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ECOLURE – BEAUTY AND SUSTAINABILITY IN ONE IN LIGHT OF TODAY'S CHALLENGES FOR THE PACKAGING MARKET

ECOLURE – PIĘKNO I EKOLOGICZNOŚĆ W JEDNYM OPAKOWANIU, CZYLI WYZWANIA STAWANIE PRZEZ TRENDY RYNKOWE

ABSTRACT: Today the packaging design and production is vastly driven by the aspect of sustainability, which is not merely a consumer trend, but a necessity to meet the goals of sustainable growth, as well as the legal demands imposed by EU regulations. Packaging manufacturers are challenged to continuously seek new ways of providing products compliant with modern demands.
Ecolure is an example of a sustainable paper packaging solution that is recyclable and compostable while still maintaining the metallized shine of a traditional PET-laminated board.
Key words: sustainable paper packaging, laminated packaging, metallized packaging, eco-friendly packaging technology, PET lamination, research packaging project

STRESZCZENIE: Obecnie w projektowaniu i produkcji opakowań ogromną rolę odgrywa aspekt zrównoważonego rozwoju, który nie jest jedynie trendem konsumenckim, ale koniecznością do spełnienia postawionych celów ekologicznych, a także wymagań prawnych narzuconych przez regulacje unijne. Producenci opakowań stają przed wyzwaniem ciągłego poszukiwania nowych sposobów dostarczania produktów zgodnych z aktualnymi wymaganiami. Ecolure jest przykładem zrównoważonego rozwiązania w zakresie opakowań papierowych, które nadają się do recyklingu i kompostowania, a jednocześnie zachowują metaliczny połysk tradycyjnego arkusza laminowanego PET.
Słowa kluczowe: zrównoważone opakowania papierowe, opakowanie laminowane, opakowanie metalizowane, ekologiczna technologia pakowania, laminacja PET, projekt badawczy opakowania

GLOBAL PACKAGING MARKET TRENDS

The leading trends at the global market of packaging may be classified in five categories: production trends, demand trends, trends in respect of packaging functionality, technological trends and the ones connected with the environment protection. For the needs of the present paper, the attention will be focused on the latter mentioned trend. Care for the natural environment is the most important trend on the packaging market which will have a deciding impact on further development of the packaging sector. Therefore, the attempts are undertaken aiming at the reduction of its negative influence on the environment and transformation of the packaging sector towards the Circular Economy. EU Directive 2019/904 of the European Parliament and of the Council of 5 June 2015 on the reduction of the impact of certain plastic products on the environment identifies 6 main trends in aspect of the sustainable development and environmental protection. The mentioned trends include:

– Eco-design, understood as the design of new products, with consideration of their complete life cycle. In the context of the products, listed in Annexes to Directive 2019/904 it means product design destined for recycling, minimization of the mass of the products, productre-use in the same or another value chain and obtaining of mono-material for manufacture

- Alternative materials – in the context of single-use plastic products, it is referred to replacing materials with similar or better properties and functionality, for example, paper, wood, glass, natural materials, bio-composites (multi-material composites, using paper and bio-plastics), materials derived from agricultural and forest waste and by-products, food products, etc.
- Reusable packaging
- Zero Waste
- E-commerce – especially in the context of fast-moving goods, for packaging of which the so-called single-use plastics are used
- The concept of the Sharing Economy (also in relation to packaging).

ECO-DESIGN OF PACKAGING IN THEORY

The trend of eco-design of packaging is well illustrated by a new line of DOT2DOT products, called Ecolure. Before discussing the mentioned products, let's learn more precisely what eco-design is.

According to standard PKN-ISO/TR 14062:2004, eco-design means "inclusion of environmental aspects in the design and development of a product". Eco-design is, therefore, the supplementation of the main elements, considered in standard process, such as safety, functionality, ergonomics, resistance parameters or costs, plus two additional factors: evaluation of impact on the environment and perspective of the complete life cycle. In practice, it means the development of a new or improved version of packaging with a smaller impact on the environment. Eco-design, as being an instrument of minimizing the influence on the environment, has already been considered for many years as the priority measure in the field of the EU as well as Polish strategies. The development of guidelines in respect of designing the eco-friendly packaging, their ecological optimization and minimization of potential food losses connected with packaging is aimed at reduction of environmental impacts resulting from production, use and recycling of the used packaging. They should also give a guarantee that they meet the requirements connected with the appropriate protection of the packaged products and safety of their use. It has been confirmed by many documents and, in particular, by the package of activities concerning the circular economy, as created by the European Commission.

ECO-DESIGN IN PRACTICE

DOT2DOT, as a packaging manufacturer , cooperates with customers from many sectors of the economy with a focus on the beauty and food industries. It is more and more frequently visible how strong a pressure is exerted by the clients who expect packaging to be sustainable without the loss of its visual values at the same time. On the one hand, we have to deal with the legal regulations, approximating the introduction of the provisions from the successive directives of the European Union concerning packaging and packaging waste. On the other , we must consider

PIC.1 : ONE OF THE LEADING TRENDS AT THE GLOBAL MARKET OF PREMIUM PACKAGING IS ECOLOGY.

also market trends and choices made by the consumers in favour of sustainable packaging. Answering contemporary market's expectations DOT2DOT has developed a concept called DOT2GREEN which places focus of all activities undertaken by the company to be aimed at minimizing the impact of packaging on the environment. Within the frames of DOT2GREEN an innovative project, "Development of innovative and eco-friendly cardboard packaging with optical protection on the metallised substrate", has been developed and successfully implemented as a result of a two-year research and development work . It was financed within the frames of the competition of the National Centre for Research and Development. The assumptions of the project include the development and manufacture (in pilot-scale line) of paper packaging that would be free of plastic and, simultaneously, would be attractive owing to a shiny metallic layer. The departure from traditional lamination with PET film as the inseparable underlying component in favour of the new sustainable solution could neither cause loss of visual quality for laminate, nor lower the functional properties of the packaging. During the industrial stage of the project, the Research & Development staff of the company developed the assumptions for production of new eco-friendly packaging. The process is commenced from coverage of cardboard with glue and laying

PIC 2: ECOLURE IS AN EXAMPLE OF A SUSTAINABLE PAPER PACKAGING SOLUTION THAT IS RECYCLABLE AND COMPOSTABLE WHILE STILL MAINTAINING THE METALLIZED SHINE OF A TRADITIONAL PET-LAMINATED BOARD.

the laminate; the successive stage includes removal of the PET layer from the laminate. The prepared sheets are subjected to the stages of overprinting and varnishing, punching, moulding and gluing of the final packaging shape. The R&D team, supported by two research units (Warsaw University of Technology, Institute of Mechanical Engineering and Printing and the Łukasiewicz Research Network –Łódź Institute of Technology) tested the products made from traditional laminate and the products with the metallised layer without PET layer (hereinafter being called Ecolure), as manufactured in the laboratory conditions. The tests included also materials used in performance of the samples.

The results of the stage of industrial tests were as follows:

- the types of the applied metallised transfer and traditional foil are characterized by highly comparable mechanical parameters;
- degree of gloss (measurement at angle of 20o) for all foils exceeds value of 200 GU (Gloss Units);
- it was found that the application of transfer foil in the composition of laminate as compared to the traditional film did not have any significant effect on the change in the resistance parameters of laminates (resistance to stretching and elongation at maximum stretching force);
- it was confirmed that overprinting with offset inks of LED UV type also did not have any effect on mechanical properties of laminates; the adhesion of overprint and quality of printing with inks LED UV in test laminates with the use of traditional and transferable films was comparable;
- the level of global migration for the test laminates with transferable foil was found significantly lower the admitted limit of 10 mg/dm^2;
- the test laminates with transferable film, as compared to those ones with the traditional foil, obtained also the comparable results in respect of the following parameters: smoothness, soaking of aluminium in cardboard, sensory evaluation (for standard substance – chocolate) and barrier to water.

The positive results of the laboratory stage of the project allowed entrance to the developmental stage and manufacture

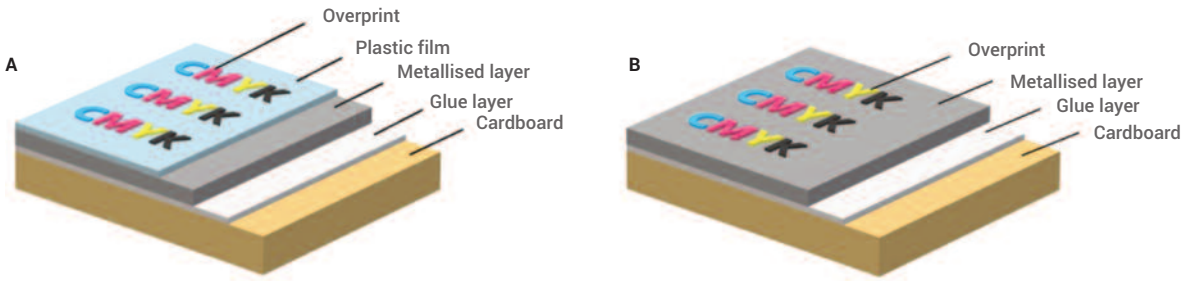

FIG. 1. COMPARISON OF THE STRUCTURE OF PRINTED LAMINATES WITH TRADITIONAL METALLISED FOIL (A) AND TRANSFERABLE FILM (B)

of packaging. When designing the pilot-scale line for manufacture of Ecolure products, the guiding factors included the results of the tests from the first stage such as temperature threshold for the implementation of effective process of lamination and the lower limit of the pressure of metallised transfer film exerted on the cardboard during lamination. The amount of appropriate glue was chosen in order to conduct the correct lamination process. The studies on the influence of the time between the process of laminating and delaminating on the effectiveness of delaminating were carried out; the negative impact on the quality of final laminates was not found. The technology of removal of the transferable film without damage of the metallised layer in manufacturing conditions was improved.

The correctness of arrangement of pilot-scale line was confirmed by production of several series of packaging. Additionally, the LED UV technology was chosen for over printing due to the lower effect on the environment in comparison to UV technology. The stability of LED UV printing process for the packaging on the metallic layer Ecolure was examined. The overprint of the traditional laminate is carried out on PET film; in the case of Ecolure it is performed directly on the metallic layer; hence, there is a necessity of verifying the correctness of overprint and its stability.

All packaging samples (printed with LED UV ink) were characterized by a high resistance to light effect. After 40 hours of exposure to UV light, the change in CMYK colours was lower than value ΔEab 5: for overprint of magenta ink, the observed change in colour was equal to 4 (ΔEab = 4.04) and for the remaining colours (C, Y, K) the values of change in colour were decisively lower. The effect of light caused a minimum change in gloss of packaging – the gloss was decreased maximum by ca. 10% of initial value. Additionally, the results of the resistance tests confirmed that the packaging with overprint on laminate with transferable film and lacquered with LED UV inks obtained the positive results in respect of resistance to abrasion.

SUMMING UP

After the completion of the research project DOT2DOT is able to offer the Ecolure packaging where the eco-friendliness has many following aspects:

- **Certificate of recycling** – the possibility of reprocessing together with other paper materials
- **Certificate of compostability** – possibility of subjecting a given packaging to the industrial composting process
- **Reduction of carbon footprint by almost 6% in relation to packaging obtained by traditional method** – index of carbon footprint for packaging made in technology with transferable film at the level of 57.5 kg CO_2 eq.
- **Lower energy consumption of overprinting and lacquering process even by 50%**. Ecolure packaging are produced with the utilization of LED UV printing technology which is characterized by a lower energy intake and owing to it, lower energy consumption as compared to the IR drying technology (hot air) by ca 10% or UV – more than 50%.
- **Elimination of ozone during processes in printing machine** – the application of LED UV technology does not cause generation of ozone as in the case of UV technology.

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