



Toward a Circular Economy for Labels

LABEL PAPER RELEASE LINERS

*PAPER BASED SILICONE RELEASE LINERS FROM LABELS
CAN & SHOULD BE RECYCLED*

November 2020

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INTRODUCTION

CELAB: Toward a Circular Economy for Labels, is publishing this white paper to provide basic technical information on recycling on a 'global' basis. CELAB's Technical Workstream, under the leadership of Alex Knott, Senior Scientist at The Dow Chemical Company, conducted a technical review of release liner recycling to understand existing recycling technology. CELAB collected non-proprietary information on current processes by obtaining input from raw materials producers (paper and silicone), recycled paper producers, recycling companies (collection) and industry organizations to understand the impact of release liner on final recycled paper product and on paper process.

CELAB thanks all the members of the Technical Workstream who contributed to this report.

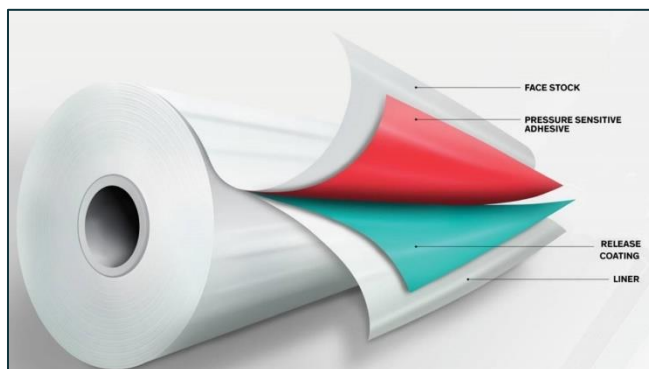
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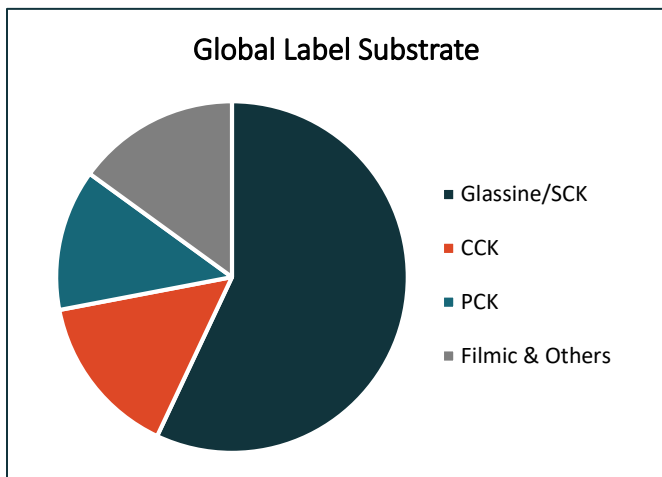
PART A – WHAT IS A PAPER BASED SILICONE RELEASE LINER?

In their most typical format, self-adhesive labels are a combination of a self-adhesive label material laminated against a “silicone release liner”. They are produced by taking a ‘base’ substrate (paper or film), onto which a silicone release coating is applied as a very thin layer, followed by a self-adhesive layer and finally a label ‘face’ material (paper or film). The ‘silicone release liner’ is the name used for the layer of ‘base’ substrate which is coated with silicone, and from which the label is peeled away during dispensing.

Self-adhesive labels are the most commonly used technology in the labelling industry, meeting a wider range of end-user requirements more effectively than any other form of labelling. They need to cover a wide range of applications where the self-adhesive needs to adhere to many different surfaces such as glass, plastic, paper, textiles, wood and metals. Their adhesion might need to be temporary (removable) or permanent and meet all kinds of different adhesion challenges for labelling depending on the wide range of applications where they are used (deep-freeze, wet labelling, high temperatures, low surface energy and even underwater). The release liner performs a critical role in supporting the label during die-cutting, protecting its adhesive and providing a surface from which the self-adhesive label can be subsequently dispensed and applied. The silicone release coating itself is only a very thin coating on the surface of the base paper (typically only 1 micrometer in thickness, or 0.001 of a millimeter).



WHAT KINDS OF SUBSTRATES ARE USED FOR PAPER BASED SILICONE RELEASE LINERS?



The majority of silicone release liners used in self-adhesive labels are based on using a Paper substrate as base material. Many different grades of paper can be used as base material, but the main grades used in self-adhesive label manufacture are; Glassine; Super-calendered Kraft (SCK), Clay coated Kraft (CCK) and Polyolefin-coated Kraft (PCK). Globally, the majority of labels use Glassine or SCK as the release liner substrate (56%), with CCK and PCK used less often. There are, however, significant regional differences in the split of the substrates being used.

In the European region, for example, Glassine represents over 70% of all substrate used for label release applications, whilst in the USA a similar trend is true for SCK and Glassine. In ASIA,

though, there is a much more even split between the different substrates including significant amounts of PCK.

PART B – CAN SILICONE COATED RELEASE PAPERS BE RECYCLED?

Once the self-adhesive label has been removed from the release liner and applied to the final surface, the silicone release liner plays no further role in the labeling process and is ready to be recycled or re-used!

Silicone paper release liners, like many other grades of paper, can be (and indeed are already) recycled. This can occur by mixing the release liner with other paper grades in large scale paper recycling processes, or through the use of dedicated recycling processes where separated streams of 100% paper release liner are taken and recycled using optimized separation processes that have been specifically developed for the release liner.

RECYCLING RELEASE LINER AS A SEPARATE STREAM

Due to the high quality of the paper fibres used in the production of the base papers for silicone release liner (such as glassine), several groups have established processes where it is possible to recycle high concentrations of silicone release liner in order to better recover these high quality fibres. These processes are typically based on modification of existing processes used for re-pulping of printed materials, where there is a deinking step included. In some cases the processes are advanced enough that the recycled fibres can be used in the production of the same quality of base paper from which they originally came. For these separated stream approaches to recycling it is important that for successful recycling of the release liner, the waste stream is of both a high purity (no more than 1% contamination with materials other than release liner such as self-adhesive labels), and an excellent homogeneity (Glassines may be recycled with SCK, but other paper release liners such as CCK should be recycled in a separate re-pulping process). In the specific case of glassine the 'colour' of the paper release liner is also a factor in recycling, and it is normally recommended that lightly colored glassines (such as white, yellow and light blue, normally used in label release), need to be recycled separately from darker shades (such as 'Havana' or brown colored, often used as self-adhesive tape release).

RECYCLING RELEASE LINER WITH OTHER PAPER GRADES

It is already well established that silicone release liners can be recycled along with other paper streams in the conventional paper recycling process. In some paper recycling processes there can be a challenge to break up the silicone coated paper, but provided that sufficiently energetic pulping conditions are utilized, the silicone coated release liner should be relatively straightforward to re-pulp. In this respect it is recommended to prefer batch re-pulping equipment over continuous re-pulping equipment in order to overcome the naturally hydrophobic nature of the silicone coating. The concentration level of silicone release liner which can be included in such mixed paper recycling processes varies significantly and depends on the process employed and the intended end application for the recycled paper fibres. Several sources claim levels of at least 10% silicone coated paper being recycled in such 'mixed source' processes, with some claiming even as high as 30%. Silicone coated release liners are already recognised as a stream in waste recycling classification such as the general European Waste Catalogue (EWC) of the European Commission where they are included under the code "15-01-01 Paper and Cardboard Packaging Waste", and more specifically they have a characterization under the standard UNI EN 643 (European List of Standard Grades of Paper and Board for Recycling), of being coded under 5.05.03 – "Paper release liner for self-adhesive labels."

As has been demonstrated here, silicone paper release liners can be recycled. There are, however, several different approaches for recycling depending on the expected use for the recycled fibre and which region of the world where the release liner is being recycled. It is especially important to be aware of the regional differences when planning recycling of silicone paper release liners.

EUROPE

In the case of Europe, the main grade of silicone release liner in label applications is based on Glassine as base substrate. This includes white glassine, but also other colored grades. The colour of the glassine grade being recycled may have an impact on the end application for the recycled fibre, which typically means that it is recommended to recycle darker coloured glassine grades (such as Havana or brown, often used in self-adhesive tapes), as a different stream to the lighter coloured glassines. The second most popular grade of release liner base used in Europe for labels is CCK.

USA

In the USA, white based paper liners are most typically used and due to this relatively homogeneous source, some paper recyclers with slight modification to the process are able to recycle up to 20-30% of release liner along with recovered 'mixed paper' and 'sorted office paper' to produce high value bleached white fiber that can be used for producing Tissue, printing and writing grades. This includes, as an example, one paper recycling process that has been recycling 650-700 t/day of recovered paper of which 20% is silicone release liner. In contrast to Europe, recycling of recovered release liner in the USA has a unique advantage in that predominantly white bleached papers are used and thus the recovered white bleached fiber can be used for many applications which require such higher quality fiber. The quality and yield of recycled fiber from recovered release liners has also increased the financial incentive for recyclers to specifically source such release liner from longer distances (e.g., sourcing recovered release liner from a 300 mile distance compared to a typical 25-30 mile distance for recovered 'mixed papers').

PART C – IMPORTANCE OF RECYCLING OF PAPER SILICONE RELEASE LINER

Despite their important and widespread global use in labelling (along with other release applications), Silicone paper release liners still represent only a very small portion of paper that is used. In Europe, as an example, the total annual production of paper is around 92 million tons of which 50 million tons are recycled. In comparison with these large volumes, less than 0.5 million tons per year of paper are produced for use as release liners (> 0.5% of the total paper produced), which explains why establishment of dedicated recycling processes has been so difficult. Due to the high quality and consistency of the papers used for silicone release liner production, their inclusion into recycling processes can definitely bring benefits to the quality of the final recycled fibres and influence the grades of paper that can be subsequently produced.

RECYCLING OF RELEASE LINER WITH DEDICATED RECYCLING STREAMS

Where the waste stream is specifically composed of silicone release liners where they are re-pulped using dedicated processes (typically including modified de-inking stages), the quality of fibre produced is quite high. This allows the recycling of such pulp streams directly back into specialty paper grades such as Glassine and Graphics papers, where the end application can include re-use as base paper for release liner or other typical applications for glassine papers.

RECYCLING OF LINER WITH STANDARD PAPER WASTE

For the case where paper-based silicone release liner is simply being recycled along with other paper and board grades in the general 'paper' recycling stream, there are a much wider range of intended end applications for the recycled fibre. Typical paper grades produced via this route include general packaging grades (carton and board), but can also include others such as tissue, Writing and even some printing papers.

The choice of whether to recycle paper-based silicone release liners as a 'dedicated' recycling stream or along with general paper recycling processes depends typically on the logistics of collecting the spent release liner and the economics of doing so. From a purely technical point of view, the dedicated recycling stream would make best use of the higher quality paper fibres present in the release liner but may not always be the most practical option due to proximity of such specific recycling processes.

REFERENCES

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 2. "Paper Based Packaging – Recycling guidelines" – CEPI publication number 19-3038
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ABOUT CELAB

CELAB: Toward a Circular Economy for Labels is an industry initiative, founded by companies in the self-adhesive label industry to create greater circularity for its products by enhancing and promoting matrix and release liner recycling around the world. Additional information can be found at www.CELABGlobal.org.