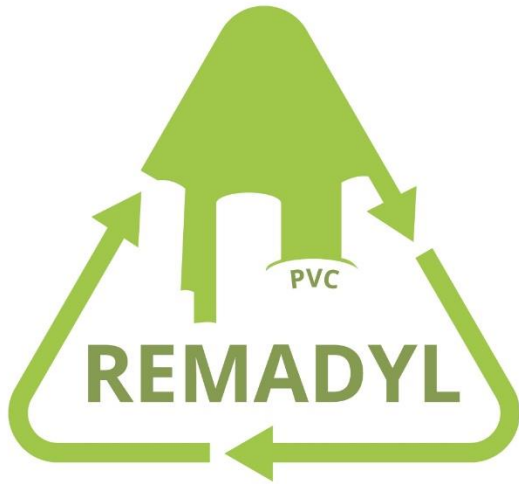


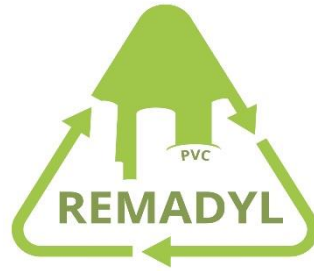
# Removal of Legacy Substances from polyvinylchloride (PVC) via a continuous and sustainable extrusion process



## Progress meeting Remadyl

Telco – 2  
27-01-2021





## WP 1+2 outline

- Progress WP
- Overview deliverables
- Pending issues
- Actions





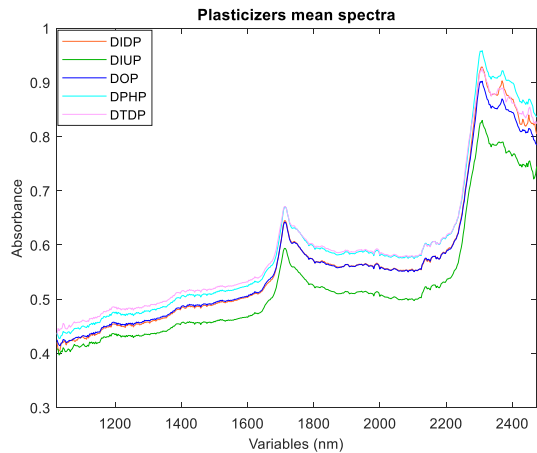
- **Task 1.1: production of model samples + mapping and characterization of PVC waste streams (Deceuninck)**
  - **Production model PVC samples**
    - Plasticized PVC samples
      - Additional samples are being produced for the detection technique of IRIS.
      - TOTM and DOTP samples delivered
    - Looking for actual recycled PVC sheets, to validate the IRIS detection technique.
      - Contact with PRE
      - Contact with AGPR



- **Task 1.2: Evaluation of detection techniques for their use as in-line detection systems for LS**
  - Update on tests using LIBS laser?
    - Optimization of LIBS parameters has been done
    - Currently measuring calibrated PVC samples with known lead content
  - Update on the NIR system
    - Further optimizing the model using additional samples.

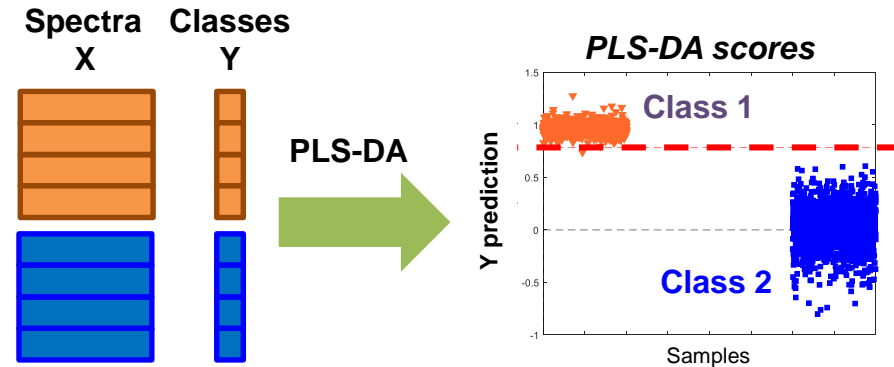
### NIR spectroscopy:

- Vibrational spectroscopic technique that describes vibrations of substances bonds after being excited by light.
- Working spectral range: **1000 - 2500 nm** (Short-wave infrared, SWIR).



### Chemometrics Model:

- Partial Least-Squares Discriminant Analysis (**PLS-DA**). Classification method that performs a regression among sample spectra and its belonging classes.





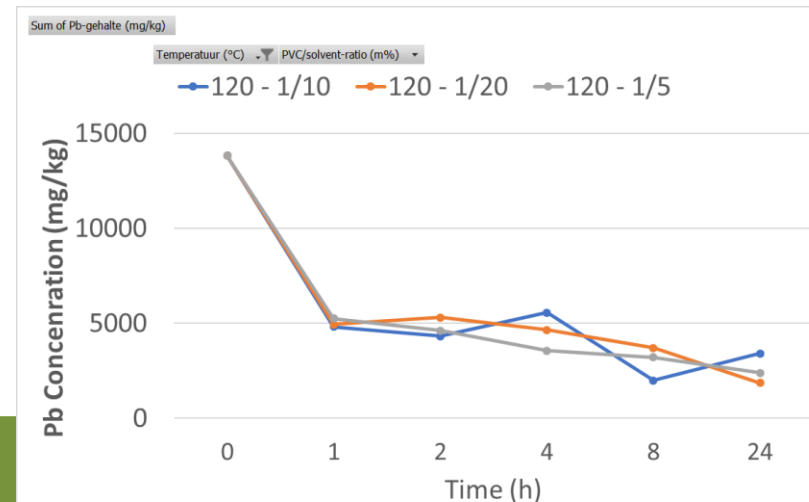
### □ Task 2.1 Development of a CO<sub>2</sub> extraction process of phtalathes

- Update on testing for Fraunhofer ICT?
  - D2.1 was submitted
  
  - Further researching the time dependency of the extraction
    - » Extension of the WP2 task will be requested to the project officer
  
  - Cooperation was set up with the circular flooring project
    - » Successful chemical modification of extracted DEHP



### □ Task 2.2 Development of an extraction process for phthalates and lead removal using NADES as Co-solvents

- Deliverable 2.2 and 2.3 were submitted
- Conditions were further optimized; best results give an extraction rate of >80%.
- NADES are an incompatible co-solvent for  $\text{scCO}_2$
- The batch process will be further upscaled to review the PVC material properties
- Extension of the WP2 task will be requested to the project officer.





### □ Task 2.3 Development of MoS<sub>4</sub>-LDH based process for lead removal

- Update on testing for UVEG and AIMPLAS?
  - Tests using the LDH?
  - Further extrusion trials by Aimplas?
- Upscaling of synthesis by UVEG + testing of Pb capture?
  
- Extension of the WP2 task will be requested to the project officer
  - D2.4 and MS3 postponed from M21 to M24





### □ Task 3.1: transfer to continuous lab-scale of the extrusion

- Initial trials for the continuous extractive extrusion have started
- Further optimization required





### □ Initial discussion has been held for the start of WP4

- Safe recovery of byproducts
  - Study based on expected contaminants
    - » Different Pb species
    - » Different additives were delivered
- Preparative work for Task 4.3 (contamination assessment and guidelines) has started.
  - Deliverable 4.4 was submitted

☐ Template for data collection has been sent out by Vertech

LCA and LCC: Mass and energy streams per unit		A. Process and market data							B. Auxiliary data about the alternative on the market				
Inputs		Unit	Amount per batch	Cost (€/unit)	Reference	Price elasticity of supply (0 to 1)	Stockpiling of the material (yes/no)	Type of waste treatment if not used	Alternative material obtained by the waste	Efficiency of the process (0 to 1)	Cost (€/unit)	Price elasticity of supply (0 to 1)	Which process difference could the production of this material instead of REMADYL reinvigorated PVC imply
<b>Used feedstocks</b>													
	Soft PVC (X% of phthalate and Z% of Pb)	kg				0		Other type of recycling? Incineration?	Electricity (incineration)? Old PVC pellets? For			0	
	Rigid PVC (X% of phthalate and Z% of Pb)	kg				0		Other type of recycling? Incineration?	Electricity (incineration)? Old PVC pellets? For			0	
<b>Auxiliary materials</b>													
	Supercritical CO <sub>2</sub>	kg											
	(NA)DES (please specify which type)	kg											
	Other solvents?	kg											
	Others? (e.g. water)	kg											
<b>Process energy</b>													
	Direct electricity consumption	kWh					Source	Note					
	Other direct consumption (e.g. heat)	MJ					Grid:	At lb scale, electricity consumption can be measured directly from the devices with voltmeters or extrapolated from the max power of each device.					
Outputs		Unit	Amount per batch	Estimation of price (€/unit)	Reference	Stockpiling of the material	Type of waste treatment if not used	Annual production (unit/year)	Substitute material on the market	Value of substitutability (0 to 1)	Cost (€/unit)	Price elasticity of supply (0 to 1)	Which difference could the use of this material instead of the alternative imply
<b>Main product</b>													
	Rejuvenated PVC	kg							Primary PVC? Other market segment?				
<b>By-products</b>									Further treatment	Destination / use	End-of-Life (after further)		
	Phthalate (DEHP)	kg							Please, specify				Primary phthalate?
	Pb	kg							Please, specify				Primary materials?
	Supercritical CO <sub>2</sub>	kg							Please, specify	Possibility of reusing it in the same			Liquid CO <sub>2</sub> ?
<b>Waste</b>													
	Wastewater (if any)	m <sup>3</sup>											
	Oil waste (please, specify)	kg											
	Other liquid or solid residues (please, specify)	kg											
	Other additives? Lubricants? Please specify.	kg											
<b>Emissions</b>													
	Air emissions (please, specify)	mg/m <sup>3</sup>											
	Water emissions (please, specify)	mg/l											
	Soil emissions (please, specify)	mg											

## Submitted Deliverables

- D1.1 – First model samples with known composition produced → submitted
- D2.1 – Protocol extractive extrusion defining the required process parameters -> Submitted
- D2.2 – Selection of suitable (NA)DES for the extraction of Pb or/and Phthalate -> Submitted
- D2.3 - Protocol: definition of the process parameters for the extraction of Pb or/and phthalates in a batch extraction process using (NA)DES as co-solvents -> in progress
- D4.4 - Contaminant assessment and Guidelines and methodology for safe handling of the byproducts metals & phthalates, including safety sheets assessing levels and estimated risks from the removal of LS from PVC (preliminary) -> in progress
- D7.4 - Exploitation of Key Results – Report on implemented activities and updated planning -> in progress
- D7.1 – Market analysis (preliminary) -> Submitted

## Submitted Deliverables

- D7.3 – Exploitation of key results → submitted
- D7.8 – Communication and dissemination → submitted
- D7.9 - Communication & Dissemination – Report on implemented activities and updated planning
- D7.11 – Overview of relevant Standards and legislation → submitted
- D8.1 – Quality risk manual → submitted
- D8.2 – Data management plan → submitted
- D9.1 – EPQ → Submitted
- D9.2 – POPD → Submitted
- MS1 – First model samples with known composition produced → submitted
- MS2 - Go' for development of continuous lab scale DEHP removal -> in progress

- Key output and decision points

<b>D2.4</b>	Efficiency of the thiomolybdate modified layered double hydroxides as lead scavengers for removal of lead salts from PVC in a discontinuous system	<b>AIMPLAS</b>	<del>M21</del> <b>M24</b>
<b>MS3</b>	'Go' for development of continuous lab-scale extrusion – Lead removal	<b>AIMPLAS</b>	<del>M21</del> <b>M24</b>
<b>D1.2</b>	Results of mapping of the relevant EoL PVC streams, their analysis and tool for identification of potential applications for the expected secondary raw materials	<b>CENTEXBEL</b>	M24
<b>D6.1</b>	Report on LCAs and Ecodesign-Screening test and first recommendations	<b>VERTECH</b>	M24
<b>D3.1</b>	Continuous extraction process at lab scale based on CO <sub>2</sub> and (NA)DES for phthalate and lead removal	<b>Fraunhofer ICT</b>	M27
<b>D1.3</b>	LS identification detection system design and prototype	<b>IRIS</b>	M33



- 29/01 H2020 Workshop European union
  - Presentation of the REMADYL project
- 18/02/2020 Review meeting
  - Only for WP leaders
  - Rehearsal 16/02/2020
- Next skype meeting proposal
  - 09 March 11h





**AIMPLAS**  
PLASTICS TECHNOLOGY  
CENTRE



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