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# CreaSolv® Process
## A Viable Solution for Sachet Recycling


In their recent update "Waste & Packaging" (published November 12, 2019) Unilever informs also about their achievements in regard to the CreaSolv® Process for sachet recycling.
Link - https://www.unilever.co.uk/sustainable-living/waste-and-packaging/

Quote: *"Following a review of our current portfolio and innovation roadmaps as well as consideration of the external context, we do not expect to hit our halving waste target by the end of 2020. However, we will continue to accelerate our efforts on packaging redesign to encourage greater recyclability as well as working with partners to drive system change on recycling and recovery infrastructure, for example through our Community Waste Banks and CreaSolv® Recycling technology pilot plant in Indonesia."*

The section "Tackle sachet waste" informs about Unilever's goal and perspective on this widely used packaging type[1)] (quote):

### *Tackle sachet waste*

*Our goal is to develop and implement a sustainable business model for handling our sachet waste streams by 2025.*

*We continue to investigate the potential of new technologies in both developed and developing markets. Progress has been slower than we originally anticipated, however we feel that we are two thirds of the way there and will have a viable solution in the near future.*

## *Our Perspective*

*Our aim is to develop a closed loop system for sachet waste. This will allow us to continue to provide the price and convenience of sachets to low-income consumers, while tackling the environmental issues associated with their use. These include litter and recyclability.*

*Over the last eight years, we have co-developed a new technology called CreaSolv® Sachet Recycling technology. The technology produces quality polymers that can be used to make plastic that can be used again and again – offering the potential for a circular economy model.* ***We have proven through large scale industrial trials that the CreaSolv® Recycling technology is a technically viable solution to recycling sachets.***

*Our pilot plant in Indonesia, opened in 2018, is the only facility in the world where this technology is being used to recycle sachets. It can process three tonnes of material a day. Once we've proved the technical and commercial viability of the technology, our ambition is to start discussions with investors and other interested parties to develop a full-scale commercial plant, capable of processing around 30 tonnes of material a day.*

*Alongside an infrastructure for collecting and processing sachets – which we are also working on with other municipal governments – CreaSolv® Recycling technology offers the potential for a circular economy model and is a win-win for business and the environment. We hope that the CreaSolv® Recycling technology will transform sachets from a global problem into a sustainable economic opportunity.*

### The CreaSolv® Process is no Chemical Recycling!

The CreaSolv® Process is a Solvent-based Purification and therefore "Physical Recycling", because the polymer only changes its physical state from solid to liquid and then back to solid – and not its composition. The polymer chains remain unchanged and can be **re-used** in their original application.

***Physical* or *Chemical* Reaction?**

*Basics*

*A chemical reaction produces new substances, while a physical reaction does not.*

*A material may change shapes of forms while undergoing a physical change, but no chemical reactions occure and no new compounds are produced.*

***Physical Change***

- ***No new substance is formed***
- ***No composition change***
- ***The change is reversible***

***Examples***

- ***Boiling water, melting ice***
- ***Shredding paper (or plastic film)***
- ***Dissolving sugar in water***
- ***Melting a polymer*** *(e.g. extrusion)*
- ***Dissolving a substance in a liquid***

***Chemical Change***

- ***New substances are formed***
- ***Composition is changed***
- ***The change is irreversible***

***Examples***

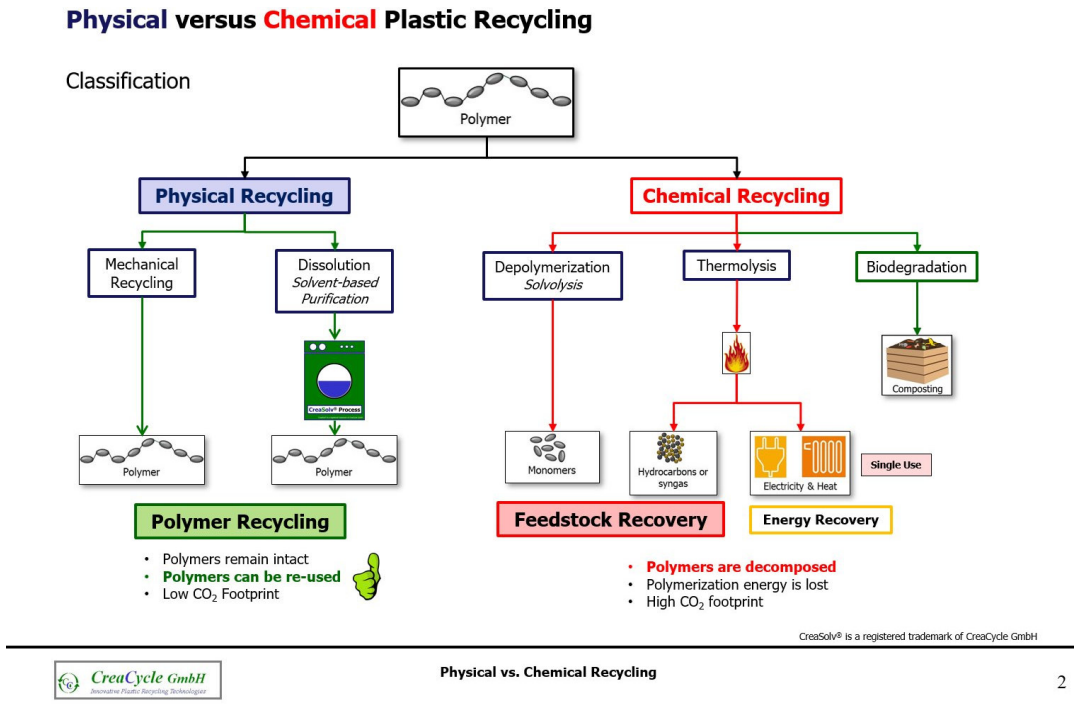
- ***Burning wood***
- ***Rusting of iron***
- ***Polymerization & de-polymerization***
- ***Pyrrolysis of polymers***

Please check:
**Bozeman Science** - "Chemical and physical changes":
https://www.youtube.com/watch?v=ziQtpXVDpn0&feature=youtu.be

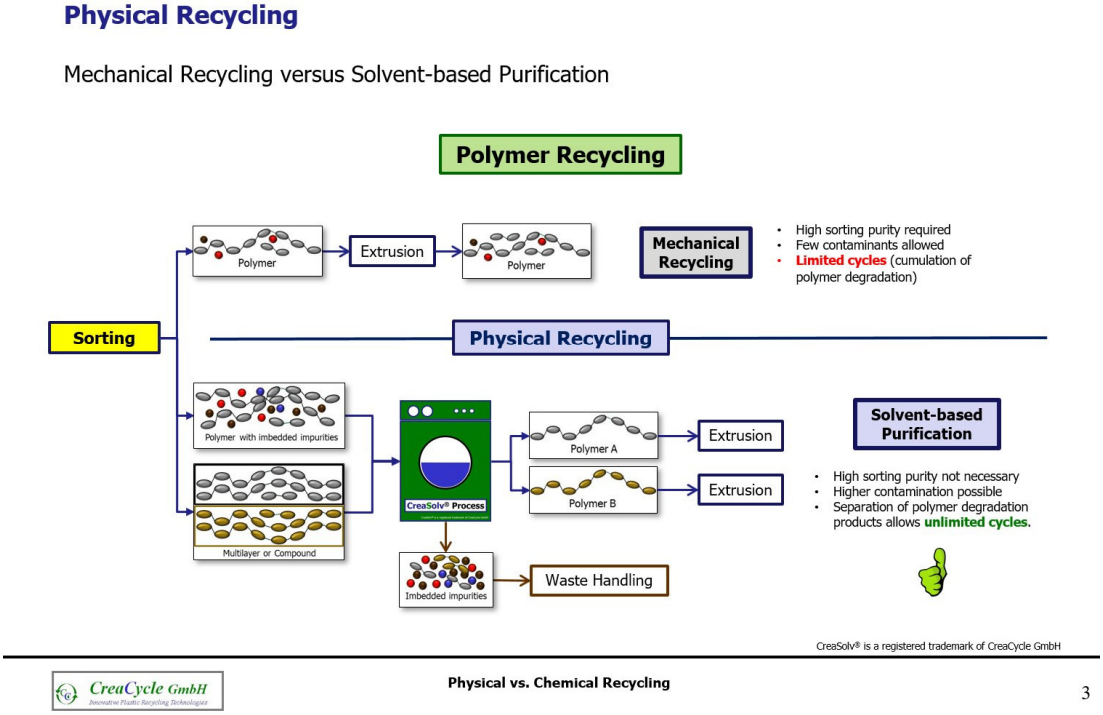
**Chemistry for Kids** – "Chemical and physical changes":
https://www.youtube.com/watch?v=x49BtB5dOwg&feature=youtu.be

Chemical Recycling is based on chemical reactions and the polymer is broken down into smaller molecules or building blocks. This is why it is also called "Feedstock Recycling" and considered as down-cycling.

Mechanical recycling and solvent-based purification belong both to the category Physical Recycling and both enable the "re-use" of the polymer without down-cycling it to raw-materials (fuel, syngas, hydrocarbons) or building blocks, which have to be polymerized again to bring them back into the cycle.




When mechanical recycling needs a high sorting purity of waste streams and fails on imbedded hazardous impurities or multilayer packaging, the CreaSolv® Process works like a washing machine on a molecular level.

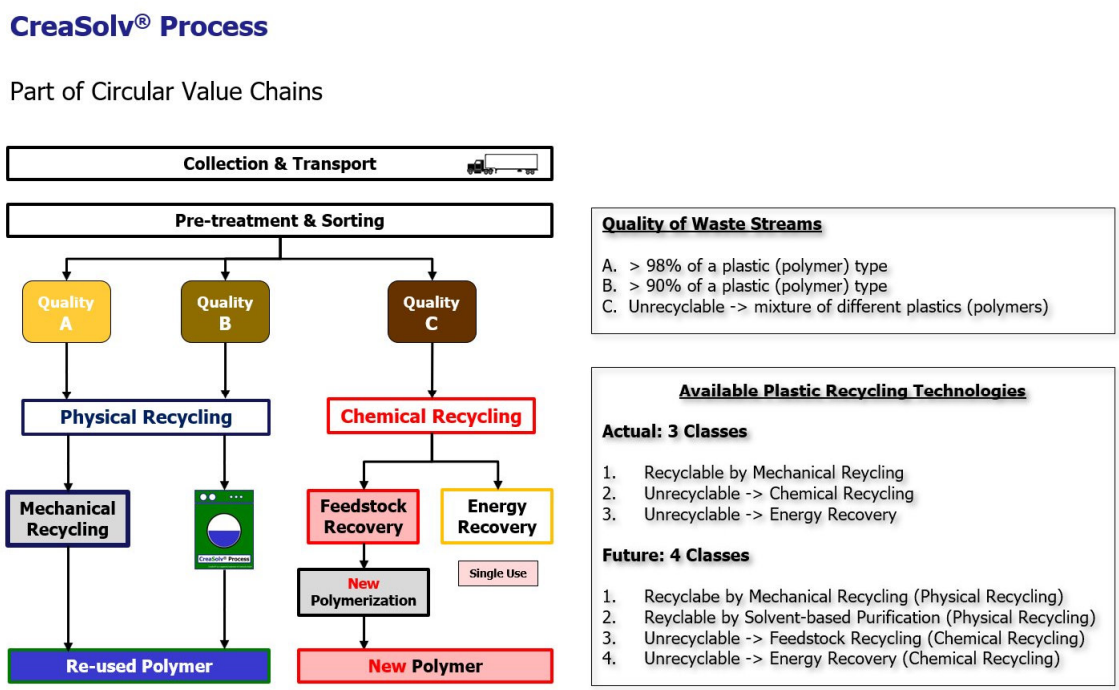


**Get the Science right and don't mix up Terminologies**

There is a need for clear definitions to allow to decide on a meaningful path to an effective Circular Economy for plastic waste.
If the term "recycling" is treated the same as "recovery" and industry, lobby groups and authorities hang on to historical differentiation criteria to sort plastic waste treatment technologies into the actual 3 categories "mechanical recycling, chemical recycling and energy recovery" instead of getting the science right, the main focus will turn to chemical recycling as preferred technology as it has been incineration and export to developing countries until today.

Most of our manufacturing industries work with physical and/or chemical processes.
Wouldn't it be logical to look at these two sciences Physics & Chemistry, compare pros & cons and sort available technologies in a meaningful sequence?

1. Physical processes for plastic recycling.
    - Benefit: They leave the polymers intact, keep the polymerization energy in the polymer, allow to re-uses the polymer and offer a low $CO_2$ footprint.
2. Chemical processes that react the polymers to monomers or petrochemicals
    - Building blocks can be polymerized again to new polymers.
    - Deficiency: High energy requirement, high cost and higher $CO_2$ foot print[4)]
3. Chemical processes for unrecyclable plastic waste to recover at least the energy.
    - Single use of the energy or energy carrier (fuel, syngas).
    - Deficiency: High energy requirement, high cost and higher $CO_2$ foot print[4)]




The CreaSolv® Process is also no Solvolysis. The fact that the polymer is dissolved doesn't classify it to be a solvolysis - but it seems to be a common mis-interpretation.

- **Solvolysis**[2)] is a chemical reaction in which the solvent is one of the reagents and is present in great excess of that required for the reaction.

- **Solvolysis**[3)] is the generic term for processes involving reactions with corresponding solvents, e.g. hydrolysis (e.g. depolymerization of polyethylene terephthalate to terephtalic acid and ethylene glycol by the addition of water) (Patel et al., 1993; Hedlund-Åström, 2005), methanolysis (by the addition of methanol) and glycolysis (by the addition of ethylene glycol) (Pickering and Beg, 2010).

In regard to plastic recycling a solvolysis is the same as a de-polymerisation and is therefore a chemical recycling process that down-cycles the polymer. The CreaSolv® Process leaves the polymer intact.

**Do not lose an Opportunity!**

Mixing up sciences and chemical terms clouds the view and leads to mis-judgement.

Declaring Solvent-based Purification – a Physical Recycling process - as Chemical Recycling instead of realizing the capabilities offered by this technology in regard to "solving" the plastic waste pollutions is a **Lost Opportunity**.

Physical Recycling is an independent class or category besides Chemical Recycling and both have to be considered as complementary technologies when trying to deal with our huge plastic waste problem.

Chemical Recycling fits within a Circular Economy when the output is used to produce new raw-materials.

Physical Recycling enables a Circular Economy because it keeps the polymer on its value chain position and in the loop.

***Plastic Recycling Quota should only be given for true volumes of physically or chemically recycled polymers instead of counting the tons of plastic waste entering a sorting plant without having a proof or a clue of what was really recycled into the original or a similar application.***



**Literature:**

1. Unilever Homepage "Waste & Packaging" published 12.11.2019 – Link https://www.unilever.co.uk/sustainable-living/waste-and-packaging/
2. Solvolysis – Encyclopaedia Britannica - Link https://www.britannica.com/science/solvolysis
3. Solvolysis – ScienceDirect – Link https://www.sciencedirect.com/topics/engineering/solvolysis
4. KIDV study Netherlands Institute for Sustainable Packaging (KIDV) "Chemical recycling of plastic packaging materials: analysis and opportunities for upscaling" published 25 October 2018 - Link https://www.kidv.nl/kidv-publicaties/8297

*In order to protect resources and our environment, high-quality recycling technologies for plastic waste are required, which allow the reuse of polymers without breaking up the polymer chains.*
*CreaCycle GmbH and the Fraunhofer Institute for Process Engineering and Packaging (IVV) in Freising, Germany combined their competencies in a cooperation aimed at "Plastic/Raw-Material Recycling with a Solvent-based Purification Technology" (selective extraction) and developed the CreaSolv® Process that is based on physical changes and leaves the polymer composition intact.*
*Proprietary CreaSolv® Formulations from CreaCycle with the lowest risk potential possible for user and environment dissolve selectively a target polymer. This reduces besides the hazard also the cost for the equipment. After the separation of imbedded impurities or undesired polymers the recycled polymer can be reused in its original application.*

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