Removal of Legacy Substances from polyvinylchloride (PVC) via a continuous and sustainable extrusion process

Grant Agreement No 821136

18M online meeting
Minutes

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Contents

1. Agenda

Date December 17th – 18th 2020

Venue Online – Teams Meeting

Agenda – Day 1: December 17th, 2020 - Click here to join the meeting

TIME	SUBJECT	Presenter
08:30-08:45	Introduction	**CENTEXBEL**
Technical Working session I WP progress, main results, deliverable status and plans for the next period Discussions on open issues and plans for next period **deliverable status and plans for the next period**		
08:45-09:45	**WP1 - Recyclate characterisation and sorting**	**IRIS**
	Task leaders makes a 10 min. presentation per task + 2 min. short discussion Technical working session: • In depth evaluation of model samples • Characterization of the PVC waste stream • Evaluation of detection techniques • Development of a monitoring system for detecting Pb- and phthalates based LS in EoL PVC	IRIS, CTB, AIMPLAS, Fr-ICT, DECEUNINCK, DANOSA, PROMOLDING , Bulk.ID, AZOR, OVAM, Vinylplus
09:45-10:00	*Break*	
10:00-11:30	**WP2 - Batch extraction of PVC containing LS**	**CENTEXBEL**

TIME	SUBJECT	Presenter
	Task leaders makes a 10 min. presentation per task + 2 min. short discussion Technical working session: • CO2 extraction process for the removal of phthalates • Extraction process for phthalates and lead removal using (NA)DES as co-solvents • Development of MoS4-LDH based process for lead removal	CTB, Fr-ICT, Aimplas, UVEG
11:30-12:00	**WP3 – Continuous extraction of PVC containing LS**	**Fr-ICT**
	Task leaders makes a 10 min. presentation per task + 2 min. short discussion Start-up of WP3: • First results of the continuous $scCO_2$ extraction	CTB, Fr-ICT, Aimplas, UVEG, Deceuninck, Danosa, Promolding
12:00-12:30	**Open issues Day 1 + closing remarks Day 1**	

Agenda – Day 2: December 18th, 2020 Click here to join the meeting

TIME	SUBJECT	Presenter
Technical Working session II WP progress, main results, deliverable status and plans for the next period		
08:30-09:30	**WP4 – Recycling/Reuse of byproducts and their safe handling**	**Azor**
	Task leaders makes a 10 min. presentation per task + 2 min. short discussion • Safe recovery of the extraction process byproducts • Contaminant assessment and guidelines and methodology for safe handling of byproduct.	CTB, Fr-ICT, Aimplas, UVEG, Deceuninck, Danosa, Azor
09:30-10:30	**WP6 - Regulating framework and policies for the health, safety and environmental risks for all proposed activities.**	**Vertech**

TIME	SUBJECT	Presenter
	Task leaders makes a 10 min. presentation per task + 2 min. short discussion • Environmental life cycle analysis • Life cycle costing and cost-feasibility analysis • Social LCA assessment • Circularity assessment	VERTECH, CTB, AIMPLAS, UVEG, Fraunhofer, DECEUNINCK, DANOSA, AZOR, PROMOLDING, ENCO, SIE, OVAM, Vinylplus
10:30-10:45	*Break*	
Dissemination, exploitation and coordination WP progress, main results, deliverable status and plans for the next period		
10:45-11:30	**WP7 - Dissemination, Exploitation and Business Planning** Task leaders 5-10 min. per running task + 2 min. discussion	**Enco** All partners
11:30-12:15	**WP8 – Coordination** Task leaders 5-10 min. per running task + 2 min. discussion	**CENTEXBEL** All partners
12:15-12:30	Short recap Action Plan for the next 6 months Planning of the next meeting, AOB, Closing remarks	All

2. Attendees

Day 1: December 17th, 2020

Attendee Name	Company/institute name
Vanessa Gutiérrez Aragonés	AIMPLAS
Ascensión Marin Moya	AZOR
Mariano Aleman Marin	AZOR
Lars van Volsem	BULK ID
Guy Buyle	CTB
Stijn Corneillie	CTB
Tom Vercoutere	CTB
Isabel De Schrijver	CTB
Eva Del Amo	DANOSA
Javier Escudero	DANOSA
Johan Pauwels	DECEUNINCK
Ruben Beernaert	DECEUNINCK
Giuseppe Salvio	ENCO
Marco de la Feld	ENCO
Jan Diemert	FRAUNHOFER ICT
Sebastian Reinhardt	FRAUNHOFER ICT
Andrei Holzer	FRAUNHOFER ICT
Ariane Zwintscher	FRAUNHOFER ITEM
Katherine Blümlein	FRAUNHOFER ITEM
Partosch Falko	FRAUNHOFER ITEM
Victor Olmos	IRIS
Tomeu Coll	IRIS
Luk Umans	OVAM
Els Herremans	OVAM
Daniel Vlasveld	PROMOLDING
Chris De Ruijter	PROMOLDING
Jorge Barona	SIE
Antonio Ribera	UVEG
Carmen Fernandez Conde	UVEG
Arjen Sevenster	VINYLPLUS
Philippe Gabriels	VINYLPLUS

Day 2: December 18th, 2020

Attendee Name	Company/institute name
Vanessa Gutiérrez Aragonés	AIMPLAS
Ascensión Marin Moya	AZOR
Mariano Aleman Marin	AZOR
Lars Van Volsem	BULK ID
Guy Buyle	CTB
Stijn Corneillie	CTB
Tom Vercoutere	CTB
Isabel De Schrijver	CTB
Javier Escudero	DANOSA
Eva Del Amo	DANOSA
Johan Pauwels	DECEUNINCK
Giuseppe Salvio	ENCO
Andrei Holzer	FRAUNHOFER ICT
Sebastian Reinhardt	FRAUNHOFER ICT
Jan Diemert	FRAUNHOFER ICT
Ariane Zwintscher	FRAUNHOFER ITEM
Katherine Blümlein	FRAUNHOFER ITEM
Partosch Falko	FRAUNHOFER ITEM
Tomeu Coll	IRIS
Els Herremans	OVAM
Luk Umans	OVAM
Chris de Rujiter	PROMOLDING
Daniel Vlasveld	PROMOLDING
Jorge Barona	SIE
Antonio Ribera	UVEG
Carmen Fernandez Conde	UVEG
Léo Staccioli	VERTECH
Arjen Sevenster	VINYLPLUS

3. Presentations

All presentations will be available on the REMADYL intranet private area (www.remadyl.eu)

4. Minutes

Day 1 – 17 December, 2020 – Online meeting

Introduction

Short introduction to the general Assembly

WP1 Recyclate characterization and sorting.

Objectives overview.

- Deliverable 1.2: overview of different types of PVC waste-> M24.
- Deliverable 1.1: to produce model samples with well-defined content of LS – M4 **submitted.**
- Evaluate several detection techniques for use as inline detection system – M12 **submitted.**
- Deliverable 1.3: to develop an inline monitoring system for PVC with LS – M33.
- Deliverable 1.4: to formulate recommendations and guidelines for EoL PVC and plastic sorting approaches – M36.

Task 1.1 Production of model samples and mapping and characterization of the PVC waste streams.

Substask 1.1.1 Model samples production for LS extraction testing.

- Additional model samples containing known concentrations of LS have been produced:
    - 600 kg batch of DEHP plasticized PVC has been produced by DANOSA and distributed to FRAUNHOFER-ICT and CENTEXBEL.
    - Additional sheets of PVC containing different plasticizers (TOTM, DOTP, DIUP, DOP, DPHP, DIDP, DTDP) have been produced by DANSOA and sent to IRIS.

Subtask 1.1.2 Mapping and characterization of PVC waste streams.

- Additional technical data is being gathered on different PVC products, their applications and their potential for the different recycling technologies.
- ERFMI and RECOVINYL are being contacted to obtain EoL plasticized PVC samples, to study the plasticizer contents that can be found.
- DECEUNINCK will share the information on the typical Pb content found in recycled PVC.
- OVAM is setting up a questionnaire to study the handling of plasticized PVC in cable insulation.

Task 1.2 Evaluation of detection techniques.

- Lead will be detected in PVC using LIBS laser

  - Question: how could the pigments influence the Pb measurement? Presumably only the Pb-containing pigments will influence the measurement? This will be researched on the real world PVC samples.

- Detection of plasticizer in soft PVC will be using extended NIR spectroscopy (1000-2500 nm).

Task 1.3 Development of a monitoring system for detecting lead and phthalates based LS in EoL PVC.

- Monitoring system for lead detection in PVC.
  - Mechanical adjustments of the LIBS systems, to simulate the continuous measurement conditions:
    - Installation of a feeder (simulate real batch of samples and estimate the throughput).
    - Installation of a guiding mechanisms of the PVC (align samples with laser beam).
    - Use of a black conveyor belt and laser safety screens (avoid laser back reflection and protect end users from laser radiation).
    - LIBS spectra on reference samples.
- Monitoring system for plasticizer detection in PVC.
  - First chemometric models for plasticizers classification in PVC sample.
  - Currently the DOP, DPHP, DIDP, DIUP and DIDP plasticizers were studied.
  - Classification using partial least square discriminant analysis (PLS-DA).
  - Good results for plasticizer discrimination using NIR.
    - Almost all replicates from all plasticizers have been classified correctly.
    - There are not enough DIUP and DTDP samples/controls to claim good discrimination results.
  - Conclusions:
    - NIR spectroscopy with chemometrics gives good predictions.
    - Additional samples of different plasticizers are required to build a more reliable predictive model.
    - The capability to predict the plasticizer concentration in the PVC will also be studied.

Next actions

- After required adjustments, LIBS measurements on calibrated and real world EoL samples will be performed
- More NIR test will be performed on PVC with DOP plasticizer, for the validation of the technique.
- T1.4 will start in the coming months.

WP2 Batch extraction of PVC containing LS

Task 2.1 Development of a CO_2 extraction process for the removal of phthalates.

- Initial extractions experiments were performed on powder blends and showed promising results. However, when testing on PVC sheets, the extraction conditions needed to be improved.
- The solubility curves showed pressures between 110-335 bar to be necessary to dissolve DEHP, depending on the temperature.
    - Addition of co-solvent could significantly reduce the required pressure by 40 to 100 bar depending on the temperature.
    - Higher extraction efficiencies were achieved using a co-solvent, in the extraction of DINP and DOA, even at lower pressures.
    - All extraction times were 4 hours. The extraction time seems to be the main bottleneck.
- A larger scale batch extraction has been performed. 1,5 kg of PVC was used, and 240 g DEHP was captured (45°C, 200 bar, co-solvent).
    - An extraction efficiency of 50% was calculated.
        - Lower extraction yield than previously tested, possibly due to the different geometry (PVC sheets vs PVC compound).
        - The remaining solvent in the PVC should be measured.
            - Can influence the extraction efficiency calculation.
            - Could be measured through VOC emissions.
    - The extracted plasticizer was sent to KULEUVEN for the cooperation between REMADYL and CIRCULAR FLOORING, in the plastics circularity multiplier.
    - A sample of PVC should be sent to CTB, for analysis of the phthalate content after extraction, and to verify the calculated extraction efficiency.
    - All DEHP was captured in EtOH.
        - As part of the extraction process, EtOH is present in the extractor.
- Transfer to larger scale extractive extrusion.
    - Lower temperatures reduce the pressure needed for solubility.
        - processability and melt seal needs to be assured.
    - Pressure range are high for pure scCO2 extraction, addition of co-solvents enables milder conditions.
        - Co-solvent has plasticizing effect itself on the PVC.
    - Lower phthalate concentrations enable conditions for complete solubility.
        - DEHP content of PVC input is rather fixed by waste composition.
    - Longer extraction time and CO2 throughput leads to better extraction.
        - Especially extraction time will be bottleneck in extractive extrusion.
- Further batch tests necessary to determine the required extraction time in more detail.

Task 2.2 Extraction of LS using NADES

- A screening took place different NADES solvents, to extract the Pb out of real EoL PVC micronisate (24h extraction, 90°C and 1/20 PVC/NADES ratio).
- 5 different classes of NADES were tested.

  - Organic acid based NADES performed the best.
    - Lactic acid/levulinic acid.
    - Levulinic acid/ethylene glycol.
  - Hydrofobic NADES also performed well.
    - Lauric acid/Menthol.
    - Decanoic acid/menthol.
- Pure solvents which make up the NADES were also tested, and 4 solvents were identified as promising.
  - Lactic acid
  - Levulinic acid
  - Ethylene glycol
  - Decanoic acid
- Using the Lactic acid/levulinic acid NADES as model solvent, the extraction conditions were further optimized.
  - Higher temperatures (120°C) increase the extraction speed and efficiency.
  - The highest PVC/NADES (1/5) ratio was most suitable. The solvent use could possibly be further reduced.
  - Longer extraction times give better extraction efficiencies, however after 1hour >50% of the Pb was extracted out of the PVC.
  - The PVC showed first signs of degradation after 8 hours of extraction. Extraction time should not exceed 8h, preferably even 4h.
  - Side effects.
    - The Ca content also decreased by 60-80% at the most optimal extraction conditions.
    - The Ti content only decreased after 24h extraction at 120°C.
- The compatibility of the NADES with $scCO_2$ was tested, in order to evaluate the use as co-solvent.
  - No NADES or pure solvent was suitable, since none of the solvent went into solution in the $scCO_2$ at conditions suitable for continuous extractive extrusion.
  - Only levulinic acid/ethylene glycol showed solubility at 130°C and 300 bar, which greatly exceeds the reaction conditions for continuous extractive extrusion.
- During the extractions, no PVC went into solution. The Pb extraction is presumed to be due to the swelling reaction of the PVC.
- Extractions might be optimized by repeating several 1h batch reactions.
- Outlook:
  - Further optimization of the solvent use.
  - Larger scale batches.
    - Evaluation of the mechanical properties of the PVC.

Task 2.3 Development of MoS4-LDH based extraction process for Pb.

- Development of labscale process for the removal of lead.

- Synthesis of the LDH at lab scale
  - Direct synthesis of LDH with tetrathiomolybdate doesn't work.
  - Direct ion-exchange rection from NO_3 to MoS4 does not work.
  - Calcination of LDH precursor and regeneration of LDH is the best procedure.
    - Calcination destroys the layered structure, so the MoS_4 can be introduced. Then the LDH can be reconstituted to its layered structure again.
    - Calcination at 500°C gave the best results.
    - 20-gram LDH has been synthesized.
    - A second batch will also be synthesized to do additional testing.
    - Calcination is a simple process, and easily scalable.
- Test will be carried out to remove lead using LDH-MoS_4 at lab scale.

- Method development to remove lead using MoS4-LDH particles.
  - The method for the filtration of LDH from PVC has been determined.
  - Initial tests seemed to indicate that the LDH would not be stopped by the melt filter.
  - Results were further checked using clear LDPE
    - The LDH was held back by the filter.
    - Visual verification.
    - Verification through ICP-MS (both CTB and UVEG).
  - The filtration process works.
  - The filtration process requires a specific particle size of the LDH.
    - AIMPLAS is in the progress of purchasing a 'pelletizer' to size the LDH to the correct dimensions.
    - It is not expected that the agglomerate will delaminate, as a low shear extruder is used, high pressures are used during the agglomeration, and during preceding trial a similar method was followed.
  - AIMPLAS will perform 1 kg trials and would use 10 gram of LDH per trial.

WP3 continuous lab-scale and pilot extraction processes

Task 3.1 Transfer to continuous lab scale of the extrusion and NADES extraction process.

- Task has started with a delay due to its dependency on input from WP1 (model materials) and WP2 (processing conditions).

- Initial trials were started with the large batch of DEHP plasticized PVC delivered from DANOSA, in the continuous extractive extrusion equipment.
  - 52D, 27mm twin screw extruder.
  - Extraction zone is 40% of the extruder.
  - Counter flow of the $scCO_2$ in the extruder.
- The extrusion parameters give a stable and repeatable process. However, there is no plasticizer captured, or extracted from the PVC.

- Processing conditions were below the predetermined solubility parameters, for DEHP in $scCO_2$. The processing conditions were further optimised to better approach the solubility parameters.
    - Lower temperature.
    - Higher pressure.
    - Lower extrusion speed, lower throughput and higher residence time of the PVC.
    - System is running at highest possible torque.
- Processing properties are still below the solubility curves, other conditions should be investigated.
    - It will be difficult to further improve the processing conditions, as the extruder is running at maximum torque.
    - Other co-solvents can possibly plasticize the PVC more, allowing a decrease in temperature of the processing conditions, and a greater pressure build up at the melt seals in the extruder.
    - Possible literature on plasticizers is “handbook of plasticizers” by George Wypych.
    - More polar molecules are typically worse plasticizers.
    - We need to find a co-solvent which plasticizes the PVC more, allowing a temperature decrease in the extruder, while also increasing the solubility of the DEHP.
- The influence of time will be further investigated. Several batch extraction at different time intervals will be set up, to determine the required extraction time.

WP8 Preparations for the review meeting

- End of M18 -> end of first REMADYL reporting period.
    - First review:
        - Based on the progress reporting.
        - Based on the deliverables.
        - Dedicated review meeting (18/02/2021) – only with WP leaders.
        - The goal is to present the project result, the timing and deviations from the plan with adequate motivations.
    - ‘Time-wise’:
        - Periodic reporting – 3 reporting periods (M1-18, M19-36, M37-48).
        - Continuous reporting – mainly the deliverables.
        - Final reporting.
    - ‘Thematic’:
        - Technical (M18 progress update).
            - Similar to month 9 reporting.
            - Some parts of month 9 can be reused.
            - Each WP leader organizes the collection of data for the WP.

- This progress report needs to cover the **full** first reporting period.

- Financial
  - We ask for the numbers, but not for the proof. However each project partners should log their proof individually (timesheets, invoices, travel tickets,….).
  - Costs can only be made for the duration of the project (e.g. things done before 1 June 2019 cannot be included in the financial reporting).
  - Reporting is done in 2 steps
    - Registration of the cost, using the excel template send out by CTB.
    - Each partner must also submit their own financial report, to the online portal of the European Union. In case there are questions concerning this reporting, CTB can be contacted for help.
- Socio-economic (publications, gender, 'innovations in market',…).

- Official Progress Reporting delivery date: **January 31**
  - Following timing proposed:
    - Submission online Jan 29
    - Financial data online Jan 25
    - Final Progress report to review by all Jan 25
    - Updated draft for review by WPL & PSC Jan 20
    - **Financial excel data deadline** **Jan 15**
    - **Update of WPL to CO** **Jan 15**
    - Financial & WP 'template' out Dec 18

Day 2 – 18 December, 2020 – Online meeting

Introduction

Short introduction to the general Assembly

WP4 recycling and reuse of byproducts and their safe handling

The objective of WP4 is the recovery of the legacy substances removed from PVC.

- Separation of Pb salts from the LDH trapped in the metallic meshes of the melt filter.
- Obtaining metallic Pb from salts for further uses in automotive batteries.
- Safe recovering and management of phthalates.
- Best practice guide for legacy substances removed.

Subtask 4.1.1. Solubility of DEHP in $scCO_2$

- Large scale PVC batch extraction (45°C, 200 bar, co-solvent).

- Cooperation with the Circular Flooring project and KULEUVEN.
- KULEUVEN does the hydrogenation of the DEHP.
- Very high hydrogenation yield >99%.

Subtask 4.1.2 Recovery of high purity metallic lead from the lead salt byproduct.

- No Pb has been recovered by the process yet.
- Waiting on the extraction trials by AIMPLAS, and the recovery of the Pb by UVEG.

Task 4.2 Recovering of high purity metallic lead from the salt byproducts

- Initial trials with the Pb species that will be captured were carried out
    - $PbCO_3$ is the expected product from the LDH.
    - Material characterization has been carried out, in comparison with $PbSO_4$ which is regularly used in Pb production.
        - Humidity and sulfur concentration determine the performance of the material and the fluxes needed for the lead melting process.
    - The REMADYL lead salts, should not have humidity or a metallic fraction present. In theory the performance should be higher.
        - Should reduce the required fluxes.
        - It is important to characterize the material and analyze all components in order to adjust the fluxes and metallurgical process conditions.
    - Using $PbCO_3$ would decrease the need of anthracite, Fe_2O_5 and increase the combustion chamber due to the reduction of iron.
    - Using $PbCO_3$ would shift the emissions from sulphate dioxide to carbon oxide.
    - Future actions
        - Analyze the Pb stabilizer used in samples previously.
        - Analyze the lead recovery from melt filters.
        - Determination of the required technology to obtain high purity lead from lead salt recovery.
        - Determination of inputs and outputs from the lead recovery process.

Task 4.3 Contaminant assessment and guidelines and methodology for safe handling of byproducts

- Risk assessment and Best practice guide consists of:
    - Hazard assessment
    - Exposure assessment
- 1st step is the hazard assessment
    - Identified common compounds of PVC
        - list of 41 compounds
        - Allocated harmonized hazard classifications according to CLP

- Most critical findings regarding human health include substances posing CRM properties (substances which are classified as carcinogenic, reproduction toxic, mutagenic) – e.g. short-chain phthalates, Pb^{2+} salts, BPA, cadmium, tributyl tin.
- Some substances with possible endocrine disrupting properties were identified (short-chain phthalates)
- Carcinogenicity is being identified in several compounds e.g. Sb_2O_3, OBPA, TiO_2 etc.

- Exposure assessment will focus on the legacy substance
    - Exposure assessment requires further input
        - Amount of PVC, ratio PVC/solvent, concentration of hazardous substances?
        - Process open or closed?
        - Contact point between the operator and byproducts?
        - Exposure time/duration
        - Room size where the process takes place.
- What will be the boundaries of the hazard assessment?
    - Will cutting and preprocessing of the PVC be incorporated?
        - The European recycling organization might have information concerning this hazard assessment.
        - Preprocessing is currently already being followed up by blood analyses and breathing analysis at DECEUNINCK.

WP6 Regulating framework and policies for the health, safety and environmental risks for all proposed activities

Task 6.1 Environmental life cycle assessment and Ecodesign

- Quantify the **environmental impacts** of the rejuvenated PVC and compare them with **primary PVC** production and other **recycling systems**.
- Support decision making in the technology development.
- Different functional units defined.
- Benchmark scenario defined.
    - the scope is cradle-to-gate analysis
- Next steps:
    - Benchmark scenarios simulation → Including mechanical and chemical processes.
    - Data collection → **Aimplas** and **Fraunhofer** processes.
    - Modelling on **SimaPro®** and **Life Cycle Impact Assessment** → Project processes.
    - Refining of the results along the project duration → several iterations.

Task 6.2 Life cycle costing and cost-feasibility analysis.

- Analysis of the **capital, operational costs** (CAPEX and OPEX) and envisaged cost reductions from the proposed technologies.

- Conducted in parallel to the LCA.
- Evaluation of the **profitability** of the project over **different lifespans** by calculating the **Net Present Value (NPV)** and the **Equivalent Annual Annuity (EAA)**.
    - **Timeframe**
        - Lifespan from few years to 10 years.
    - **System boundaries**
        - Operations of a semi-industrial / industrial sorting and recycling line.
    - **Discount rate**
        - TBD
- Next steps:
    - Update of the estimated figures in accordance to the different scenarios to be proposed and studied.
    - Data Collection.
    - Analysis of the figures and develop a projection for the upcoming months.

Task 6.3 Social life cycle assessment

- Determination and evaluation of the **social and socio-economic benefits** of implementing the REMADYL technologies.
- Performed following the UNEP/SETAC guidelines.
- **Discussion started with OVAM concerning the available data.**
- SIE will be involved in the literature review and indicator selection.
- System has been defined, and data has been collected.
    - Will identify the main stakeholders.
        - Classification via power-interest grid.
    - Indicators selection based on the stakeholder's requirements.
- Will use the performance reference point methodology.

Task 6.4. Circularity Assessment

- definition of appropriate circular economy indicators through the complete PVC value chain.
- Different circularity scenarios will be evaluated.
- Several useful sources of data have been identified:
    - **Report on circular economy (OVAM)** to select the circularity indicators will be translated to English very soon.
    - Identification of some **macro-indicators:**
    - **Use of raw materials** (direct material input, raw material input, domestic material consumption, water consumption, built-up area).
    - **Losses and emissions** from the cycle.
    - Ability to **keep resources** in the cycle.
    - Contact of OVAM at **KULeuven** for the selection of the methodology.

  - **Plastic Waste management plan** in Flanders could be useful for the analysis (in Dutch).

- **Comparison with other indicators to aid decision-making.**
- **Complementary risk indicators** (material price variation risk, material supply chain risks, material scarcity, toxicity).
- **Complementary impact indicators** (energy usage and CO_2 emissions, water consumption…).
- **Next steps:**
  - Review of the **circularity report** (OVAM).
  - **Selection of circularity indicators.**
  - Data collection from **technology developers** (WP1, WP2, WP3, WP4 and WP5).

WP7 Dissemination, Exploitation and Business Planning

Several deliverables have already been submitted (D7.1, D7.3, D7.8, D7.11).

Task 7.1. The market analysis

- Preliminary market analysis has been developed and submitted as deliverable in M15.
  - Analyzed the European PVC market.
    - Germany has the largest share.
    - Germany best in recycling followed by Italy and the Netherlands.
    - PVC waste generation is 5kg/capita.
  - Analysis of use of PVC in different applications.
  - Will consider the effects of COVID -19 in the next deliverable.

Task 7.2 IPR management, Exploitation & business planning

- A first plan for the protection of REMADYL results has been drafted
- A questionnaire has been sent to the partners and its results have been included in D7.4

Subtask 7.2.2 Exploitation and Business Plan (BP) development and preparation for market uptake

- The Exploitation Roadmap has been designed and it will be useful in the next 18 months of the project in order to define all the actions and activities needed to fully exploit the project results assuring their commercialization. Each partner will play a key role that will be further defined in the D7.6 Business Plan
- Partners have updated the table of KERs provided in deliverable D7.4
- A Business Model CANVAS (that will be included in the more detailed Business Plan – D7.6) will be designed

Task 7.3 Dissemination & communication activities

- Start to organize advisory and support meetings
- Remadyl brochures, roll-up, poster have been designed.

- All project partners are encouraged to log their dissemination activities in the documents supplied by ENCO.
    - The Remadyl project is also advertised on the REMADYL website.
- The scheduled news items should restart again.
- Cooperation with EuPC on the MORE platform started at M5.
- Remadyl Joined the **Plastics Circularity Multiplier group in** November 2019.
    - On 29/01/2020 a workshop with plastics circularity multiplier group will be held.
    - **Invite your contacts to subscribe to REMADYL Newsletter.**
    - C&D Logbook, Scientific publications database, Event report **tools are not used .**

Task 7.4 Standardization and Legislation

- Reviewal of the listed standards and legislation up to this month does not indicate substantial advancements.
- New perspectives are being added to this report.
- The EN15346 standard – characterization of PVC recyclates is an additional interesting source.
- OVAM is following up on the European evolution of legislation concerning waste handling and recycling.
- The proposal on lead restrictions has been rejected by parliament, the commission has not subjected a new proposal, as it has been delayed. Not much might happen in 2021 regarding lead legislation, due to a new study that has been ordered. Currently there is no restriction yet.

WP8 Coordination

- Day to day communication
    - Project steering committee, regular telco's should be continued.
- Twinning
    - Collaborations with other research projects are stimulated by the EU. Please think about other such collaborations (even national and regional projects).
    - A workshop is organized by the EU for all the projects in the plastics circularity multiplier.
        - 29/01/2021
        - Open for participation for all project partners. See the meeting registration link send out by Isabel De Schrijver.
        - Currently a collaboration is already ongoing between REMADYL and Circular Flooring.
- COVID-19
    - Please keep CTB informed off all important delays, also regarding the COVID-19 situation.
- **Periodic reporting & review**

- Please report any delays relating to the deliverables and milestones in advance of the review meeting to Centexbel. If necessary, extensions of the project could be discussed.
- The aim is to anticipate any difficulties and delays in the reporting of the project to the project officer.
- Mitigation of the continuous process should be included in the project review. The possibility to go to batch processes should be mentioned.
- Further discussion will follow during the meeting of January

- Official Progress Reporting delivery date: **January 31**
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    - Updated draft for review by WPL & PSC Jan 20
    - **Financial excel data deadline** **Jan 15**
    - **Update of WPL to CO** **Jan 15**
    - Financial & WP 'template' out Dec 18
- **Deliverables**
  - D1.1 Mapping of relevant EoL PVC streams – M24
  - D2.1 Protocol extractive extrusion – phthalates, batch M15 submitted
  - D2.2 Selection of suitable (NA)DES M12 -> M15 submitted
  - D2.3 Protocol: definition process parameters for extraction of Pb or/and phthalates – batch M15 -> M18 *pending (!)*
  - D2.4 Efficiency of LDH as lead scavengers – M21 –> *progress will depend on the results obtained in January.*
  - D3.1 Continuous extraction process, lab scale, based on CO2 & (NA)DES M27
  - D4.4 Contaminant assessment and Guidelines and methodology for safe handling of the byproducts – M18 -> *pending (!)*
  - D6.1 Report on LCAs and Ecodesign-Screening test and first recommendations M24
  - D7.1 Market analysis (preliminary) M12 submitted
  - D7.4 Exploitation of Key Results (update) -> M18 *pending (!)*
  - D7.9 Communication & Dissemination Report (update) – M18
  - D7.11 Policy & Standardisation -> *update at M18 for progress update, not for reporting.*

Task 8.4 data management plan

- Help beneficiaries to make the research data findable, accessible, interoperable and reusable (FAIR)
- A new questionnaire will be sent out in the coming days
  - Please reply to the e-mail, even if no modifications to the data management plan must be made.

Task 8.5 innovation management

- **Internal**: Ensure REMADYL project outcome is relevant for industry
    - Example: in line monitoring of PVC waste
- **External**: Monitoring evolving PVC (recycling) landscape and to signal potential influence on REMADYL goals
    - Example: rejection of European Parliament of higher lead content in recycled PVC + follow up
- **Next steps:**
    - Assess economic feasibility of solutions
    - Building further on the technical progress
    - Align with WP6 LCC & WP7 Market study

WP8 next steps

- Official reporting for M18
- Prepare the review meeting
- Actual Review (Feb 18)
- **Do announce a dissemination activity beforehand to EDM and CO (and update for past actions)**
- **Keep the WP telco's going**

5. Action points

Work package	Partner	Action point	Timing
WP1	**IRIS, DANOSA**	Production of the different plasticizer's samples. Some plasticizers still have to be tested/produced.	TBD
WP2	**Fraunhofer ICT,**	Send PVC samples for	Week 3

	CTB	analysis of the DEHP content.	
WP2	**CTB, AIMPALS, Fraunhofer ICT, UVEG**	Discussion on progress of WP2 and the most promising technologies.	January 2021
WP2	**AIMPLAS UVEG**	Exchange of LDH for testing the capture of Pb during extrusion	January 2021
WP8	**All project partners**	Financial reporting	15 January 2021
WP8	**All project partners**	Technical reporting: progress report	15 January 2021
WP4	**AZOR, CTB, DECUNINCK**	Providing Pb stabilizers and PVC additives for a first analysis.	January 2021
WP4	**Fraunhofer-ICT, Fraunhofer-ITEM, CTB, AIMPLAS, UVEG**	Information relating to the processes for the exposure assessment	TBD
WP6	**VERTECH, CTB, Fraunhofer ICT, AIMPLAS, UVEG**	Exchange of data concerning the extraction process.	TBD
WP8	**All WP leaders**	M18 Review meeting	18/02/2021

UPDATED GANNT CHART