INK, HEART & SOUL

REPULPING AND RECYCLING OF

FIBER-BASED PACKAGING

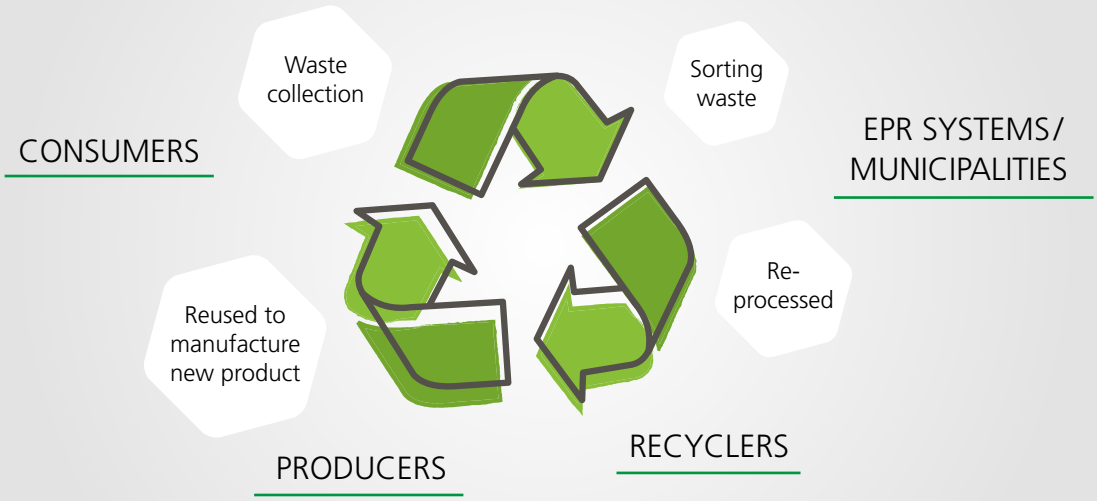
SIEGWERK

1. RECYCLING

1.1 DEFINITION

Recycling is the process of converting waste materials into raw materials to again produce manufactured goods. The basic phases of recycling are the **collection** of waste materials, their **sorting**, the **reprocessing** into products, and the purchase of these products as **raw materials** which can then be recycled again.

RECYCLING IS
"COLLECTION + SORTING + REPROCESSING"



The recyclability of a material depends on its ability to be collected, sorted and recovered on a large scale for reuse as a raw material. In Europe, there is a list of standard paper and board grades that can be recycled, summarised in EN 643.

Recycling promotes environmental sustainability by reducing the use of virgin raw materials and redirecting the waste output in the economic system. Recycling is therefore one of the pillars for achieving a circular economy and a sustainable future.

Today, the European recycling rate for paper and pulp packaging is 83,2%*. The European target for 2030 is 85%. Increased collection volumes, collection of all types of streams such as away-from-home or household, and better sorting will help to improve recycling rates and recyclate quality.

As part of the cross-industry alliance 4evergreen, Siegwerk supports the development of tools and guidelines to achieve a recycling rate of 90% for fiber-based packaging by 2030.

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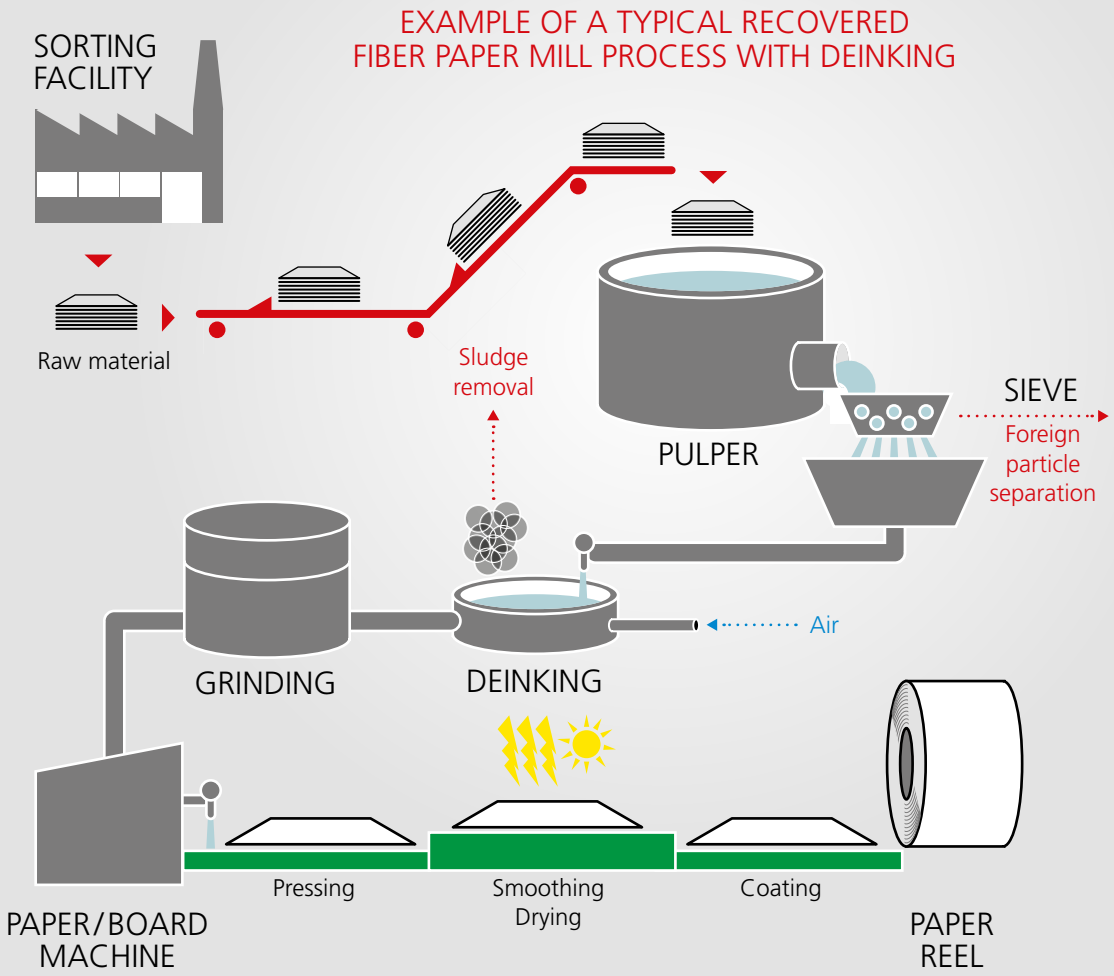
** Source: ForEverGreen*

2. REPULPING

2.1 DEFINITION

Pulping is the process of separating and treating wood fibers to produce pulp.

The process for repulping waste paper is the same as for making paper from virgin fibers. It consists of mixing the collected and sorted waste paper stream, which has been shredded into pieces, with warm water and sometimes chemicals to break it down into fibers. The resulting mixture is called pulp. The pulp is then filtered several times through a series of screens to remove coarse components such as plastics or residual metals. Depending on its final use, the pulp may be cleaned (via hydrocyclones), deinked or bleached. Finally, it is mixed with fresh paper pulp and fed into a paper machine to produce new recycled paper.



Most recycling paper mills can process paper containing inks, water-soluble chemicals and small amounts of converting products such as staples, adhesive tape or starch-based or other water-soluble adhesives. Standard recycling mills can also process a limited amount of packaging with a non-paper layer on one side.

However, fibers cannot be recycled forever, but only for a limited time before they lose their papermaking properties. A certain amount of virgin fiber must be added to the recycling stream.

Some other recycling mills can also deink using flotation equipment. Air is blown into the low concentration pulp, where the ink adheres to the air bubbles and rises to the surface where it can be separated. Flotation deinking mills are designed to process graphic grades of paper.

Others, called specialist recycling mills, can handle complex structures where paper-based packaging has been laminated with non-water-soluble products such as plastic extrusion or lamination film or aluminum layers.

HOW TO EVALUATE THE REPULPABILITY OF PACKAGING?

There are various test protocols in Europe: the German PTS method, the Italian Aticelca standard, the French CTP method and others. They all aim to ensure the suitability of a tested product in a paper mill's stock preparation system.

In order to „speak the same language" across the EU, the Confederation of European Paper Industries (CEPI) has proposed a harmonized version based on these existing test protocols. This test method, known as the CEPI method, is intended to become an international standard. To complete the methodology, the 4evergreen alliance has proposed the Recyclability Evaluation Protocol, which aims to evaluate and score the potential repulpability in standard mills, deinking mills or specialized mills.

To learn more about the Cepi method please click **here**.

2.2. EXISTING TESTING METHODS AND PROTOCOL

The tests consist of evaluating a fiber-based material, which may be a finished product as market-ready packaging or a semi-finished or conceptual product, through an initial disintegration phase. The pulp obtained is then filtered to quantify coarse rejects and then fine rejects. At each filtration stage, some sheet formation is performed and visually assessed. In addition, a sheet adhesion test is performed so that macro stickies can also be quantified (optional).

Other additional tests such as fiber image analysis, fiber dispersion analysis, water phase analysis (ash test), and Chemical Oxygen Demand for a qualitative assessment can complete the evaluation. The tests can be used to certify an end product or to support innovation and new packaging development.

3. PACKAGING AND PACKAGING WASTE REGULATION

With the new Packaging and Packaging Waste Regulation (PPWR), the European Union is clearly defining the future of packaging towards circularity. One of the driving ideas behind the PPWR is that from 2030, all packaging put on the market should be recyclable.

The regulation is expected to be formally adopted by the European Council at the end of 2024 and will be implemented 20 days after its publication in the Official Journal of the EU. The regulation has been adopted by the European Council this end of 2024, and will be implemented after its entry into force. This means that the new EU packaging rules will have to be implemented in all 27 EU Member States by the summer of 2026.

In the future, packaging, regardles of materials, will have to achieve **Design for Recycling** and **Recycling at Scale**. Not only will it have to meet certain recyclability criteria, but it will also have to be proven that it can actually be recycled. At scale means separately collected, sorted and recycled at a 55% recycling rate (the minimum target may be recised by 2035). Based on these two categories, packaging will be assessed for its actual recyclability and divided into recycling performance levels from A to C, based on the weight percentage (wt%) of the packaging unit.

From 2030, only packaging with a rating of A to C can be placed on the market. Any packaging below grade C (less than 70% recyclable) will be banned from the market. From 2038, only grades A and B can be placed on the market. Packaging that falls below level B (less than 80% recyclable) will then be banned from the market (see Table X).

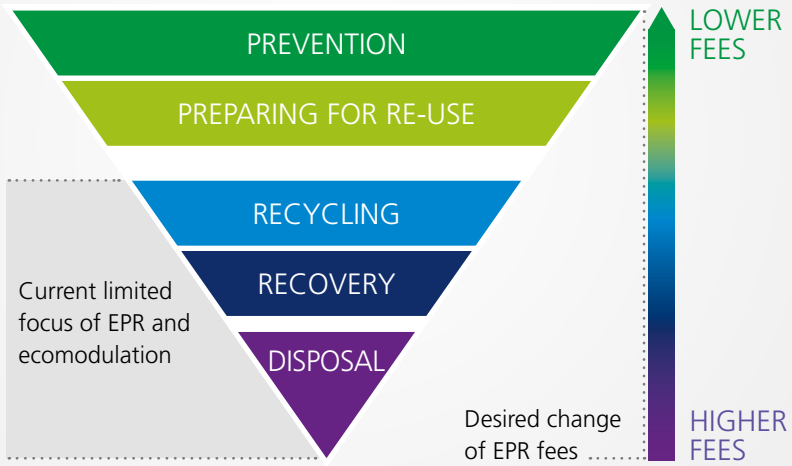
DEADLINES	2030 SELFASSESSMENT BASED ON DESIGN FOR RECYCLING		35 DESIGN FOR RECYCLING + RECYCLED AT SCALE		2038 DESIGN FOR RECYCLING + RECYCLED AT SCALE	
Recyclability grading *EPR fee modulated according to grades*	Performance grade	Recyclability assessment	Performance grade	Recyclability assessment	Performance grade	Recyclability assessment
	A	≥95 %	**A**	≥95 %	**A**	≥95 %
	B	≥80 %	**B**	≥80 %	**B**	≥80 %
	C	≥70 %	**C**	≥70 %	**Non recyclable**	<80 % Banned from EU market
Non recyclable		<70 % Banned from EU market				

** Assesment of recyclability per unit, in terms of weight*

However, many of the detailed requirements arising from PPWR will remain open for several years. In particular, the design for recycling guidelines and recyclability grades will be defined by the European Commission in so-called delegated acts by 1 January 2028.

The impact will largely depend on the design of the recycling criteria and recyclability grades to be adopted by 2027. Extended Producer Responsibility (EPR) fees would be modulated according to the waste hierarchy and based on the recycling performance level.

WASTE HIERACHY & ECOMODULATION OF
EPR FEES



Source = https://www.ecologic.eu/18226

Some exceptions, such as for medical packaging, are foreseen until December 31, 2034. So compostability is not a waste management solution for the EU, but it will be mandatory for limited applications such as sticky fruit and vegetable labels and tea or coffee bags and capsules.

Compostability is also called organic recovery or organic recycling, but although the material is returned to the earth, the raw material is not returned to the economic system. So it is the least bad solution before disposal.

4. UPCOMING CHALLENGES

Most packaging categories will be affected by this new regulation, and the packaging value chain needs to prepare for increasing consumer demand for sustainable packaging and the upcoming legislation.

But how to interpret the recyclability grades and the existing repulpability protocol to be ready for 2030? How to quantify the impact of the EPR modulation without the readiness of design for recycling guidelines?

READY FOR THE CHALLENGE?

1 Repulpability testing protocol

2 Collecting and sorting evaluation grading Design for Recycling

3 EPR fees

PPWR RECYCLABILITY GRADING SCALE

5. HOW SIEGWERK CAN SUPPORT

Siegwerk believes that barrier and functional coatings will be a key enabler of circularity and will drive the creation of innovative sustainable packaging that complies with EU regulations.

Recycling and repulpability are now the starting point for every new development.

WATER-BASED DISPERSION BARRIER COATINGS ON FIBER-BASED PACKAGING PAVE THE WAY:

- an increased proportion of renewable materials in packaging through paperization
- educed packaging complexity (from multi-material to mono-material)
- recyclable packaging

To assess the impact of our CIRKIT product line, Siegwerk evaluates its product with the PTS and now also with the CEPI test protocol together with the 4EverGreen scorecard. These tests allow our technical team to adjust the formulation to reduce the potential impact of macro stickies or low fiber-based recovery at paper mills. By sharing credible data, we demonstrate that our portfolio supports the development of recyclable packaging.

By establishing a global business unit dedicated to circular coatings, Siegwerk underlines its strategic focus on the development of functional coatings to support sustainable packaging innovations in the sense of a circular economy. Water-based coatings offer numerous environmental and performance benefits.

To learn more about our products for circular coatings, please visit **Printing coatings – Siegwerk Druckfarben**

6. CONCLUSION

In addition to technical performance and safety, which remain mandatory targets, end-of-life must be considered from the beginning of product development.

Depending on the packaging and its end-use, different combinations of materials in fiber-based packaging can be used to meet all these performance criteria.

Fiber-based materials are likely to come to the forefront because of their renewable, recyclable and compostable potential. They are an excellent example of how closed-loop material cycles work today in the context of a circular economy.

ANNEXES

4Evergreen Circularity by Design Guidelines / Recyclability Evaluation Protocol I II III / Guideline for collection and sorting