FuturEnzyme
Technologies of the FUTURe for low-cost ENZYMEs for environment-friendly products

18 M meeting

14.11.2022

Project funded by the European Union's Horizon 2020
Research and Innovation Programme under grant agreement No [101000327]

Work packages description

WP Number[9]	WP Title	Lead beneficiary[10]	Person-months[11]	Start month[12]	End month[13]
WP1	Management and Coordination	1 - CSIC	58.00	1	48
WP2	Machine learning enzyme bio-prospecting integrated into an industrial context	2 - BSC	51.00	1	48
WP3	Activity-based bio-prospecting for enzymes	3 - BANGOR	75.00	1	36
WP4	Small-scale enzyme production and characterisation	4 - UHAM	173.00	1	40
WP5	Enhancing enzymes through innovative engineering	9 - FHNW	96.00	3	42
WP6	Development and supply of best enzyme prototypes	16 - EUCODIS	97.90	16	48
WP7	Formulation and manufacturing of consumer products: sustainability and environmental assessments	10 - CLIB	83.00	1	48
WP8	Communication, Dissemination and Exploitation	8 - ITB	70.57	1	48
WP9	Ethics requirements	1 - CSIC	N/A	1	48
		Total	704.47		

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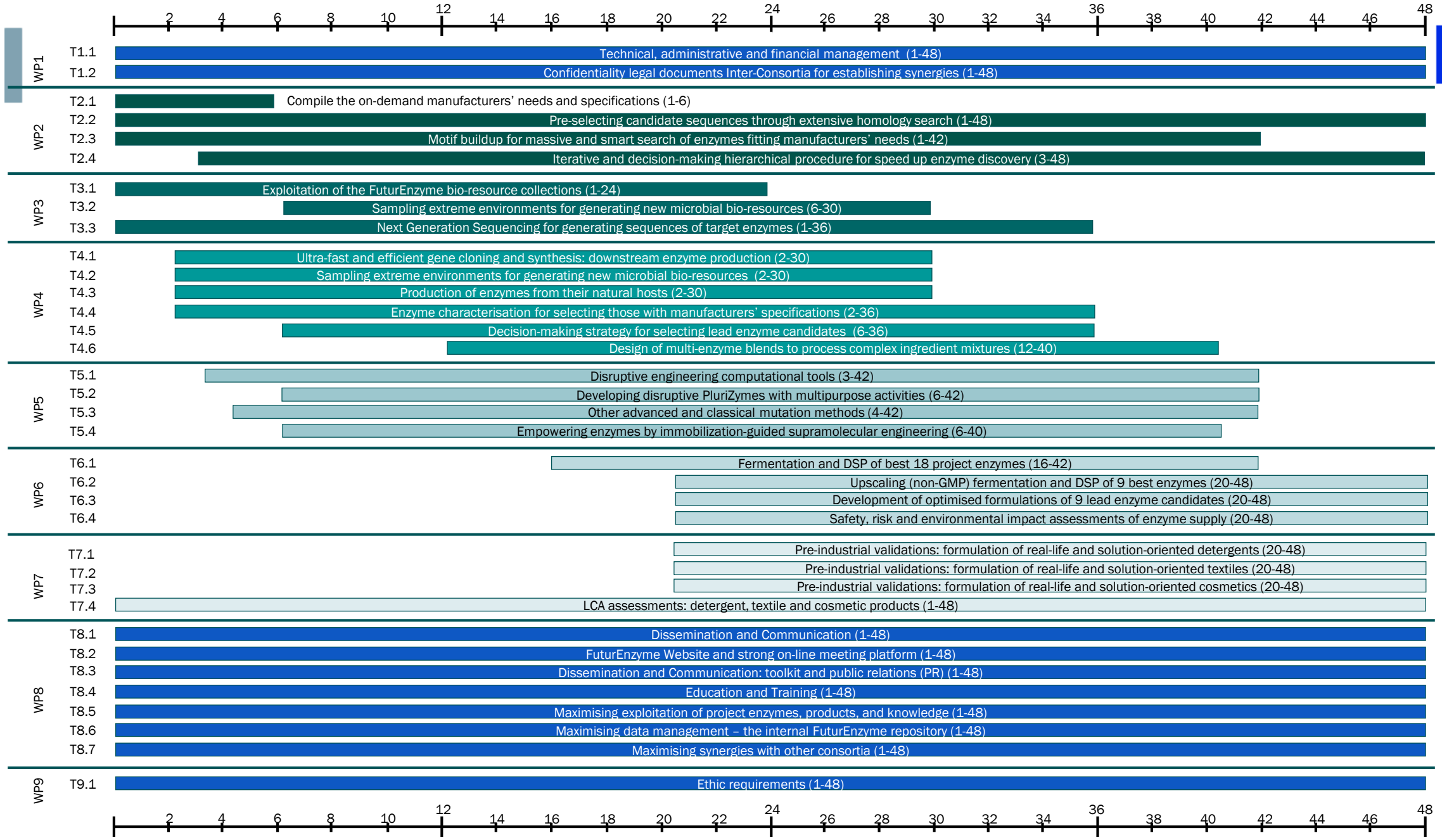
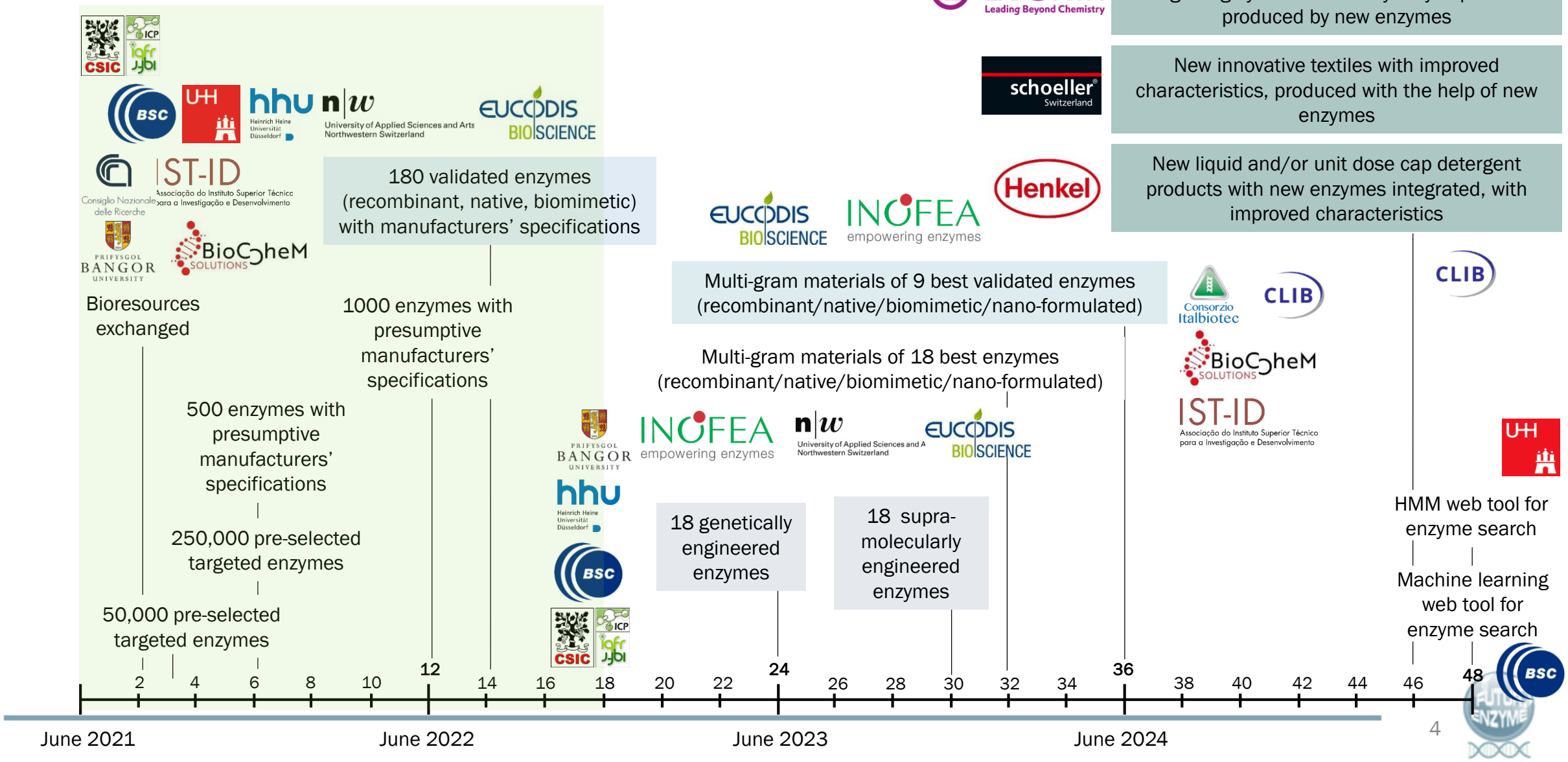

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48
WP1
T1.1 Technical, administrative and financial management (1-48)
T1.2 Confidentiality legal documents Inter-Consortia for establishing synergies (1-48)
WP2
T2.1 Compile the on-demand manufacturers' needs and specifications (1-6)
T2.2 Pre-selecting candidate sequences through extensive homology search (1-48)
T2.3 Motif buildup for massive and smart search of enzymes fitting manufacturers' needs (1-42)
T2.4 Iterative and decision-making hierarchical procedure for speed up enzyme discovery (3-48)
WP3
T3.1 Exploitation of the FuturEnzyme bio-resource collections (1-24)
T3.2 Sampling extreme environments for generating new microbial bio-resources (6-30)
T3.3 Next Generation Sequencing for generating sequences of target enzymes (1-36)
WP4
T4.1 Ultra-fast and efficient gene cloning and synthesis: downstream enzyme production (2-30)
T4.2 Sampling extreme environments for generating new microbial bio-resources (2-30)
T4.3 Production of enzymes from their natural hosts (2-30)
T4.4 Enzyme characterisation for selecting those with manufacturers' specifications (2-36)
T4.5 Decision-making strategy for selecting lead enzyme candidates (6-36)
T4.6 Design of multi-enzyme blends to process complex ingredient mixtures (12-40)
WP5
T5.1 Disruptive engineering computational tools (3-42)
T5.2 Developing disruptive PluriZymes with multipurpose activities (6-42)
T5.3 Other advanced and classical mutation methods (4-42)
T5.4 Empowering enzymes by immobilization-guided supramolecular engineering (6-40)
WP6
T6.1 Fermentation and DSP of best 18 project enzymes (16-42)
T6.2 Upscaling (non-GMP) fermentation and DSP of 9 best enzymes (20-48)
T6.3 Development of optimised formulations of 9 lead enzyme candidates (20-48)
T6.4 Safety, risk and environmental impact assessments of enzyme supply (20-48)
WP7
T7.1 Pre-industrial validations: formulation of real-life and solution-oriented detergents (20-48)
T7.2 Pre-industrial validations: formulation of real-life and solution-oriented textiles (20-48)
T7.3 Pre-industrial validations: formulation of real-life and solution-oriented cosmetics (20-48)
T7.4 LCA assessments: detergent, textile and cosmetic products (1-48)
WP8
T8.1 Dissemination and Communication (1-48)
T8.2 FuturEnzyme Website and strong on-line meeting platform (1-48)
T8.3 Dissemination and Communication: toolkit and public relations (PR) (1-48)
T8.4 Education and Training (1-48)
T8.5 Maximising exploitation of project enzymes, products, and knowledge (1-48)
T8.6 Maximising data management – the internal FuturEnzyme repository (1-48)
T8.7 Maximising synergies with other consortia (1-48)
WP9
T9.1 Ethic requirements (1-48)
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48

FuturEnzyme: Important achievements to keep in mind

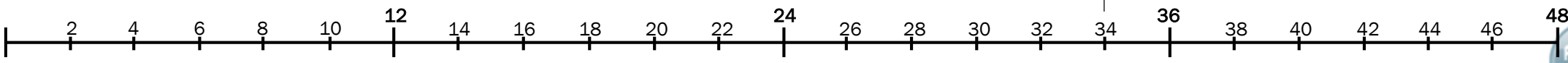


FuturEnzyme: Important achievements to keep in mind

Report informing about the overall success of the new enzymes and enzymatic processes to produce environmentally-friendly consumer products and how they may help producing similar or other products with environmental benefits

Report describing how the integration of best 18 enzymes as ingredients or as parts of production processes result in greener, functional and sustainable products

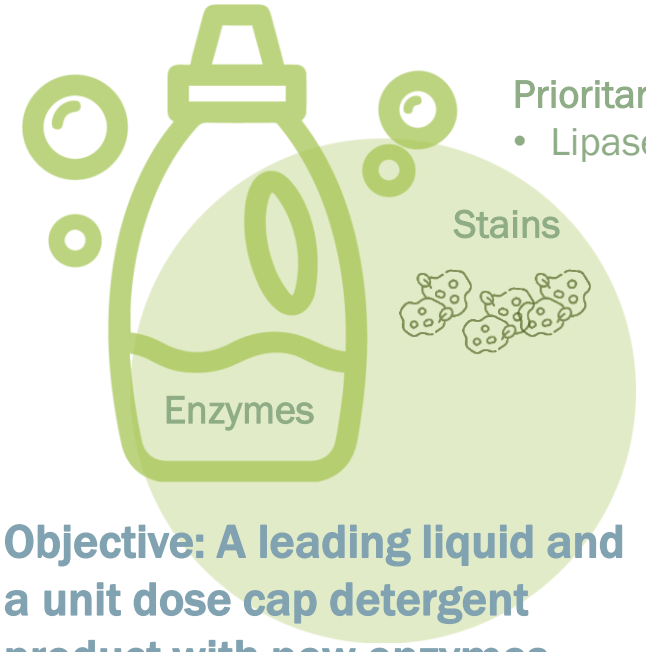
Report informing about the economic feasibility and sustainability of the new enzyme supply system



Enzymes envisioning 3 greener and improved consumer products

- Clearly define the priorities and requirements: Henkel and detergents

Target enzymes:
- Lipases, esterases, cutinases, proteases, amylases, peroxidases



Prioritary enzymes:
- Lipases-like

Requirement:
- Stable 2-3 months at 30°C in the liquid detergent formulation
- Effective at conditions mimicking the wash cycle: 20-40°C, pH 7.0-8.5, 120 min
- Wash liquor: 50 g liquid detergent per 20 liter of water

Decision taken screen 3:
- Enzyme retaining activity 120 min in wash liquor
- Enzyme stable in liquid detergent for few days
- Active against standard soils/stains on textiles

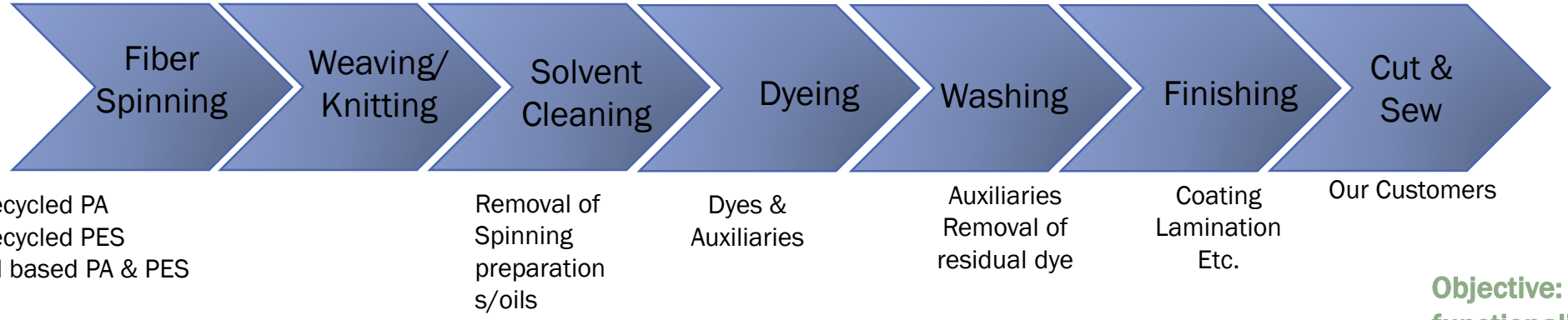
Decision taken screen 2:
Active towards commercially available standard soils/stains on textiles and natural soils
- Cuff and collar, natural skin fat, butterfat, olive oil, frying fat, lard and tomato beef sauce
- Beef lard, pigment, oil, pigment, sebum, mayonnaise with carbon black, butterfat with colorant, lipstick, pink and make up

Decision taken screen 1:
- Enzyme retaining some activity 5-10 min in wash liquor

Objective: A leading liquid and a unit dose cap detergent product with new enzymes integrated

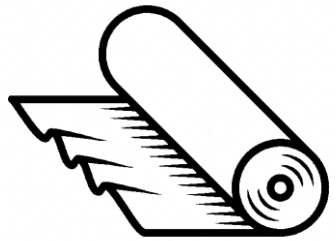
Enzymes envisioning 3 greener and improved consumer products

- Clearly define the priorities and requirements: Schoeller and textiles



Objective: 3-4 Enzymatically functionalised leading textiles in more than DIN A4 size

Mainly PES, PA and EL



Fabric on rolls

Enzymes envisioning 3 greener and improved consumer products

Priority enzymes:
- Lipases-like

Priority substances:
- Silicon/mineral oils at below 80°C

Enzyme

Recycled PA
Recycled PES
Oil based PA & PES

Fiber Spinning → Weaving / Knitting → Solvent Cleaning → Dyeing → Washing → Finishing → Cut & Sew

Removal of Spinning preparations/oils

Dyes & Auxiliaries

Auxiliaries Removal of residual dye

Coating Lamination Etc.

Our Customers

Raw material

Pre-treated material

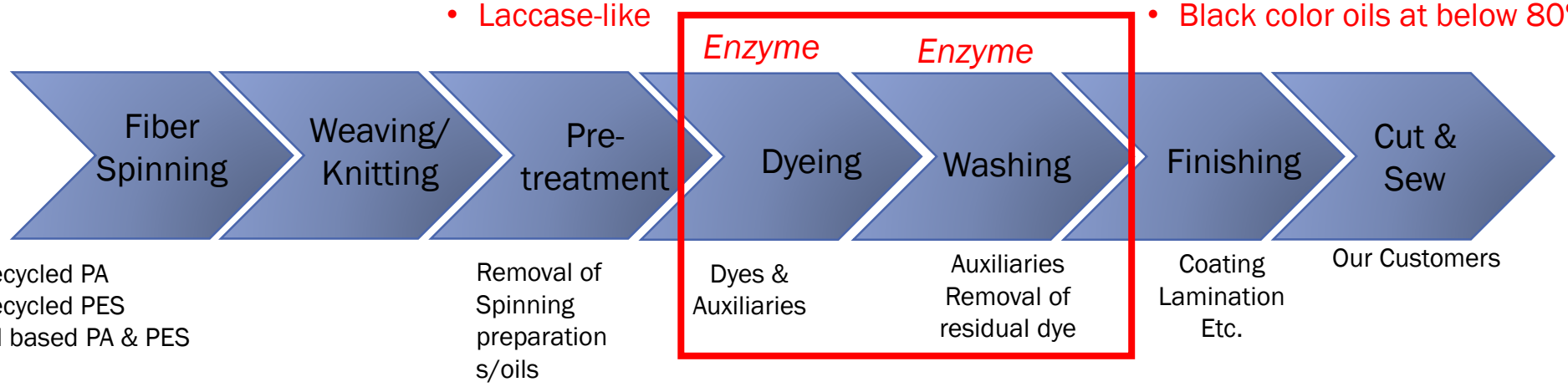
Problem:
- Removing of silicon/mineral oils
- Small fine dtex EL can't be solvent cleaned (they will be destroyed), and additives can't be fully removed by water/surfactant process
- Residual spinning oils will generate emissions during the drying and fixation steps
- These residual oils can have negative impact on the subsequent dyeing/finishing

Goal by the newly-developed enzymes:
- Removal of the above-mentioned additives/preparation materials
- Water-based process, low temperature, fewer water discharge, fewer energy consumption
- Please refer to the qualitative/quantitative analysis already sent from Schoeller Textiles to all partners

Enzymes envisioning 3 greener and improved consumer products

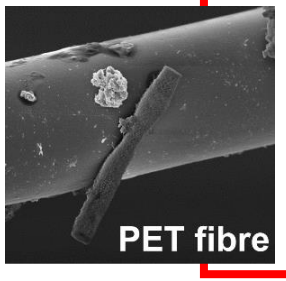
Priority enzymes:
- Laccase-like

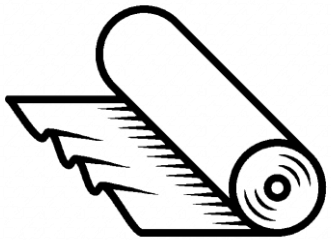
Priority substances:
- Black color oils at below 80°C



Problem:
- Textile industry is one of the most polluting industries for water and energy consumption
- Extensive rinsing process during the dyeing/fixing of the textile materials
- Dyeing of the textile materials needs a lot of water
- Prior to dyeing procedure, removal of sizing products (Acrylic acids)

Secondary enzymes:
- PES/PA hydrolases

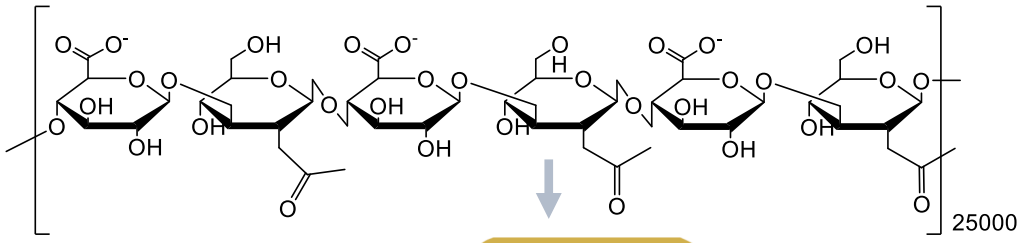




(Ambitious) Goal by the newly-developed enzymes :
- Reduce water/energy consumption and reduce the carbon footprint
  - Reducing the rinsing steps/duration
  - Optimize the dyeing process
- Discoloration and neutralization of the used processed water and circulate it in the system again

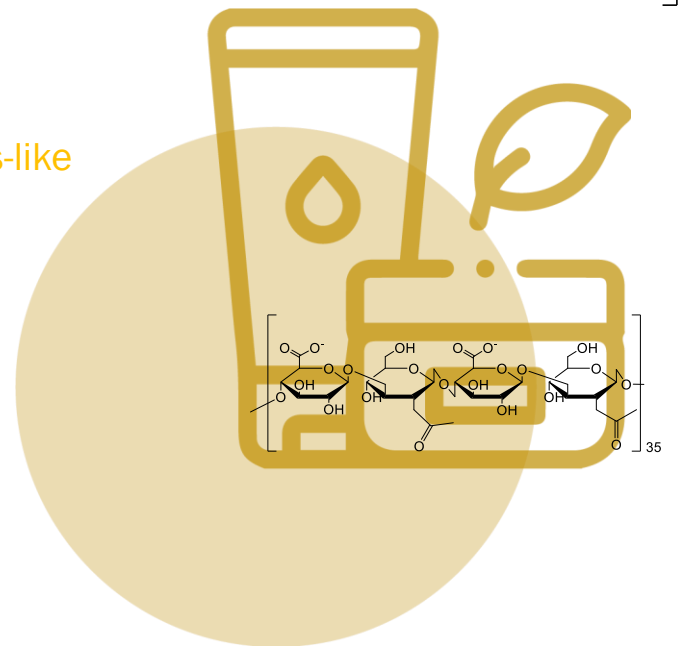
Enzymes envisioning 3 greener and improved consumer products

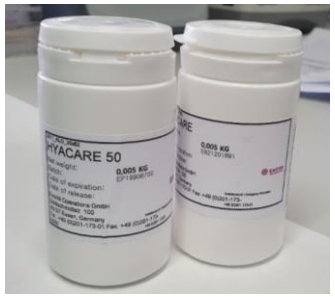
- Clearly define the priorities and requirements: Evonik and cosmetics



Priority enzymes:

- Hyaluronidases-like





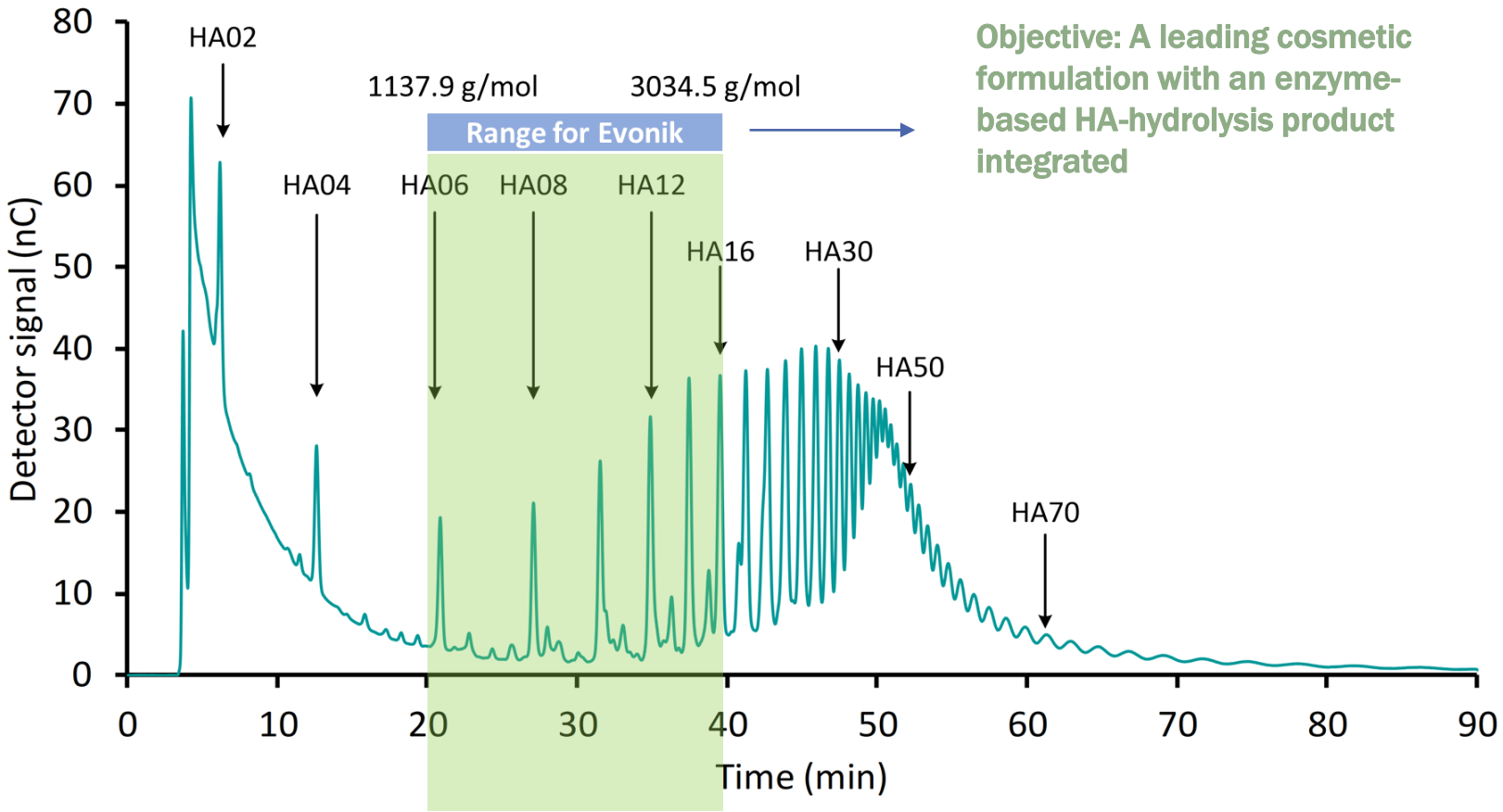
- Low molecular weight (50 kDa) hyaluronic acid HyaCare® 50
- Low molecular weight hyaluronic acid (<10 kDa), Hyalo-Oligo

Requirements:

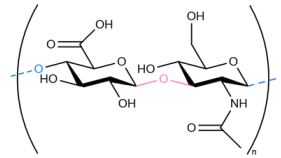
- Small hyaluronic acid with 1-2 k Dalton molecular weight, <37°C, no solvents, high viscosity solutions

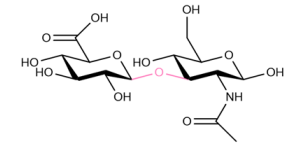
Enzymes envisioning 3 greener and improved consumer products

- Clearly define the priorities and requirements: Evonik and cosmetics

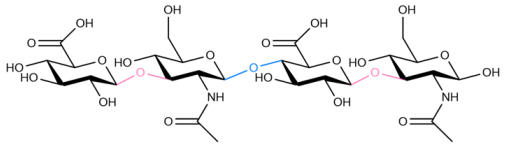


Objective: A leading cosmetic formulation with an enzyme-based HA-hydrolysis product integrated

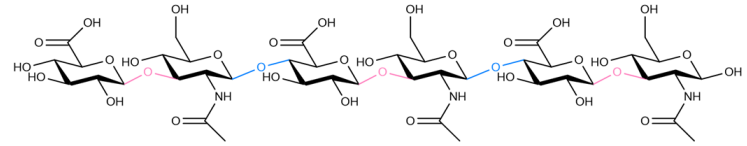




HA02 (C14H21NO11)1 = 379.3 g/mol



HA04 (C14H21NO11)2 = 758.6 g/mol



HA06 (C14H21NO11)3 = 1137.9 g/mol

Deliverables: 22 submitted, all at due time

- D4.4 delivered but reopened with the PO's consent (new due date month 30, November 2023)
- 6 are in the final stages of document preparation for this month

Deliverables, Ethics, DMP, Other Reports

For each Deliverable, a single file (max 52MB) can be uploaded

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WP No	Del Rel. N	Del No	Title	Description	Lead B	Nature	Dissemina	Est. Del. [	Rev. Due Date	Receipt Date	Approval Date	Status
WP3	D3.1	D12	Bio-resources prepared and exc	This deliverable will consist in a set of bio-r...	BANG	Other	Confider	31 Jul 2021		30 Jul 2021		Submitted
WP3	D3.2	D13	Standard assays, analytics and	This deliverable will consist in a report detai...	UHAM	Report	Confider	31 Jul 2021		30 Jul 2021		Submitted
WP8	D8.1	D43	FuturEnzyme website	This deliverable will consist in an open websit...	CSIC	Websites	Public	31 Jul 2021		26 Jul 2021		Submitted
WP2	D2.1	D6	Manufacturers' needs and speci	This deliverable will consist in a report conta...	CSIC	Report	Confider	31 Aug 202		04 Aug 202		Submitted
WP4	D4.1	D18	QR barcoding system, available	To ensure the traceability of all materials and...	CSIC	Other	Confider	31 Aug 202		06 Aug 202		Submitted
WP8	D8.2	D44	Visual identity guidelines	This deliverable will consist in a series of vi...	CSIC	Websites	Public	31 Aug 202		06 Aug 202		Submitted
WP8	D8.3	D45	Plan for using, communication	This deliverable will consist in a report defin...	ITB	Report	Confider	31 Aug 202		30 Jul 2021		Submitted
WP8	D8.4	D46	Data Management Plan	This deliverable will describe the Data Managem...	CSIC	ORDP: O	Confider	30 Sep 202		29 Sep 202		Submitted
WP1	D1.1	D1	Project meetings and bodies or	This deliverable will consist in a report summa...	CSIC	Report	Confider	30 Nov 202		26 Nov 202		Submitted
WP2	D2.2	D7	Set of 250,000 sequences pre-s	This deliverable will consist in a fasta file c...	CSIC	Other	Confider	30 Nov 202		26 Nov 202		Submitted
WP8	D8.5	D47	FuturEnzyme repository for dat	This deliverable will consist in an internal re...	BSC	Websites	Confider	30 Nov 202		26 Nov 202		Submitted
WP9	D9.1	D64	H - Requirement No. 1	- The procedures and criteria that will be used...	CSIC	Ethics	Confider	30 Nov 202		26 Nov 202		Submitted
WP9	D9.2	D65	POPD - Requirement No. 2	- The beneficiary must check if special derogat...	CSIC	Ethics	Confider	30 Nov 202		26 Nov 202		Submitted
WP9	D9.3	D66	NEC - Requirement No. 3	- If applicable, detailed information to demons...	CSIC	Ethics	Confider	30 Nov 202		26 Nov 202		Submitted
WP9	D9.4	D67	EPQ - Requirement No. 4	- Further information about the possible harm t...	CSIC	Ethics	Confider	30 Nov 202		26 Nov 202		Submitted
WP3	D3.3	D14	Set of 100 best clones, 10 isola	This deliverable will consist in a set of selec...	IST ID	Other	Confider	31 Mar 202		29 Mar 202		Submitted
WP2	D2.3	D8	Set of 1,000 enzymes selected	This deliverable will consist in a fasta file c...	BSC	Other	Confider	31 May 202		30 May 202		Submitted
WP8	D8.6	D48	Preliminary exploitation plan	This deliverable will consist in a report defin...	CLIB	Report	Confider	31 May 202		30 May 202		Submitted
WP8	D8.7	D49	FuturEnzyme project leaflet an	This deliverable will consist in a series of le...	ITB	Websites	Public	31 May 202		20 May 202		Submitted
WP2	D2.4	D9	Set of 180 enzymes for experin	This deliverable will consist in a fasta file c...	BSC	Other	Confider	31 Jul 2022		21 Jul 2022		Submitted
WP4	D4.2	D19	The FuturEnzyme Portfolio of 1	This deliverable will consist in a set of prote...	CSIC	Other	Confider	30 Sep 202		30 Sep 202		Submitted
WP4	D4.3	D20	Cell-free expression/reported s	This deliverable will consist in a cell-free ex...	UHAM	Other	Confider	30 Sep 202		27 Sep 202		Submitted
WP4	D4.4	D21	Biomimetic protease productio	This deliverable will consist in a cgreen chemi...	FHNW	Other	Confider	30 Sep 202				Pending
WP1	D1.2	D2	Initial-term external evaluatior	This deliverable will consist in a series of re...	CSIC	Report	Confider	30 Nov 202				Pending
WP3	D3.4	D15	Sequence, activity, and stabilit	This deliverable will consist in the datasets i...	BANG	data set	Confider	30 Nov 202				Pending
WP4	D4.6	D23	The metadata on expression yie	This deliverable will consist in the big datase...	UDUS	data set	Confider	30 Nov 202				Pending
WP4	D4.7	D24	At least 180 enzymes (recombi	This deliverable will consist in material of th...	CSIC	Other	Confider	30 Nov 202				Pending
WP5	D5.1	D26	The shortlist of at least 18 enz	This deliverable will consist in a report detai...	CSIC	Report	Confider	30 Nov 202				Pending
WP8	D8.9	D51	Report on public, intra-consort	This deliverable will consist in a report listi...	UHAM	Report	Confider	30 Nov 202				Pending

Milestones: 13 submitted, all of them at due time

- The 2 due to this month are achieved

Milestones

Number	Name	Lead Beneficiary	Delivery Date (Annex I)	Achieved	Delivery Date (actual)	Comments
1	First Consortium General Assembly c	CSIC	30 Jun 2021	☑	08 jun 2021	The First Consortium General Assembly (kick off) was convened 08.06.2021. After the kick off meeting, the first draft of the minutes were prepared by CSIC and circulated among partners on 14.06.2021. Currrently, the minutes are being revised by partners and as soon as final minutes are prepared and approved, the final version will be included in the Intranet
29	First version FuturEnzyme website	CSIC	30 Jun 2021	☑	28 jun 2021	The first draft for the FuturEnzyme website was completed; access to all partners and the EU Officer was allowed for comments and suggesions before publication
5	Set of 50,000 homology-driven sequ	CSIC	31 Aug 2021	☑	31 ago 2021	For the achievement of this milestone, internal and public repositories have been screened in silico using Hidden Markov Models (HMM) and BLAST (DIAMOND TOOL) approaches, followed by network analysis to identify sequences encoding enzymes of interest. The list of sequences will be made available in the internal project repository.
30	First version database for data mana	CSIC	30 Sep 2021	☑	27 sep 2021	This milestone consists in creating the first version database for data management. A tool available to consortium that will serve as FuturEnzyme internal repository has been made available to all the members for its evaluation. A document describing this tools (FuturEnzyme's website private area, FuturEnzyme's Zenodo Community and FuturEnzyme's repository at MareNostrum5) has been circulated
6	Set of 500 computational-driven seq	BSC	30 Nov 2021	☑	24 nov 2021	Report/sequences available - this milestone will consist in a fasta file containing 500 full-length candidate sequences encoding enzymes relevant to FuturEnzyme with high probability to fulfill manufacturer' specifications based on computational predictions. The fasta file will be deposited in the FuturEnzyme internal repository. Through a protocol extensively described in the deliverable D2.2, at least 3,152,857 sequences have been selected by in silico approaches and are available in the intranet's project website. From them, a total of ca. 500 representing each of the clusters representing the enzymes identified, have been selected and and are available in the intranet's project website.
9	First round of functional screens cor	IST ID	30 Nov 2021	☑	24 nov 2021	Materials available - this milestone will attest the realisation of the first screens of available bio-resources. By applying a number of protocols extensively described in the deliverable D3.2 and in silico methods, a number of bio-resources (enzymes, clones, microbes, microbial communities) were screened and selected. In details: 382 new bio-resources (strains: 191; clones: 3; pure enzymes: 188) were found positive for activities: • Hydrolases (esterase/lipase/cutinase): 134 • Hydrolases (proteases): 48 • Hyaluronidases: 3 • Oxidoreductases: 58 • Others (proteases, amylases, etc.): 139 Among them, 307 were identified by...
10	First round of sequencing completec	BANGOR	30 Nov 2021	☑	24 nov 2021	Data available - this milestone will attest to the realisation of the sequencing of the first selected bioresources found to be positive in the screen tests. the sequences are available at the laboratories of the partners performing the selection and sequencing, and soon will be made available at the intranet's project website and the intranet's repository at the Barcelona Supercomputing Center (BSC).
12	First set of 250 enzymes expressed a	CSIC	31 Mar 2022	☑	30 mar 2022	Report/material available - this milestone attests the realisation of the first production batches for 250 enzymes.
13	First set of benchmark enzyme mate	CSIC	31 Mar 2022	☑	30 mar 2022	Report/material available - this milestone attests the realisation of the first production batches of benchmark enzyme materials
11	The first sampling campaign comple	CNR	31 May 2022	☑	27 may 2022	This milestone attests the completion of campaigns for sampling new bio-resources with information about sample sites available (sites data, samples available)
14	Characteristics, first 180 enzymes (V	UDUS	31 May 2022	☑	27 may 2022	This milestone attests for the realisation and availability of the characteristics of the 180 enzymes selected as prioritary targets (data available)
15	Characteristics, first 3 multi-enzyme	CSIC	30 Sep 2022	☑	27 sep 2022	Data available - this milestone will attest the realisation and availability of the production systems and characteristics of the 3 first multi-enzyme
16	Genetic engineering: first round con	BSC	30 Sep 2022	☑	27 sep 2022	Report/material available - this milestone will attest the realisation of the first genetic engineering tests
17	Supramolecular engineering: first ro	FHNW	30 Nov 2022	☐		
18	First set of PluriZymes	BSC	30 Nov 2022	☐		

Next Deliverables (all)

Deliverable Number	Deliverable Title	WP number	Lead beneficiary	Description	Type	Dissemination level	Due Date	Month/year
D1.2	Initial-term external evaluation reports	WP1	1-CSIC	This deliverable will consist in a series of reports from the "Panel of External Advisory Scientists, Stakeholders, Policymakers and Consumers" in which experts judge the overall project success, both in terms of the quality of scientific results and the potential impacts during the first reporting period	Report	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D3.4	Sequence, activity, and stability datasets from best positive bioresources	WP3	3-BANGOR	This deliverable will consist in the datasets informing about the sequences, performances and stabilities of best preselected bio-resources (isolates and clones). This information, which will be detailed in a comprehensive manner in a report that will accompany this deliverable, will be associated to the QR codes linked to each bio-resource, which will be made available in the internal FutureEnzyme repository	Data sets, microdata, etc.	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D4.6	The metadata on expression yield, activity and stability, available	WP4	5-UDUS	This deliverable will consist in the big datasets informing about the expression yield, activity and stability datasets of all enzymes generated in the project. This information, which will be detailed in a comprehensive manner in a report that will accompany this deliverable, will be associated to the QR codes linked to each enzyme, which will be made available in the internal FutureEnzyme repository	Data sets, microdata, etc.	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D4.7	At least 180 enzymes (recombinant, native, biomimetic) with attractive properties, available	WP4	1-CSIC	This deliverable will consist in material of the 180 best enzymes (recombinant, native, biomimetic). This material will be produced by, and exchanged/transferred to, partners for in deep engineering and analysis. This deliverable will be accompanied by a report that will include the SDS-PAGE analyses to prove the expression levels and protein yields as well as the purity of the proteins after purification, as well as the details of expression systems, production methods and purification methods, and the characteristics of each enzyme on the basis of which they were selected. This information will be linked to the corresponding QR code associated to each material, which will be made available in the internal FutureEnzyme repository	Other	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D5.1	The shortlist of at least 18 enzymes nominated for engineering	WP5	1-CSIC	This deliverable will consist in a report detailing the best 18 enzymes nominated for engineering out of the initial set of 1000 enzymes. This deliverable will be accompanied by a report detailing the characteristics of each enzyme on the basis of which they were selected. This information will be linked to the corresponding QR code associated to each enzyme, which will be made available in the internal FutureEnzyme repository	Report	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D8.9	Report on public, intraconsortium, and interconsortia 18-months events	WP8	4-UHAM	This deliverable will consist in a report listing all public, intra-consortium, and inter-consortia events organized until month 18 with indication of assistance, outcomes, communication and dissemination efforts, etc. This material will be available through the website. Public events will include workshops, courses and other public events. Intra-consortia events will include internally organized exploitation worshops, with indication of assistance, and outcomes. Upcoming exploitable results will be monitored in intra-consortium exploitation workshops by providing questionaries to partners, the results of which will be evaluated and summarized in this deliverable as a report. The exploitation workshops will consist in 1 h meeting after the general annual meetings. Questions will include at least the following: i) identification of potential users of the results inside or outside the consortium; ii) Identification of authors of a result (Should co-ownership be applied?); iii) which enzymes are interesting? (are they published?; are there any genetic modifications that allow us to patent or protect them?; iv) If an interesting enzyme or results is found, which could be the next steps before publishing/protecting?; v) What additional steps would be needed so that the enzyme can be applied / manufactured industrially?; vi) do the enzyme/results has other applications different to those initially thought for the Project?; vii) Have we achieved the proposed objective of the Exploitation Plan?; viii) Is there something similar published or patented? Is the enzyme/result easy to copy?, etc. Inter-consortia events will include online and face-to-face meetings with partners of other consortia	Report	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
D4.8	Set of high-performing multi-enzyme blends	WP4	1-CSIC	This deliverable will consist in materials representing multi-enzyme blends for formulating detergents and textiles. This deliverable will be accompanied by a report detailing the enzymes used to prepare each of the multi-enzyme blends and their concentrations. This information will be associated to the QR codes linked to each enzyme, which will be made available in the internal FutureEnzyme repository	Other	Confidential, only for members of the consortium (including the Commission Services)	20	January 2023

Next Milestones (all)

Milestone Number	Milestone Title	WP number	Lead beneficiary	Means of verification	Due date	Month/year
MS17	Supramolecular engineering: first round completed	WP5	9-FHNW	Report/material available – this milestone will attest the realisation of the first supramolecular (nanoimmobilisation) engineering tests.	18	November 2022
MS18	First set of PluriZymes	WP5	2-BSC	Report/material available – this milestone will attest the realisation of the first sets of PluriZymes	18	November 2022
MS4	First inter-consortia confidentiality agreements	WP1	1-CSIC	Minutes approved, consortia - this milestone will consist in the minutes of meetings (online or face-to-face) with members of other funded projects	20	January 2023
MS19	First set of best enzymes at gram scale	WP6	12-Bio_Ch	Report available – this milestone will attest the realisation of the first production baches at gram scale for best enzymes to be used for tests prior to preindustrial validations	20	January 2023
MS17	Supramolecular engineering: first round completed	WP5	9-FHNW	Report/material available – this milestone will attest the realisation of the first supramolecular (nanoimmobilisation) engineering tests.	18	November 2022
MS18	First set of PluriZymes	WP5	2-BSC	Report/material available – this milestone will attest the realisation of the first sets of PluriZymes	18	November 2022
MS4	First inter-consortia confidentiality agreements	WP1	1-CSIC	Minutes approved, consortia - this milestone will consist in the minutes of meetings (online or face-to-face) with members of other funded projects	20	January 2023

Next WP1 Deliverables & Milestones

Del/Ms Number	Title	WP number	Lead beneficiary	Description	Type	Dissemination level	Due Date	Month/year
D1.2	Initial-term external evaluation reports	WP1	1-CSIC	This deliverable will consist in a series of reports from the "Panel of External Advisory Scientists, Stakeholders, Policymakers and Consumers" in which experts judge the overall project success, both in terms of the quality of scientific results and the potential impacts during the first reporting period	Report	Confidential, only for members of the consortium (including the Commission Services)	18	November 2022
MS4	First inter-consortia confidentiality agreements	WP1	1-CSIC	Minutes approved, consortia - this milestone will consist in the minutes of meetings (online or face-to-face) with members of other funded projects	-	-	20	January 2023
MS4	First inter-consortia confidentiality agreements	WP1	1-CSIC	Minutes approved, consortia - this milestone will consist in the minutes of meetings (online or face-to-face) with members of other funded projects	-	-	20	January 2023

The FuturEnzyme Project Officer

Meetings with Project Officers: 3

- 26.04.2022
- 18.09.2022
- September 2021

The FuturEnzyme Advisory Board

02 November 2022

Stakeholders

Dr. Jog Raj

PATENT CO

20 October 2022

Stakeholders

Dr. Ksenia Niesel

BAYER AG

Scientific

Prof. Víctor de Lorenzo

Centro Nacional de Biotecnología, CSIC

Scientific

Prof. Daniele Daffonchio

King Abdullah University of Science and Technology (KAUST)

18 October 2022

Consumers

Luisa Crisigiovanni

ALTROCONSUMO

- Prepare a report summarizing all the activities, actions, and results obtained so far, equivalent to the document for the first reporting period, but adapted to the AB
- Invited to the 24-month General Assembly, 6-7 July 2023, Hamburg, Germany

The FuturEnzyme Advisory Board

Stakeholders

Dr. Jog Raj

PATENT CO

- Convenience of online meetings when necessary.
- Interest in **transparency and traceability**: QR code for every enzyme of interest that details the relevant information (e.g. partner, origin of the enzyme, sequence, expression system, activities, stability, etc.).
- Use of **hit enzymes out of FuturEnzyme manufacturers' interests**. We commented that they will be made available outside the consortium e.g. by Eucodis' commercial portfolio, or partners' choices (see Preliminary exploitation plan, D8.6). Essential to clearly define the path (if you get interest from 2 or 3 companies, what will the group do? Who will own the IP? Advertising by website and social media is appropriate, but the website should be linked to enzyme producing companies, e.g Novozymes, Advanced Enzymes, Dupont, etc.).
- **Offering the enzymes to other industries**: The **enzyme activity should be validated** in industry processes and tested by labs in industry.
- Importance of having a **strict price control**, and how maintain a low cost of the final product is essential. For instance, in PatentCo's case, the product price is around 1-3€ per kg, so they do not have big profit margin.
- The work from this project and **the enzymes should be presented in reputed congresses** of different sectors, e.g enzymes, detergents, biochemistry, etc.

The FuturEnzyme Advisory Board

Stakeholders

Dr. Ksenia Niesel

BAYER AG

- Cooperation if necessary for the high scale enzyme production.
- Relevance of **Nagoya protocol**.
- All the partners have access to the **metadata**.
- In case we do not use **eukaryotic systems** for expression processes, we might be losing possibilities and yield. We commented that we usually begin with *E. coli*, but we have a variety of other expression organisms, eukaryotic and prokaryotic, that can be further tested if needed.
- Offers **possibility to check the enzymes** by Bayer

Scientific

Prof. Víctor de Lorenzo

Centro Nacional de Biotecnología, CSIC

Points to reinforce: **production, improve innovation in the expression systems**.

De Lorenzo was telling that we used in many cases sophisticated bioinformatic, computational and HTP systems to discover the enzymes and engineer them, but at the end we are cloning mostly in E. coli. Alternative "microbial chassis" to produce the enzymes?

We highlighted that we have available different expression organisms (Eucodis or BioC_Chem) and the cell-free expression system (UHAM); BioC_Chem is developing a method to predict the culture media depending on the sequence and organism.

The FuturEnzyme Advisory Board

Scientific

Prof. Daniele Daffonchio

King Abdullah University of Science and Technology (KAUST)

- Relevance of the **Nagoya Protocol**.
- Interest in how we managed **to search amongst the thousands of proteins we started looking for our hits, and the criteria** we use (and keep on using) for selecting samples and the type of environmental source to search for the enzymes.

  We commented that in the case of hyaluronidases, they are mostly found in microbes inhabiting salty environments; in the case of textiles and detergents, we know the fatty acids that we want to transform, so we screened amongst the meta/genomes by homology. All the partners involved follow the decision-taking workflow.

The FuturEnzyme Advisory Board

Consumers

Luisa Crisigiovanni

ALTROCONSUMO

- **Adequate labelling of the final products**, regarding sustainability and eco-friendliness. Access to as much information of the formulations of the products as possible, essential for increasing transparency and avoiding greenwashing. Green claims substantiated by facts and figures.
- Increase consumers' awareness of the **impact of their decisions when choosing** what they purchase. Messages such as "repair instead of buying again; wear a garment longer is greener; recycle, etc." can be included in divulgative articles.
- European platform **Euroconsumers** (Consumer's Rights Organisation): article related to our project and the new innovations for daily-use products with a green vision. Next year. They need to evaluate the possibility to mention some of the project's outcome. Reach aprox 300 000 consumers (Italy) plus the website visitors (around 40 million per year).
- **Subcontract agreement** (ITB) in order to carry out the activities, such as an extensive consumers' survey. Even their environment experts can participate in some of FuturEnzyme's events.
- **ICRT** (International Consumer and Research Testing) to assess the sustainability and eco-friendliness of the new products, and their accessibility in terms of price. This would be a different **comparison** than that made inside our consortium **with benchmark products**.

Final remarks

- For the 18 M report
- Efforts should be done to clearly define the source of each enzyme
  - Clearly compile information about new Bioresources (e.g., new samples, libraries, enrichments, isolates, etc.) for WP3
  - Clearly compile information about sequences (metagenomes, genomes and fosmid sequences) for WP3
  - GPS coordinates (WP3)
- Effort should be done to compile information about the enzymes we retrieved
  - How many were identified by in silico approach (WP2) and the source
  - How many were identified by functional approach (WP3) and the source
  - Have their sequences, so that we can compared within them and with similar enzymes in databases
- Effort should be done to compile as much information as possible for all enzymes cloned/synthetized/characterized

Final remarks

- For the 18 M report
- Effort should be done to define the best candidate to focus on, how to proceed with engineering (genetic and supramolecular) and how to transfers to SMEs and industrial partners.
  - How the enzymes should be selected which will undergo further characterization and/or optimization.
  - Will industry partners first perform tests by themselves with promising candidates?
  - As a next step, they then remove appropriate candidate enzymes from the collection, which are no longer available for the university partners?
  - As mentioned by the Advisory Board member Jog Rag, how will the patent situation be handled?
  - A decision-taking workflow needed.
- WP leaders should help in compiling the information to be later on digested by the coordinator.
- Economic period: be ready

Final remarks

- For the 18 M report
- Periodic reporting functionality in the participant portal: following the end of each reporting period the functionality of periodic reporting in the Participant Portal will be activated. While the periodic reporting session is open in the electronic exchange system:
  - Each participant will be able to complete on-line their own Financial Statement (and the financial report of their Third Parties, if any) including the explanations on the use of resources;
  - Coordinator will be able to upload the Part B of the periodic technical report as a pdf document.

Final remarks

- Next year meetings
- 1. Date of the meeting in Brussels 1 February 2023
- 2. Date of the next Annual Meeting in Hamburg 6-7 July 2023
- 3. Date of the course in Hamburg? 3-6 July 2023 (ESSIB)
  - Draft agenda in progress