Food packaging unwrapped

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Food packaging plays an important role in protecting and delaying chemical, physical, and biological deterioration. In this way, even simple packaging (such as glass, metal, plastics and paper) can extend product shelf-life, improve quality and safety, reduce food waste and promote widespread availability.

An important purpose of food packaging materials is to serve as a physical barrier to protect their contents from exposure to microorganisms, pests and the absorption of external odours.They prevent mechanical damage, vibration, shock, and protect from possible contamination or tampering during transport and storage.[1]

In addition, most foods are susceptible to moisture (e.g. biscuits go soft, bread dries out), and require protection using appropriate packaging. Oxygen and light on the other hand are involved in oxidation, a process which results in off-flavours or discolouration in meat, and lower vitamin C in fruit juice. The technique of modified atmosphere packaging (MAP) replaces the air inside the packaging with a single gas or mixture of gases that extends the product shelf life for these foods. For example, lowering the level of oxygen inside the packaging can slow down bacterial growth. Combining this technology with packaging materials that limit the transfer of gases from the outside air (e.g. to stop oxygen entering) and low-temperature storage further prevents spoilage and keeps foods safe for longer.[2] Often packaging is made up of multiple layers of different materials each offering a functional benefit. For example, a paperboard/cardboard container to maintain shape can be combined with a resin-coated foil liner to protect the freshness of the product by acting as a barrier to moisture or air.

Food packaging and technology

Over the last 50 years there have been many significant technological breakthroughs in this field such as: sterile (free from bacteria and other microorganisms) processing and packaging, flexible and reusable containers, gas absorbers, microwaveable materials, tamper-evident closure, and active, intelligent, and recyclable packaging systems.[1] Over this time, there has also been a reduction in the

number of food manufacturers, which has resulted in longer food distribution chains, often spanning multiple European countries.[2] With this comes a need for longer product shelf lives, particularly for fresh and chilled foods.

Moreover, the importance of prolonging the shelf life of food products and reducing waste has been gaining momentum in recent times; the European Commission has set a target to reduce food waste by 50%,[3] and recycle 75% of packaging,[4] by 2030. Sustainable alternatives to petrochemical-based (plastic) packaging can help protect the environment; materials made from by-products from food processing are easily recyclable or biodegradable and can help to reduce waste and landfill from food packaging.[5] Some current innovations in sustainable food packaging include potato- and whey-coated cartons[5], a biodegradable replacement for polystyrene made from mushroom material,[6] and sugarcane-based bottles.[7] Research is being carried out to develop packaging additives that can control or speed up composting time or biodegradation of packaging materials. Edible coatings and films (made from ingredients like casein, whey, collagen, egg, or corn) which can be applied directly to the food products thereby removing the need for packaging are also being developed.[8] In the long term sustainable packaging materials should lower costs and increase competitiveness for packaging producers and the agro-food sector.

Nanotechnology is also considered an important area for the development of innovative food packaging. This applied science involves the control of matter on the atomic scale, with nanoparticles typically having an average size of 100 nanometres or less.[9] These new materials have unique physical and chemical properties such as: improved strength, reduced weight, antimicrobial properties, or increased resistance to heat, gases, UV radiation, and moisture.[10] Exciting areas of research include the design of colour-changing nanosensors to instantly detect leaks in vacuum or gas-packed foodstuffs, temperature variations over time, and microbial growth (e.g. the presence and growth of bacteria, viruses or moulds that can lead to food spoilage). In addition, active packaging has been developed that contains preservatives that are released in a controlled way only when a food starts to spoil.[11]

So-called intelligent packaging materials are also increasingly being used to monitor and communicate the condition of a packaged food to the consumer or supply chain actors. For example, indicators in packaging can change colour to let consumers know whether the product has been heated or cooled above a critical temperature that affects the quality or safety of the product (e.g. freeze–thaw–refreezing).[12]

Regulation of food packaging

In the EU, a food contact material (FCM) is defined as any material that is intended to, or that can reasonably be expected to, come into contact with food during production, transport, storage or consumption e.g. packaging, cutlery, containers, machinery etc. European regulations ensure that FCMs produced and used in the EU are safe for their intended uses.[13],[14] For example, packaging materials should not affect the composition, taste or odour of the food inside in an unacceptable way. Manufacturers must also ensure that chemicals and particles from packaging materials do not migrate into food at levels that could cause harm. In addition, there are specific measures (with more detailed restrictions) in place to regulate certain materials such as recycled plastics, active and intelligent FCMs, regenerated cellulose and ceramics.[15]

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