two dimensional materials
PWI 113-75 Ed. 1.0	IEC 62607-6-1: Nanomanufacturing - Key control characteristics - Part 6-1: Graphene - Electrical characterization
PWI 113-76 Ed. 1.0	IEC 62607-6-2: Nanomanufacturing - Key control characteristics - Part 6-2: Graphene - Evaluation of the number of layers of graphene
PWI 113-77 Ed. 1.0	IEC 62607-6-3: Nanomanufacturing - Key control characteristics - Part 6-3: Graphene - Evaluation of the defect level in the graphene layer
PWI 113-78 Ed. 1.0	IEC 62607-7-1: Nanomanufacturing - Key control characteristics - Part 7-1: Nano-enabled photovoltaics measurement of the electrical performance and spectral response of tandem cells
PWI 113-79 Ed. 1.0	IEC 62607-4-4: Nanomanufacturing - Key control characteristics - Part 4-4: Nano-enabled electrical energy storage - Thermal characterization of nanomaterials, nail penetration method
PWI 113-80 Ed. 1.0	IEC 62565-5-2: Nanomanufacturing - Material specifications - Part 5-2: Silver nanomaterials - Detail specification for nano-ink
PWI 62607-2-2 Ed. 1.0	PWI on IEC/TS 62607-2-2: Nanomanufacturing - Key control characteristics - Part 2-2: Carbon nanotube materials - Electro-magnetic compatibility
PWI/TR 62565-1 Ed. 1.0	Nanomanufacturing - Material specifications, Part 1 - Basic concept

6. STANDARDIZATION ON BIOTECHNOLOGY

The biotechnological component of the project is present in both, the development stages and in the expected exploitation. Starting from cellulosomes naturally present in relevant bacteria, redesign process for the obtaining of improved cellulosomes will be developed and scaled up using biotechnological processes. On the other hand, in addition to the energy-production through the transformation of lignocelluloses into biofuels, it is expected that the capability of cellulose degradation of this redesigned cellulosomes be a helpful tool for many biotechnological processes.

Biotechnology is a completely recent area in standardization. In the last months, international standardization has just given its first steps in this area by the establishment of **ISO/TC 276 "Biotechnology"**. This technical committee will deal with terminology, biobanks and bioresources, analytical methods, bioprocessing, metrology and data processing including annotation, analysis, validation, comparability and integration. Due to its recent start, there are no standards or projects ongoing so far.

7. STANDARDIZATION ON BIOFUELS

Since the focus of CELLULOSOMEPLUS is the design of cellulosomes capable of process biomass into value-added chemicals, mainly biofuels, the standardization related to liquid biofuels is described next.

Despite of the wide standardization activity related to solid biofuels, the list of standardization works decreases when the focus is put on liquid biofuels. This works are related to environmental concerns of biofuels. Some activity on this topic can be found in the works developed by **CEN/TC 383 "Sustainably produced biomass for energy applications"** which works on sustainability principles, criteria and indicators including their verification and auditing schemes, for as a minimum, but not restricted to, biomass for energy applications. This includes green house gas emission and fossil fuel balances, biodiversity, environmental, economic and social aspects and indirect effects within each of the aspects.

At international level, **ISO/PC 248 "Sustainability criteria for bioenergy"** (PC is the abbreviation of project committee, a TC intended to work during a limited time for developing just one standard) deals with standardization in the field of sustainability criteria for production, supply chain and application of bioenergy, including terminology and aspects related to the sustainability (e.g. environmental, social and economic) of bioenergy

The standards and projects related of both technical committees that have relation with liquid biofuels are listed below.

Table 7 – Published standards related to liquid biofuels

Reference	Document title
EN 16214-1:2012	Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 1: Terminology
CEN/TS 16214-2:2014	Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 2: Conformity assessment including chain of custody and mass balance
EN 16214-3:2012	Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 3: Biodiversity and environmental aspects related to nature protection purposes
EN 16214-4:2013	Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis approach
CEN/TS 16214-2:2014	Sustainability criteria for the production of biofuels and bioliquids for energy applications - Principles, criteria, indicators and verifiers - Part 2: Conformity assessment including chain of custody and mass balance

Table 8 – Project standards related to liquid biofuels

Reference	Document title
ISO/CD 13065	Sustainability criteria for bioenergy

8. STANDARDIZATION ON ORGANIC WASTE

The substrate to be used by the project to evaluate the efficiency of the designed cellulosomes is based on the organic fraction of municipal solid waste, which is the final substrate intended for the designed cellulosomes. Standardization in this area has been developed at European level focused on characterization of waste.

Not within CELLULOSOMEPLUS but in further projects, it is intended that the process be applicable to biomass from agriculture and forest waste, so standardization on solid biofuels (widely covered by standardization works) is not addressed in this document.

CEN/TC 292 "Characterization of waste" develops standards applicable to all kind of waste, including municipal waste. The work of this technical committee includes

procedures to determine the characteristics of waste and waste behavior, especially leaching properties and standardization of subsequent terminology. Excluded from its scope are radioactive waste, exhaust gases, waste water, explosives, animal carcasses. Standards and projects of CEN/TC 292 is listed below.

Table 9 – Published Standards on characterization of waste

Reference	Document Title
CEN/TR 15310-4:2006	Characterization of waste - Sampling of waste materials - Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery
CEN/TR 14589:2003	Characterization of waste - State of the art document - Chromium VI specification in solid matrices
CEN/TR 15310-1:2006	Characterization of waste - Sampling of waste materials - Part 1: Guidance on selection and application of criteria for sampling under various conditions
CEN/TR 15310-2:2006	Characterization of waste - Sampling of waste materials - Part 2: Guidance on sampling techniques
CEN/TR 15310-3:2006	Characterization of waste - Sampling of waste materials - Part 3: Guidance on procedures for sub-sampling in the field
CEN/TR 15310-5:2006	Characterization of waste - Sampling of waste materials - Part 5: Guidance on the process of defining the sampling plan
CEN/TR 15018:2005	Characterization of waste - Digestion of waste samples using alkali-fusion techniques
EN 14735:2005/AC:2006	Characterization of waste - Preparation of waste samples for ecotoxicity tests
EN 14899:2005	Characterization of waste - Sampling of waste materials - Framework for the preparation and application of a Sampling Plan
EN 14735:2005	Characterization of waste - Preparation of waste samples for ecotoxicity tests
EN 15875:2011	Characterization of waste - Static test for determination of acid potential and neutralisation potential of sulfidic waste
CEN/TR 16176:2011	Characterization of waste - Screening methods for elemental composition by X-ray fluorescence spectrometry for on-site verification
CEN/TR 16130:2011	Characterization of waste - On-site verification
EN 16192:2011	Characterization of waste - Analysis of eluates
EN 16377:2013	Characterization of waste - Determination of brominated flame retardants (BFR) in solid waste
EN 16123:2013	Characterization of waste - Guidance on selection and application of screening methods
CEN/TR 16376:2012	Characterization of waste - Overall guidance document for characterization of waste from the extractive industries
CEN/TR 16110:2010	Characterization of waste - Guidance on the use of ecotoxicity tests applied to waste
CEN/TR 16365:2012	Characterization of waste - Sampling of waste from extractive industries
CEN/TS 15364:2006	Characterization of waste - Leaching behaviour tests - Acid and base neutralization capacity test
CEN/TS 15864:2012	Characterisation of waste - Leaching behaviour test for basic characterisation - Dynamic monolithic leaching test with continuous leachant renewal under conditions relevant for specified scenario(s)
CEN/TR 16184:2011	Characterization of Waste - State-of-the-art document - Analysis of

	eluates
CEN/TS 15862:2012	Characterisation of waste - Compliance leaching test - One stage batch leaching test for monoliths at fixed liquid to surface area ratio (L/A) for test portions with fixed minimum dimensions
CEN/TS 15863:2012	Characterisation of waste - Leaching behaviour test for basic characterisation - Dynamic monolithic leaching test with periodic leachant renewal, under fixed test conditions
EN 13965-2:2010	Characterization of waste - Terminology - Part 2: Management related terms and definitions
EN 15192:2006	Characterisation of waste and soil - Determination of Chromium(VI) in solid material by alkaline digestion and ion chromatography with spectrophotometric detection
EN 15002:2006	Characterization of waste - Preparation of test portions from the laboratory sample
EN 13137:2001	Characterization of waste - Determination of total organic carbon (TOC) in waste, sludges and sediments
EN 16457:2014	Characterization of waste - Framework for the preparation and application of a testing programme - Objectives, planning and report
EN 15875:2011/AC:2012	Characterization of waste - Static test for determination of acid potential and neutralisation potential of sulfidic waste
CEN/TS 16023:2013	Characterization of waste - Determination of gross calorific value and calculation of net calorific value
EN 12457-1:2002	Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 1: One stage batch test at a liquid to solid ratio of 2 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)
EN 12457-2:2002	Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 2: One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 4 mm (without or with size reduction)
EN 12457-3:2002	Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 3: Two stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with high solid content and with particle size below 4 mm (without or with size reduction)
EN 12457-4:2002	Characterisation of waste - Leaching - Compliance test for leaching of granular waste materials and sludges - Part 4: One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction)
EN 12920:2006+A1:2008	Characterization of waste - Methodology for the determination of the leaching behaviour of waste under specified conditions
EN 13656:2002	Characterization of waste - Microwave assisted digestion with hydrofluoric (HF), nitric (HNO ₃) and hydrochloric (HCl) acid mixture for subsequent determination of elements
EN 13657:2002	Characterization of waste - Digestion for subsequent determination of aqua regia soluble portion of elements
EN 15309:2007	Characterization of waste and soil - Determination of elemental composition by X-ray fluorescence
EN 14346:2006	Characterization of waste - Calculation of dry matter by determination of dry residue or water content
EN 15169:2007	Characterization of waste - Determination of loss on ignition in waste, sludge and sediments
EN 15216:2007	Characterization of waste - Determination of total dissolved solids (TDS) in water and eluates
CEN/TR 16363:2012	Characterization of waste - Kinetic testing for assessing acid

EN 14582:2007	generation potential of sulfidic waste from extractive industries Characterization of waste - Halogen and sulfur content - Oxygen combustion in closed systems and determination methods
EN 15527:2008	Characterization of waste - Determination of polycyclic aromatic hydrocarbons (PAH) in waste using gas chromatography mass spectrometry (GC/MS)
EN 15308:2008	Characterization of waste - Determination of selected polychlorinated biphenyls (PCB) in solid waste by using capillary gas chromatography with electron capture or mass spectrometric detection
EN 14345:2004	Characterization of waste - Determination of hydrocarbon content by gravimetry
CEN/TS 14405:2004	Characterization of waste - Leaching behaviour tests - Up-flow percolation test (under specified conditions)
CEN/TS 16229:2011	Characterization of waste - Sampling and analysis of weak acid dissociable cyanide discharged into tailings ponds
EN 14039:2004	Characterization of waste - Determination of hydrocarbon content in the range of C10 to C40 by gas chromatography
CEN/TS 14429:2005	Characterization of waste - Leaching behaviour tests - Influence of pH on leaching with initial acid/base addition
CEN/TS 14997:2006	Characterization of waste - Leaching behaviour tests - Influence of pH on leaching with continuous pH-control

Table 10 – Project standards on characterization of waste

Reference	Document Title
FprCEN/TS 16675	Characterization of waste - Test methods for the determination of the monolithic status of waste
FprEN 14429	Characterization of waste - Leaching behaviour test - Influence of pH on leaching with initial acid/base addition
FprEN 14997	Characterization of waste - Leaching behaviour test - Influence of pH on leaching with continuous pH control
FprEN 16424	Characterization of waste - Screening methods for the element composition by portable X-ray fluorescence instruments
prEN 14405 rev	Characterization of waste - Leaching behaviour test - Up-flow percolation test (under specified conditions)
prEN 14582 rev	Characterization of waste - Halogen and sulfur content - Oxygen combustion in closed systems and determination methods
prEN 15002	Characterization of waste - Preparation of test portions from the laboratory sample
prEN 15863	Characterisation of waste - Leaching behaviour test for basic characterisation - Dynamic monolithic leaching test with periodic leachant renewal, under fixed conditions
prEN 16660	Characterisation of waste - Leaching behaviour test - Determination of the reducing character and the reducing capacity

9. STANDARDIZATION ON RELEVANT CHARACTERIZATION TECHNIQUES

CELLULOSOMEPLUS project intends to use several characterization techniques including x-ray crystallography and atomic force microscopy. Many technical committees address sector specific characterization techniques as is the case of Nanotechnologies committees. Standardization focused on these two techniques used in the project is described below.

9.1 X-RAY CRYSTALLOGRAPHY

X-ray crystallography is not specifically covered by standardization works, however, x-ray diffraction, basis of this technique, is in some way addressed by European standardization. CEN/TC 138 "Non-destructive testing" covers the standardization of the terminology, equipment, and general principles of methods for non destructive testing; this includes X-ray diffraction and other methods like acoustic methods, ionizing radiations, liquid penetrant testing, electrical and magnetic methods, optical and visual methods and leak testing. It is oriented to characterization of materials but it addresses horizontal standardization on x-ray diffraction.

X- ray diffraction standards are developed by **WG 10 "X-ray diffraction" within CEN/TC 138 "Non-destructive testing"**. The standards related to x-ray diffraction are listed next.

Table 11 – Published standards on x-ray diffraction

Reference	Document Title
EN 1330-11:2007	Non-destructive testing - Terminology - Terms used in X-ray diffraction from polycrystalline and amorphous materials
EN 13925-1:2003	Non-destructive testing - X-ray diffraction from polycrystalline and amorphous material - Part 1: General principles
EN 13925-2:2003	Non-destructive testing - X-ray diffraction from polycrystalline and amorphous materials - Part 2: Procedures
EN 13925-3:2005	Non destructive testing - X ray diffraction from polycrystalline and amorphous materials - Part 3: Instruments
EN 15305:2008	Non-destructive Testing - Test Method for Residual Stress analysis by X-ray Diffraction
EN 15305:2008/AC:2009	Non-destructive Testing - Test Method for Residual Stress analysis by X-ray Diffraction
EN 12543-2:2008	Non-destructive testing - Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 2: Pinhole camera radiographic method
EN 12543-1:1999	Non-destructive testing - Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 1: Scanning method
EN 12543-3:1999	Non-destructive testing - Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 3: Slit camera radiographic method

EN 12543-4:1999	Non-destructive testing - Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 4: Edge method
EN 12543-5:1999	Non-destructive testing - Characteristics of focal spots in industrial X-ray systems for use in non-destructive testing - Part 5: Measurement of the effective focal spot size of mini and micro focus X-ray tubes
EN 12544-1:1999	Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 1: Voltage divider method
EN 12544-2:2000	Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 2: Constancy check by the thick filter method
EN 12544-3:1999	Non-destructive testing - Measurement and evaluation of the X-ray tube voltage - Part 3: Spectrometric method

No x-ray diffraction related standards are in development so far.

9.2. ATOMIC FORCE MICROSCOPY

Another standardization technical committee dealing with characterization is ISO/TC 201 "Surface chemical analysis", specifically, **ISO/TC201/SC 9 "Scanning probe microscopy"**. This area of standardization is focused on surface analysis for the characterization and development of advance materials and processes, used to identify the surface phases, the concentration of elements in them and the variation of composition with the position, but it has been found worthy of being included as relevant standardization for the project because it is about to publish a standard based on atomic force microscopy. This and other relevant standards and projects of this Subcommittee are listed below.

Table 12 – Published standards related to atomic force microscopy

Reference	Document title
ISO 13095 *	Surface Chemical Analysis -- Atomic force microscopy -- Procedure for in situ characterization of AFM probe shank profile used for nanostructure measurement
ISO 11039:2012	Surface chemical analysis -- Scanning-probe microscopy -- Measurement of drift rate
ISO 11952:2014	Surface chemical analysis -- Scanning-probe microscopy -- Determination of geometric quantities using SPM: Calibration of measuring systems
ISO 27911:2011	Surface chemical analysis -- Scanning-probe microscopy -- Definition and calibration of the lateral resolution of a near-field optical microscope

* This standard is expected to be published within the next few months

Table 13 – Project standards related to atomic force microscopy

Reference	Document title
ISO/DIS 11775	Surface chemical analysis -- Scanning-probe microscopy -- Determination of cantilever normal spring constants
ISO/DIS 13083	Surface chemical analysis - Scanning Probe Microscopy- Standards on the definition and calibration of spatial resolution of Scanning

	Spreading Resistance Microscopy and Scanning Capacitance Microscopy
ISO/WD TR 13096	Surface chemical analysis -- Scanning-probe microscopy -- Guidelines for the description of AFM probe properties

10. STANDARDIZATION ENVIRONMENTAL IMPACT ASSESSMENT

The project involves life cycle analysis and green house gas emissions assessment for the designed cellulosomes. Both, life cycle analysis and specific environmental impact assessments are covered by standardization activities.

10.1. LIFE CYCLE ANALYSIS

This process for the evaluation of the environmental impact of a product or service is addressed by **Subcommittee 5 "Life cycle assessment" within ISO/TC 207 "Environmental management"**. This subcommittee develops standards in the field of life cycle assessment as a tool for environmental management of product and service systems. It encompasses the assessment of impacts on the environment from the extraction of raw materials to the final disposal of waste. The standards of this subcommittee dealing with the principles and guidelines for life cycle analysis are listed next.

Table 14 – Published standards on life cycle assessment

Reference	Document title
ISO 14040:2006	Environmental management -- Life cycle assessment -- Principles and framework
ISO 14044:2006	Environmental management -- Life cycle assessment -- Requirements and guidelines
ISO 14045:2012	Environmental management -- Eco-efficiency assessment of product systems -- Principles, requirements and guidelines
ISO/TR 14047:2012	Environmental management -- Life cycle assessment -- Illustrative examples on how to apply ISO 14044 to impact assessment situations
ISO/TS 14048:2002	Environmental management -- Life cycle assessment -- Data documentation format
ISO/TR 14049:2012	Environmental management -- Life cycle assessment -- Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis
ISO/TS 14071:2014	Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006

No product life cycle assessment related standards are in development so far. All standardization work in this field is developed at ISO level although some standards were adopted at European level: EN ISO 14040:2006 and EN ISO 14044:2006

10.2. SPECIFIC ENVIRONMENTAL IMPACTS ASSESSMENT

Either as lone assessments or as part of the impacts included in the life cycle assessment, several environmental impacts are undertaken by standardization works.

10.2.1 GREEN HOUSE GAS EMISSIONS ASSESSMENT

The assessment of green house gas emissions is addressed by international standardization by **Subcommittee 7 "Greenhouse gas management and related activities" within ISO/TC 207 "Environmental management"**. This technical body developed several standards intended to manage and mitigate GHG emissions and to improve adaptation o the effects of climate change. This includes quantification, reporting and verification of GEI emissions applicable to organizational level, verification bodies or emissions reduction project level, but it has recently developed a standard for the quantification and communication of the carbon footprint of a product which is applicable to the designed cellulosomes. This standard is referred below.

Table 15 – Published standards on green house gas emissions assessment of products

Reference	Document title
ISO/TS 14067:2013	Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication

No related standards are in development so far.

10.2.2 ENVIRONMENTAL IMPACT ON WATER

Another relevant environmental impact is the consumption and pollution of water. Again **Subcommittee 5 "Life cycle assessment" within ISO/TC 207** has just published a standard about how to assess all the impacts on water related to a product, process or organization. The standard is referred below.

Table 16 – Published Standards on environmental impact on water

Reference	Document title
ISO 14046:2014	Environmental management -- Water footprint -- Principles, requirements and guidelines

This technical body has recently started working on a technical report based on example of application of ISO 14046 referred next.

Table 17 – Project standards on environmental impact on water

Reference	Document title
ISO/AWI TR 14073	Environmental management -- Water footprint -- Illustrative examples on how to apply ISO 14046

11. CONCLUSIONS

After the analysis of the current standardization context, it has been found that there is not any standardization technical body which activity impacts broadly in CELLULOSOMEPLUS project due to the highly technical specificity of its objectives. However, specific tasks to be addressed in the project do are related with standardization works.

Depending on the assessment by CELLULOSOMEPLUS partners of the impact of the identified standardization bodies on their tasks and the level of contribution their results can represent for this bodies, several actions can be performed. These actions include the follow up of the standardization activity through updates reported by AENOR, the follow up through the joining of one or more CELLULOSMEPLUS representatives to this standardization bodies, the performance of dissemination tasks of the project work by delivering reports to the relevant Secretaries or the dissemination of the project activity by attending at relevant technical committees meetings. The most deep relationship possible with these standardization bodies, the "project liaison", is not required since the impact of the on the project works is not so decisive.

Focusing on the dissemination actions, the most relevant technical bodies for the CELLULOSOMEPLUS project are the ones related to nanotechnology, biotechnology and biofuels.

A compilation of the technical bodies and the analysis of the interaction with the project is shown in the next table.

Table 18 – Compilation of technical bodies related to CELLULOSOMEPLUS project and recommended actions

Technical body	Follow up recommended	Dissemination action recommended
ISO/TC 229 "Nanotechnologies"	X	X
CEN/TC 352 "Nanotechnologies"	X	X
IEC/TC 113 "Nanotechnonology standardization for electrical and electronic product and systems".	X	X
ISO/TC 276 "Biotechnology"	X	X
CEN/TC 383 "Sustainably produced biomass for energy applications"	X	X
ISO/PC 248 "Sustainability criteria for bioenergy"	X	X
CEN/TC 292 "Characterization of waste"	X	
CEN/TC 138/WG 10 "X-ray diffraction"	X	
ISO/TC201/SC 9 "Scanning probe microscopy".	X	
ISO/TC 207/SC 5 "Life cycle assessment"	X	
ISO/TC 207/SC 7 "Greenhouse gas management and related activities"	X	

At a later stage of the project when the actual results are closer, next standardization task will evaluate the interest and potential of these results to be part of future standards. This will be assessed by considering factors such as:

- the situation of the works of the relevant TCs at that moment,
- the possible contents of the project to be proposed,
- the exploitation and IP protection plans of the project, balancing confidentiality requirements and benefits of inclusion in standards for future commercialization.

With the technical contribution of CELLULOSOMEPLUS partners and the standardization advice of AENOR, technical proposals will be elaborated at this stage. AENOR will assist the consortium so that these proposals fit the standardization procedures and requirements to be ready for inclusion in the future development of new standards or into revised ones. The proposals shall be provided to the technical committees or to the technical bureau of the relevant standardization organization, and presented to them in the most adequate way (e.g. writing report, presentation in a TC meeting or other suitable event, organization of a joint meeting...).

Since patenting intentions can be present for some of the results of the project, it was agreed that the proposals will be kept in the confidentiality of the consortium until the patents be applied for, and the relevant information be public. Then the proposals will be submitted to the standardization organizations, even if this happens after the closure of the project, as it is foreseeable.

The results of this stage will include the technical proposals, the foreseen submission procedure as well as the future expectations after the project lifetime and will be reported in deliverable D 10.7 "Technical proposal for the future work programme of the European/ International Standardization Organizations".