

Packaging Technology and Design

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Introduction

Packaging is used in almost every aspect of our lives, you can't really get away from it, even if you tried. It's used to protect products in transport, keep food fresh, entice us to purchase, to provide warnings and to relay legal and safety information. Any product that is designed and made available to the public will need to be packaged and there is a variety of materials to choose from and many rules to follow.

Packaging is the technology of enclosing or protecting products for distribution, storage, sale, and use. It refers to the process of designing, evaluating, and producing packages that can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries, it is fully integrated into government, business, institutional, industrial, and personal use.

Packaging engineering, also package engineering, packaging technology and packaging science, is a broad topic ranging from design conceptualisation to product placement. All steps along the manufacturing, distribution, marketing and consumption process, should be taken into account in the design of the package for any given product. Package engineering includes industry-specific aspects of industrial engineering, marketing, materials science, industrial design and logistics. Packaging engineers must interact with research and development, manufacturing, marketing, graphic design, regulatory, purchasing, planning, etc. The package must sell and protect the product, while maintaining an efficient, cost-effective process cycle.

Packaging engineers design and develop packages from a wide variety of rigid and flexible materials. Some materials have scores or creases to allow controlled folding into package shapes. Packaging involves extrusion, thermoforming, moulding and other processing technologies. Packages are often developed for high speed fabrication, filling, processing, and shipment. Packaging engineers use principles of structural analysis and thermal analysis in their evaluations.

Packaging Technology Drivers

We continue to move towards environmental conservation, an aged population, and highly networked information, the packaging industry is required to review the social significance of packaging for development and improvement in harmony with society. Our need for food safety and reassurance, environmental consideration, and universal packaging design is now increasing more than ever before. There is a growing tendency to consider the social and environmental compatibility of packaging among consumers as well as among people of industry, government agencies, and academics. We are in the century of the environment. It is becoming very important to convert our present society systems based on mass production, consumption and waste into a recycling oriented society system based on recycling and reuse. Significant work has been done these past 15 years on Recycle, Reuse, Reduce, Refuse and Repurpose in packaging and other industries. The participation of local municipalities and consumers as well as people in industry is extremely vital in addressing these tasks. We need to teach our children and grandchildren. It needs to become a way of life by all of us.

There is a greater consideration for seniors and disabled people which is becoming a great movement in society along with the environmental issue. The packaging industry began full-scale efforts a few years ago. The packages created from these efforts are called universal design packages, which have been used for food and toiletries.

Along with the two streams of environmental compatibility and universal packaging designs, the development of packaging technologies specified for ensuring food safety and reassurance has been

advancing in recent years. In our society created by advanced computer network technology, quickly promoting the traceability of food and developing packages that indicate information about the food including expiration dates are required.

In our society, the development or improvement of packages has started to respond to the five streams of environmental conservation, consideration for seniors and disabled people, and food safety and reassurance.

We need to develop specific packaging technologies which includes packaging materials because, package design must help a product differentiate itself from the masses on the retail shelf, stimulate sales volume of mature product categories, and leave the consumer with a positive experience. The package is the "silent salesperson" sitting next to the competition; it must not only get the busy consumer's attention, but shout, "buy me!" To be successful in the market today, one must not only achieve this type of reaction with the package design, but the package must also function well and provide a positive, memorable experience for the consumer.

Those packs that have been developed for reducing the environmental load include Eco Inks (Aroma-free Ink, Aqueous Printing Ink, and Soy Ink), and biodegradable plastics that decompose due to microorganisms in the ground or compost. In general, packaging materials complying with the needs of society are mainly created by improving or advancing existing technologies rather than by developing new technologies. What types of packages should be developed to address the 5R's by defining the recycle ratio and setting the numerical target goal for each product becomes a challenge that each enterprise is to address as a priority.

Since consumer participation becomes extremely important in environmental considerations, packaging technologies must be developed or improved in accordance with standardisation efforts, such as establishing related laws and regulations, and the quantification of the LCA technique. Although we may not want laws to inhibit pro-activity, we do need them for control, adherence and consistency.

Technologies considering seniors and disabled people

Packaging considering seniors and the disabled, as represented by universal or accessible design, must be designed for everyone to easily use, irrespective of age, capability and lifestyle. Packaging has responded to these requirements by improving or advancing existing technologies, such as convenience for everyone to use e.g., notched paper containers for drinks, easy-to-grip bottles provided with an indentation for easily grasping the plastic bottle, and package containers with notched sides so users can differentiate similar package containers from each other to prevent improper use.

Another equally important aspect is improving the technology for tamper-proof seals that can easily detect the breaking of the seal or opening of the package to guarantee a hermetically sealed packaged container, and child-resistant technology to prevent children from easily manipulating packages consciously or unconsciously.

The evaluation method for universal and accessible designs and the standardisation of design guidelines considering seniors and disabled people are now important elements for developing or improving packages.

More recently accessible designs have done extremely well on the world stage, this trend will continue along with packaging that focusses on Save Food. The global community is the driver of these developments and is most encouraging.

Technologies for highly functional packages

There are many highly-functional packages developed particularly for food safety and reassurance.

In paper manufacture and paper boards, the development or improvement of technologies is advancing for producing paper containers which can be used for liquid, replacing conventional cans, bottles, and plastic bottles. The same for producing paper-made cushion materials, paper-laminated cans, heat insulating paper cup, paper containers water-proof-processed at edge faces, non-staple cardboards, pulp moulds, and micro flute packaging. In transport packaging, functional cardboard is under development including cardboard that is recyclable, excludes moisture, conducts electricity, and is waterproof, corrosion proof, and insect proof.

The development of technologies concerned with food safety and reassurance is remarkable in plastics. Representative technologies relate to active and intelligent packages. The active package itself reacts with the environment to change its attributes, thus improving the quality, safety, expiration date, and usability of packaged contents. The intelligent package has mechanical, electrical or scientific monitoring and is able to display changes in the quality of its packaged contents over time. The technological development or improvement of packaging is advancing with light-blocking film, transparent and evaporated film, nanocomposites, passive packages, microwavable containers, retort-related containers, and more.

In metal products, an embossed can has been developed which has a rugged part on the can body to make it distinctive in terms of both design and printing. In addition, the developed products include resin laminated cans, diamond-shaped pattern cans, and resealable cans.

In glass products, the representative packages are ultra-lightweight bottles developed as a container friendly to the environment and compatible with our recycling society, and UV-cut transparent bottles that protect their contents by blocking harmful ultraviolet rays. The development of technologies for these packages is still progressing. The greatest attention in this field is focused on the manufacture of bottles using cullet made from recycled broken bottles with a ratio of over 90%.

The advancement or improvement of other packaging technologies is well under way to respond to the various streams of environmental conservation, considering seniors and disabled people, and food safety and reassurance. Further improvement has been made in the technologies of the existing aseptic fill system, foreign-matter-detection, soft-X-ray inspection, marking, in-mould labels, in-line blow fill, shrink labels, and blow-off.

Packaging technology education

Education is fundamental to development. It is both a human right and an investment for sustainable development. Education enables people to live healthier and more productive lives: a path to maximise individual potential, extend freedoms, build capabilities and open up opportunities. The benefits of education within the packaging industry remain particularly strong. Evidence highlights that for education to enhance economic growth, students are to be in a place of learning. Some packaging engineers have backgrounds in other science, engineering, or design disciplines while some have college degrees specialising in this field.

Formal packaging programs may be listed as package engineering, packaging science, packaging technology, etc. BE, BSc, MSc, M.Tech and PhD programs are available. Students in a packaging program typically begin with generalised science, business, and engineering classes before progressing into industry-specific technology related topics such as shelf life stability, corrugated box design, cushioning, engineering design, labelling regulations, project management, food safety, robotics, quality management, package testing, packaging machinery, tamper-evident methods, recycling, computer-aided design, etc.

Education is also an essential part of responding to current and future challenges, rising inequalities within and between countries.

Conclusion

To be in the forefront of packaging design, it is imperative to consider cost effective packaging. To remain at the forefront and set the benchmark, one needs to be resolute in a lateral thinking approach.

It is also important to remember that packaging is a medium that invades our homes. It is something we see perhaps many times over long periods. It can therefore be a good medium to promote information about a whole host of issues from positive, general well-being messages about healthy eating, to warnings about poor habits. Many packs use wit to arrest attention through clever use of illustration and typography. Packaging drives innovation with packs that aid the cooking experience – such as its steam cuisine range – and promoting the provenance of its food by putting farmers and chefs on the pack.

Finally, there are two simple questions one can ask oneself and that is to judge whether packaging design is different or whether it's relevant.

01 September 2018

Note that Prof Pierre Pienaar lectures at:

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