greiner PACKAGING

Whitepaper
Paperization

Is paper packaging the more sustainable choice?

In the pursuit of more sustainable solutions, more and more food producers are considering using paper packaging, as consumers perceive paper as environmentally friendly. The trend toward fiber-based packaging can be seen in various innovative prototypes, from paper bottles to special cardboard packaging. But is paper packaging really the more sustainable choice? In this whitepaper, we take a look behind the scenes and put assumptions and myths about paper packaging to the test, including an exclusive graphic, giving an overview of the barrier properties of different food categrories.

Ideally, modern packaging should be a jack-of-all-trades: It should provide the best possible protection for the product as well as being practical to use, appealing to the touch, visually striking, cost-efficient, and environmentally friendly. The latter, in particular, has become much more critical in recent years: More and more consumers are paying attention to sustainable purchasing and scrutinizing packaging closely. Political pressure is also increasing: The PPWR, the EU's Packaging and Packaging Waste Regulation (see page 16), is the latest step toward promoting a circular economy and drastically reducing packaging waste. Therefore, companies are inevitably looking for environmentally friendly packaging solutions. In the pursuit of greater sustainability, more and more food producers and retail chains are turning to paper packaging – or, more precisely, to fiber-based packaging. We'll come back to this later.

Paper and its environmentally friendly image

"Paperization" is the name of the trend in which attempts are being made to replace plastic with paper in the packaging sector. At first glance, the move seems almost logical. After all, paper has a good image in society. The material is considered a renewable raw material and is thus perceived as sustainable and environmentally friendly. It has a pleasant feeling and can be designed to attract attention. The positive ecological perception among the population and the image that companies are only too happy to adopt for their own products are big reasons why paperization is booming.

Not all paper is the same

The advantage of paper as a material is that it is made from a renewable raw material and can decompose under natural conditions. However, paper only decomposes optimally if it is not overloaded with food waste or other contaminants. Ensuring that the paper used comes from sustainable forestry is also important. This is because paper loses its ecological benefits and can contribute to the destruction of forests and associated ecosystems if it is not sustainably sourced. Furthermore, extracting fibers and producing pulp is an energy and resource-intensive process. In the EU, the USA, and China, a large proportion of the primary fibers used are imported, which means that the ecological impact of paper production is often shifted to countries such as Canada or Brazil. Recycled paper has a better environmental footprint than paper made from virgin fibers: It protects forests and requires less energy and water. One disadvantage of paper packaging is that it runs more slowly in filling plants than plastic packaging. This is a significant drawback, especially in the dairy industry, where huge quantities are filled, as a slower filling process can significantly reduce efficiency and productivity.

Paper often requires coating

Paper is also neither water nor grease-resistant. It therefore needs an appropriate coating for drinks or moist food. A plastic coating extends the shelf-life of packaged food, but makes recycling much more difficult and costly. At first glance, coated laminates are perceived as paper, so consumers are often unaware that they are holding packaging with a significant plastic content. It is precisely this type of coated paper and cardboard packaging that is included in the fiber-based packaging category. For the sake of completeness, it should be mentioned that fiber-based packaging also includes traditional corrugated cardboard boxes, paper bags, etc., in addition to coated paper and cardboard packaging. However, the fiber-based packaging category also includes cardboard-plastic combinations, i.e., plastic cups with a cardboard sleeve, as these generally meet the requirement of at least 50% fiber. In contrast to

coated paper packaging, the two recyclable materials, cardboard and plastic, can be easily separated in cardboardplastic combinations.

The environmental challenge for fiber-based packaging:

- Material composition: Paper packaging for food rarely consists of pure paper, but of coated or laminated paper structures that contain plastic or other components. These coatings are necessary to improve the barrier properties and ensure the shelf-life of the products.
- Recyclability: The inseparable combination of paper and plastic makes recycling difficult. While pure paper and pure plastic can be separated and recycled relatively easily, coated paper packaging poses a challenge for the recycling industry.

It turns out that the question of a sustainable packaging solution is often more complex than assumed. After all, there is no single ideal material for all products in terms of protection and ecology: Nuts and chocolate, which go rancid quickly, place different demands on packaging than something like pasta. Liquid or fatty foods also require different packaging than, for example oatmeal. When looking for ecological packaging, it's therefore important to take a close look at the requirements and then analyze the environmental impact of the packaging in question.

Why do we need a coating at all?

Paper packaging for food often contains a combination of paper and plastic to meet specific requirements. While the paper as the base material of the packaging provides structure and shape, the thin coating of polyethylene or other plastics serves as a barrier against moisture, grease, and other substances that could penetrate the packaging and spoil the food:

- **Moisture barrier:** Foods such as dairy products, which have a high water content, require a barrier to keep moisture inside and prevent moisture from penetrating from the outside. Pure paper is absorbent and, without a coating, would quickly soak through and lose its structure.
- **Fat barrier:** A plastic layer prevents fat from penetrating the paper and damaging the packaging for fatty foods, such as butter or cheese.
- **Oxygen barrier:** Many foods are sensitive to oxygen, which can lead to spoilage or loss of quality. A plastic coating can prevent oxygen penetration and thus extend the shelf-life of the food.
- **Microbiological safety:** Plastic coatings help to prevent the penetration of microorganisms that could also spoil the food

The barrier therefore ensures a longer shelf life, which often makes preservatives superfluous. However, it is not generally possible to say whether a barrier coating is useful, as foods and their requirements are too varied. Therefore, different packaging is used for food that is stored in a cool place and only has a shelf-life of two or three weeks anyway than for food that is stored at room temperature and needs to keep for months. Better protection is needed here.

Oxygen vs. water vapor barrier

The coatings enable the packaging to guarantee the food's quality and safety. This is particularly important for products with a longer shelf-life and those stored in a humid or variable climate. The issue of barrier thus plays a decisive role in more than just paper packaging. If the right packaging material is to be selected for a product, two parameters in particular need to be considered at the outset: the oxygen transmission rate (OTR) and the water vapor transmission rate (WVTR). Both values guarantee the products' freshness, quality, and shelf-life.

We created an overview of the barrier properties of different food categories for you. You can find the graphic in the appendix on the last page.

Recycling coated packaging

Coatings in paper packaging may be necessary to ensure the quality and safety of the food inside, but they pose a challenge for the recycling industry. If only paper packaging coated on one side is added to the paper stream, it can generally be recycled. However, the different materials must first be separated from each other. Double-sided coated packaging (such as that used for wet food) requires cost-intensive, specialized equipment and processes that are not available in all recycling plants. This can lead to many of these packaging types not being recycled. This not only means the loss of valuable resources: If it is incinerated or ends up in landfill sites, this packaging, perceived initially as particularly sustainable, has a much worse impact on the climate and environment than previously thought.

One way to combine the advantages of paper and plastic is through cardboard-plastic combinations: Saving plastic significantly reduces

CO2e emissions, the product is optimally protected in the thin-walled plastic cup, and the material's barrier properties contribute to the shelf-life and safety of the food. The cardboard sleeve ensures the stability of the packaging, a pleasant feel, and a sustainable look that consumers appreciate. Additionally, the cardboard sleeve reduces the plastic content by over 30%. The significant advantage of this packaging variant is that cardboard and plastic can be easily separated, recycled, and fed into the right material stream for reuse.

However, consumers do not always separate the cardboard sleeve from the plastic cup before disposing of it in the trash, which can lead to difficulties in recycling. Greiner Packaging has tackled this problem with its K3® r100 innovation: Cardboard wrap and plastic packaging are separated from each other during the waste disposal process without human intervention. As a result, achieving excellent recyclability does not depend on proper separation by consumers, as is the case with all previous cardboard-plastic packaging, but happens completely independently during waste disposal. It's a decisive step towards greater sustainability and recyclability – but it's still not the last word on the subject. Sorting facilities also need to have the appropriate sorting options for the separated paper and plastic components (and this is not yet the case everywhere in the EU). The recyclability of its cardboard-plastic combinations is a major concern for Greiner Packaging – and is therefore constantly being put to the test and further developed.

Working together toward a circular economy

Whichever way you look at it, there is no such thing as perfect packaging – both coated paper packaging and cardboard-plastic combinations have advantages and disadvantages. The decisive factor is that the materials are selected to suit the respective application, ensuring both functionality and recyclability. However, due to the material properties, foods with high barrier requirements are better off in plastic packaging (or in cardboard-plastic combinations) than in coated paper packaging. A differentiated approach is, therefore, currently required to achieve genuine sustainability. The right sustainable packaging for every product – this is what Greiner Packaging is committed to with its packaging expertise. Fiber-based packaging is also being intensively discussed. Future developments will show what the next step toward a circular economy could look like.

Advantages of Paper as a packaging material:

- Renewable raw material (if from sustainable forestry)
- Biodegradable (if not too heavily soiled)
- Appealing feel

Advantages of plastic as a packaging material:

- High barrier properties
- Recyclable (in compliance with the Design for Recycling Guidelines)
- Efficient filling

Do you have questions?
Contact us!

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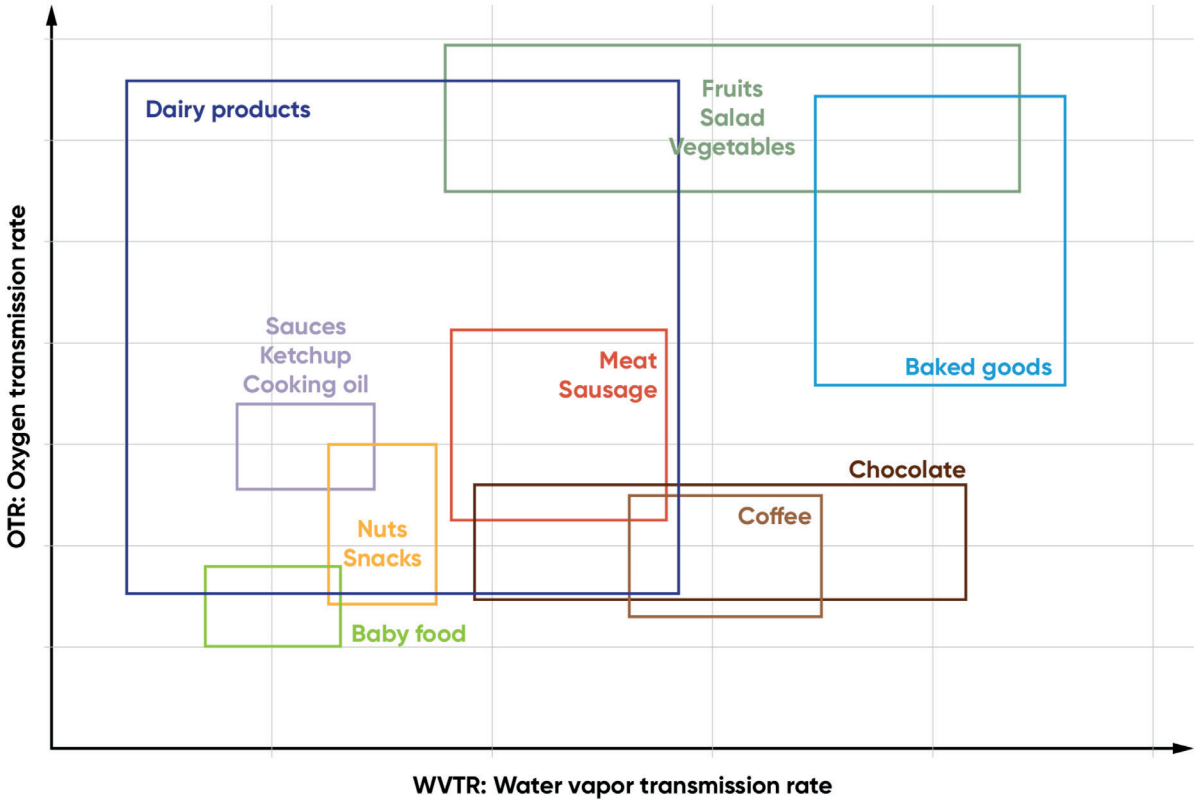
APPENDIX



What does this mean for individual categories?

Dairy products:

- Variety of different products.
- Dairy products are susceptible to oxidation, which can affect their taste, smell, and nutritional value. A low OTR ensures that less oxygen penetrates the packaging, extending the product's shelf-life and quality.
- Dairy products often have a specific moisture balance, which is essential for their texture and consistency. A low WVTR prevents moisture from escaping from the product or external moisture from penetrating.

Baby food:

- Ethylene vinyl alcohol (EVOH) barrier as an additional protective layer.
- Very low OTR and WVTR.

Coffee:

- Unconditional protection from oxygen to preserve flavor and freshness.
- Very low OTR necessary.

Nuts / chocolate:

- High fat content.
- Low OTR and WVTR values necessary.

Fruit / vegetables:

- High OTR to maintain the breathing process.
- Medium WVTR to avoid moisture loss and absorption and ensure freshness.

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