

PROPERTIES AND APPLICATIONS

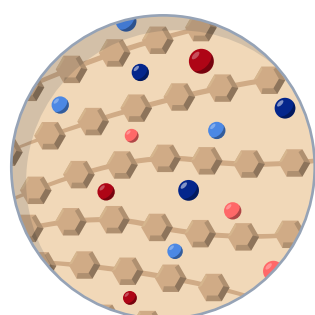
Paper and board have a long tradition as packaging materials. They are made of cellulose fibers that are mainly derived from wood. Paper and board are renewable and biodegradable materials.

Paper and board are typically used as packaging material for dry foods, e.g., flour, rice, and pasta. In addition, they are broadly applied as secondary packaging, for example, cardboard boxes containing a plastic bag.

Chemical treatments or combinations with other materials extend the application of paper and board packaging to liquid and/or fatty foods.

COMPOSITION OF PAPER AND BOARD PACKAGING

Paper and board consist of cellulosic fibers forming the structure of the material. During the production and for customizing the technical properties of paper and board, various additives are used, e.g., fillers, coatings, biocides, and synthetic binders. Furthermore, paper and board are commonly printed, dyed, glued, or labelled. The chemical composition of paper and board food packaging can vary and is often unknown, also to its manufacturers. Therefore, the chemical safety of paper and board packaging is often not well understood.



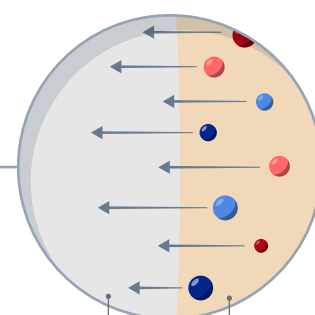
Cellulosic fibers

Additives



CHEMICAL SAFETY

Paper and board have very low barrier properties, as the material is very porous. [Migration](#) of chemicals present in the bulk material, but also from, e.g., printing inks and adhesives, is therefore common and levels may be very high. Chemical migration depends on factors such as food type, temperature, and storage time, but also on the volatility of the chemical.



Food

Paper & board

PAPER INSTEAD OF PLASTIC?

Paper and board that is chemically made waterproof and grease resistant is increasingly used as an alternative to plastic packaging. For example, per- and polyfluoroalkyl substances (PFAS) are regularly used in such packaging. However, PFAS are highly persistent, and exposure can lead to adverse human health effects. Hence, extending the functionality of paper and board packaging can come at the expense of chemical safety.

END-OF-LIFE

In many countries, paper and board are separately collected and recycled, but paper and board food packaging are often not recyclable due to coatings, chemical treatments, or contamination with food residues. Alternative end-of-life options include incineration and landfill. In theory, paper and board packaging is compostable, but persistent chemicals (like PFAS) may be dispersed in the environment through this practice.



RECYCLING

of paper and board

Recycling of paper and board is an established technology in many countries, and products made of recycled paper and board are widely used, also in contact with food. The addition of fresh fibers is usually required during recycling to maintain the desired mechanical properties of the product. Waste streams contain many types of paper and board, such as newspa-

pers, magazines, packaging material, carbonless copy paper, and thermal paper. Many chemicals present in these products are not intended to come into contact with food but cannot be removed from the recycling stream. Therefore, they often remain in food packaging articles made of recycled paper and board and can eventually migrate into the packaged food.



How is paper & board recycled?

RECYCLING PROCESS

The production of recycled paper and board requires sorting of the recovered material. In contrast to plastic recycling, fractionation of the collected paper and board into food-grade and non-food grade streams before recycling is not common practice.

The next steps include pulping, removal of non-fibrous parts, cleaning and, optionally, bleaching and de-inking steps. It is always necessary to mix with fresh fibers to maintain the quality before processing the pulp on a paper (board) machine.

What needs to be addressed?

CHEMICAL SAFETY

Several groups of chemicals with hazardous properties have been regularly found in food packaging made of recycled paper and board and in the packaged foods.

TYPICAL MIGRANTS

- Mineral oil hydrocarbons that originate from printing inks, adhesives, waxes, and processing aids present in the recycling stream.
- Bisphenols that were used in thermal paper receipts entering the recycling stream.
- Photoinitiators that were not completely converted during printing.
- Phthalates that have been widely used in many materials during the last decades.

How can safety be improved?

BARRIERS AND ABSORBENTS

Chemical migration from paper and board food packaging can be reduced in different ways:

- The use of virgin fibers in direct contact with food leads to more defined materials.
- Internal bags and barrier layers on the inner surface of the recycled paper and board packaging can slow down chemical migration.
- Additives, such as active carbon, present in the recycled paper and board bind chemicals and can thus reduce migration.

In turn, these measures increase the environmental impact and affect recyclability. This dilemma can only be solved by avoiding hazardous chemicals during all production steps.

