

Using Possibility of QFD Method for Development of the “Ready-To-Go” Package

Authors

Jelena Krstić*

*University of Novi Sad,
Faculty of Technical Sciences,
Serbia*

**E-mail: krsticj@uns.ac.rs*

Abstract:

Although quality function deployment (QFD) is mostly used in the development of new products, the methodology is equally varied and applied as a packaging design/development tool. Since the demands of the market, i.e. users are constantly changing, the designers of all products, including packaging food designers must implement the introduced requirements into the design of their products. The aim of this paper was to explain the QFD method, the mode of its operation and implementation and its potential for practical application in the packaging design process, as well as highlighting all the advantages and disadvantages of this method. The goal of the implementation of the QFD method during the development of the packaging is to find out exactly what the user expects from the packaging, i.e. customers' voice transforms by means of this method into new products that really meet their needs. It can be concluded that the application of QFD methods can reduce the length of the product development cycle, in this case the packaging, while simultaneously improving the quality and marketing of products in the market.

Keywords:

Quality Function Deployment, House of Quality, Package, Product Development, Market

1. Introduction

The designers of packaging are faced with frequent changes of consumers' demands. The requests for a change in the packaging of these products are primarily affected by changes in consumers' habits that are associated with style and the way of life. Besides the aesthetic

characteristics of the packaging, the designer has to harmonize the price and the quality of new packaging with the ease of handling, use, transportation and storage. Good packaging design is vital for the success of the product on the market, so designers take on much of the responsibility

for the sustainability of the product. Hence, there is a need to study and develop procedures that can help a company or project team gain profound knowledge of customer requirements and satisfaction, and then develop products with innovative features (Shen *et al.*, 2000).

There are four key factors in terms of viability of the product on the market: product design, product price, product quality and delivery of products. Product design significantly affects other factors. Of these four factors, design and quality of the product are the most relevant (Shen *et al.*, 2000; Farsi & Hakiminezhad, 2012; Bruce *et al.*, 2001). Product quality primarily depends on the ability of the company to meet the demands of consumers. One of the key factors for the maintenance of the achieved quality of the product, especially for consumer products is that they are packed in appropriate packaging. Packaging products, must be aesthetically appealing and attractive, but also functional. In order to define customer requirements more precisely, it is necessary to conduct a market research. For this purpose many methods have been developed that have been used successfully in the development of products (interviews, surveys, focus groups, customer specifications, observation, field reports, etc.) (Kim *et al.*, 2000; Mehrjerdi, 2010a). The problem that arises is the translation of the results of market researches and subjective demands of consumers in product performance that will continue to be used in each stage of product development (for example, planning, design, construction design and product evaluation of the prototype, the development of production and sales) (Kim *et al.*, 2000; Mehrjerdi, 2010a; Mehrjerdi, 2010b; Bouchereau & Rowlands, 2000; Chan & Wu, 2002). One of the methods with the aim of connecting oriented demands and expectations of product performance is the method of Quality Function Deployment - QFD. The objective of this paper is to explain the implementation of the QFD method in the design process of the packaging of consumer products, i.e. the packaging for multivitamin drinks, as well as to point out the advantages and the importance of application of the QFD method and the sustainability of the product.

2. The concept of quality function deployment method

Ever since the beginning of the development of this method (late 1960s of the 20th century), its aims were to improve design quality and to provide creative professionals engaged in the marketing and manufacturing with a tool to plan quality control. The method allows the definition of the points in the production process to be controlled before the beginning of the production process. Many companies have used QFD to gain competitive advantages in business (Shen *et al.*, 2000; Bruce *et al.*, 2001, Mehrjerdi, 2010a; Mehrjerdi, 2010b; Chan & Wu, 2002). The QFD method is a formal way of how a team, in accordance with customers' requirements and expectations defines the operating characteristics of the product in order to find out the exact parameters of the product that the customer expects. This method is the concept and mechanism for the transformation of the voice of customers through various stages of product planning, engineering design and manufacturing, to the final product (Kim *et al.*, 2000; Vonderembse & Raghunathan, 1997).

There are two sets of requirements to be taken into consideration in this type of modelling. First, there are consumer's requirements, known as "CRs". To determine such information, a survey can be conducted by the marketing department. Second, a number of engineering design requirements (DRs) affecting CRs are also identified to maximize customer satisfaction. Consumer needs i.e. voice of the customer are summarized in a product planning matrix and arranged with the voice of engineers (Chan & Wu, 2002).

Graphical representation of the matrix for the product development planning, i.e. house of quality, is presented in Figure 1. House of Quality consists of six blocks. The development of the house of quality begins by determining customer's needs (block 1) and is often termed "customer requirements" or "customer attributes", or simply "Wants." Customer requirements may be determined from focus groups,

in-depth interviews or similar techniques. During the collection of useful information about user's requirements for the development of new packaging, target groups are users of products whose packaging design is necessary to change. Target group is based on the age of users, their daily habits or time consumption of the target product. Block 1A allows the requirements to be prioritized. The weights used to establish priorities may be derived from customer's input, or from direct experience of those involved in developing the matrix. Block 2 of the house helps determine whether satisfying perceived customer needs will yield a competitive advantage. If a company wants to match or exceed the competition, they must first determine their position among competitors (Raper, 1999).

Block 3, "engineering characteristics/design factors" describes "how" an engineer can meet customer's needs. Thus, the voice of the customer is translated into engineering terminology by highlighting engineering characteristics, which affect customer attributes. Engineering characteristics should describe the product in measurable terms and directly affect customer's perceptions. It should also be noted that a single engineering characteristic may affect more than one customer attribute. Block 4 is a relationship matrix which indicates the degree

to which each engineering characteristic influences each customer attribute. These relationships are usually stated symbolically in some manner, as shown in Figure 1, but a numerical value may be assigned to the symbols to indicate relative importance. When the matrix is completed, objective measures are included in block 5 of the house. These measures help establish target values for engineering characteristics, and compare the organization to the competition (Raper, 1999).

The top portion of the house of quality is its "roof" and it is shown as block 6. The roof is also often referred to as the correlation matrix. The correlation matrix serves to identify qualitative correlations between various engineering characteristics and is accomplished by the use of relationships symbols. These correlations may be either positive or negative and may range from weak to strong. Too many positive interactions may indicate redundancy in critical product requirements or technical characteristics. Negative interactions point to the need to consider engineering trade-offs in order to address customer requirements. These trade-offs can be based upon company priorities, competitive strategies, etc. This segment of the house of quality enables in particular the team involved in the process

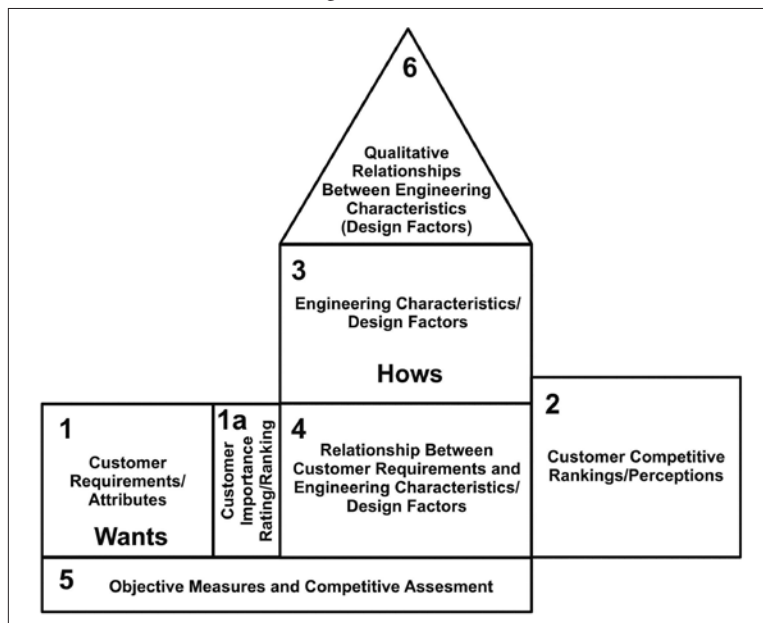


Figure 1. Structure of the house of quality

to note how one engineering change may affect other characteristics (*Raper, 1999*).

The completed house provides a number of benefits such as measurable target values (block 5), competitive assessment and competitive position (blocks 2 and 5), relationships between customer requirements and engineering attributes (block 4), and the relationship between engineering characteristics (block 6). If numerical emphasis is used, the house can readily identify the most important customer attributes to pursue through engineering design characteristics.

In the packaging research conducted by Duizer et al., the authors investigated only the elderly attitudes towards food packaging. Injuries from packaging were surveyed by Winder in the UK. The results showed that packages required consumer's close attention (46.5% of the participants), consumers could not see where and how to start opening the package (36.5% of the participants), it was not obvious how to open the package (30% of the participants), consumers were not strong enough to open the package, and consumers were worried about spilling or wasting product (16% of the participants) (*Yiangkamolsing, Bohez & Bueren, 2010*).

3. The results of applying the QFD method to the development of packaging for multivitamin drinks

Packaging is considered the silent company's salesman. Since the diffusion of self-service in several sectors, packing was considered a very valuable function for products sale. The customer inspects several varieties of brands in the supermarket and his/her final decision would be primarily influenced by products packaging. There is no doubt that packaging shall correspond to the image idealized by costumers, by its positioning, and it also can be used as competitive advantage in Products Management, through a strategy of differentiation.

Changes in the pace of life of working people, students, athletes and others influence the development and the customization of commonly consumed products. Of course, most of them have a habit of not wanting to change, but they need to adapt the existing products to their life style. One example is the consumption of vitamin drinks sold in powder form and the preparation prior to consumption. The users of these products insist upon consuming their favourite multivitamin drinks anyplace and anytime. It is thus understandable that users of these products cannot afford themselves any comfort, especially if they are on the move, at work, outside home, etc. For these reasons, the designers of packaging, in collaboration with the producer team have developed new packaging concepts.

The effort resulted in the matrix shown in Figure 2, which indicates the correlation between the respective "Wants" and "Hows." Each of those participating in determining "Wants" and "Hows" was given a copy of the initial matrix and allowed to fill in the relationships from their viewpoint. Correlation relationship matrix values were marked as strong, medium, or weak. A weighted scoring system was developed to help prioritize or weigh the importance of the "Hows." The scores in the house of quality (Figure 2) are the sum of the product of the "Wants" rank and the matrix value. The value of the "Hows" score associated with the person surveyed was determined from their "Wants" ranking and matrix values. The final scores were determined by calculating the percentages of the total and the average of rank/matrix products of all surveyed. Based on those scores, the requirements, in order of importance, were: rigidity, package breakability, and simplicity of design, internal stability, information location, dirt resistance, compression load support, and standard dimensions (*Raper, 1999*).

As can be seen from Figure 2, user requirements, including engineering requirements, are systematically divided into four main fields: use, protection, communication and other conditions that must be met and which are necessary to fulfil the expectations and wishes of the users. Figure 2 demonstrates the key requirements for

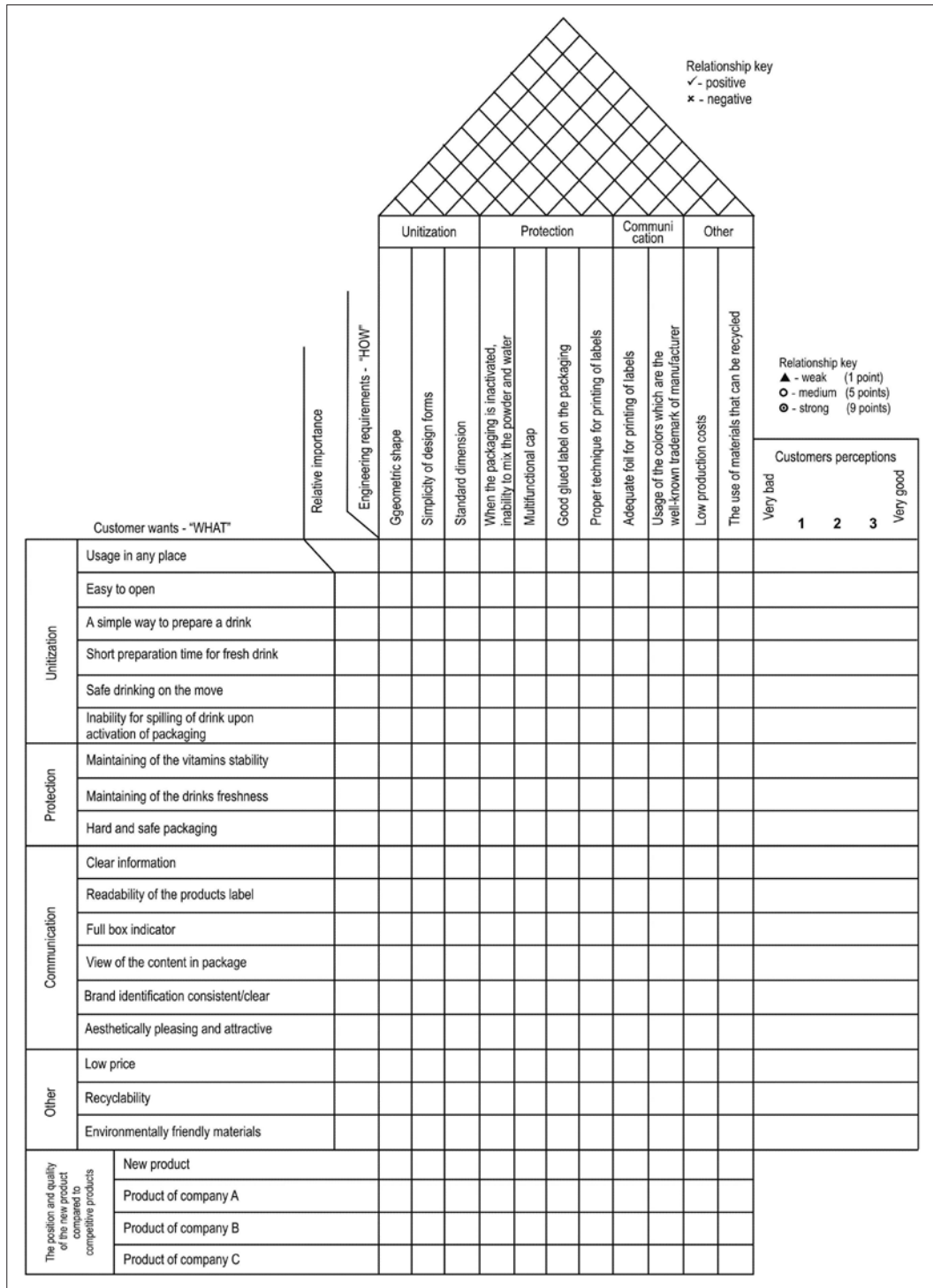


Figure 2. Initial house of quality for development of innovative package for multivitamin drinks

the development of a new type of “ready-to-go” packaging for multivitamin drinks. This type of packaging primarily allows the user to consume the drink anyplace and anytime. Principal requests are focused on the ease of use, the ease of activating the packaging and the short time of preparing the beverage. One of the key requirements for this type of packaging is the freshness of the product. Nowadays, when a lot of attention is paid to the problems and possibilities of environmental protection, it is impossible to avoid the environmental conditions and their integration in the development of innovative packaging. An important factor for the survival of the product on the market is definitely its recognition among similar products which are offered on the market. This type of request is classified in the domain of communication products with the consumer. Successful communication with the customer packing is essential for the survival of the product on market.

There is a large number of different types of packaging available on the Serbian market, but a unique solution is adopted by the Croatian company CEDEVITA Ltd. The company has marketed a new, unique packaging solution for the instant drink CEDEVITA, developed by the Pacific Group. Atlantic’s engineers have been working on the project for more than six years, during which they developed and patented this innovative product solution. The new product helped Cede- vita become a leading vitamin instant drink in the region and introduced a new aspect of its use, i.e. consumption on the movement. After a great success in the 15 g packaging of Cede- vita for catering facilities, the Cede- vita GO! project is a cherry on top in the 40 year popularity of Cede- vita in households. A patented twist cap which releases granules/powder in water offers considerable co- operation possibilities with companies in this sector as it can be applied to various segments of food industry, such as children or sports nutrition.

Multipower brand Cede- vita is a well-known quality brand for healthy vitamin drinks in Cro- atia. For their latest product, Cede- vita Go!, the company selected the Dutch injection moulder Teamplast to develop a dispensing bottle cap. Result: with a simple rotation of the dispensing

cap 26 g vitamin powder is dispensed into the liquid of the bottle, creating a fresh, healthy, on- the-go bubbling multi- vitamin drink.

The developed system transfers a rotating movement into a linear one. The movement is activated by a handle connected with an oval disc with a sharp knife-like point at the bot- tom pinching the seal foil when the handle is moved, as can be seen in Figure 3. Dispensing cap features two pieces: the ‘vitamin chamber’, including the handle with the pinching knife and the bottle cap itself. The system works as follows: A device which picks up the top of the handle when rotated is located inside the cap. The movement of the handle anti-clockwise pushes the knife down. The beauty of the sys-

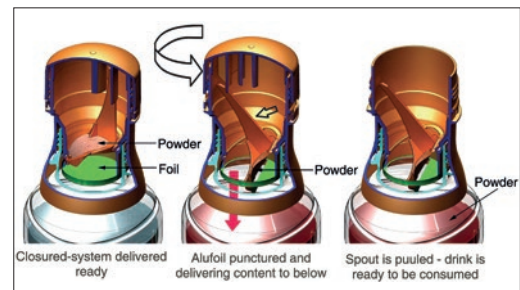


Figure 3. Operation principle of packaging for Cede- vita

tem is that for the activation of the vitamin drink the consumer only has to exercise the common opening of a bottle (*Nacional, Neo- visni news magazin, 2009*).

An important advantage of the product is that the mixing of granules Cede- vite with water immediately before consumption preserves the stability of vitamins from the liquid.

Innovative packaging design for multivi- ta- min drink Cede- vita GO! is responsible for the characteristics and requirements presented in the initial quality of the house (Figure 2). All requirements are met in the field of the use of packaging – opportunities for the consump- tion of multivitamin drink everywhere, ease of opening, safety of spills before and after activa- tion of packaging, simplicity and short prepara- tion time of fresh drink. Packaging is activated by a simple turn of the cap, which is somewhat

larger than usual. Once activated, the packaging can be closed again without the possibility of spilling the drink. The drink is always freshly prepared. When it comes to the protection, this packaging concept fully meets all the criteria. This patent offers a physical separation of the powder, placed under an innovative shutter containing a membrane, from the liquid. The membrane separates the two parts of the packaging, bottle and cap.

Communication of the product with the consumer is one of the most important roles of packaging. It was respected and adapted with the new design. Label is an integral part of the packaging and it contains clearly defined information about the content of the product and information on the use of packaging. It also allows clear identification of the brand, the product, and the emphasis is placed on distinctive colours and the brand's well-known logo. It is still possible to see the content inside the packaging. Transparent wrapping label printed by means of techniques suitable for printing such products, namely the flexographic printing technique. The presence of such labels does not remit overview of the content inside the packaging. In order to meet environmental requirements for this type of packaging, only recyclable materials are used in the production of this package. The packaging label contains the information about the possibility to recycle the packaging. This is a good solution for the protection and preservation of environment, but also a quick and easy solution for the collection of used packaging that could be recycled and reused.

There are different concepts of solutions for this type of packaging. One of them on the global market is ViCapsystems Ltd., a Swiss company and a renowned innovator in the packaging industry. This company is specialized in the production of sports-cap packaging. Vicapsystems helps companies from different business segments to expand their product lines and generate growth using VICAP unique solution: a revolutionary way to store and protect key ingredients to the moment of consumption. After the consumer has activated

the cap to release the supplement into the liquid, most dispensing caps have to be removed from the bottle so as to be able to drink.

There are a few solutions that allow spills of the supplement from the caps directly into the liquid. At first glance ViCap looks pretty much like a conventional sport bottle cap. But ViCap is much more than that. It can discharge 12.5 millilitres of liquid concentrate or 7 grams of powder to create a flavoured drink, a nutritional supplement or an energy booster, Figure 4 (Steeman, 2009).

In 2005 Renè Wilhelm started the development of ViCap when the idea to develop a functional sports cap came up with Aqua Nova launching a drink which contained Q12. The problem with this drink was its short shelf life due to vitamins and other sensitive ingredients losing effectiveness over time when mixed with water. Renè Wilhelm conceptualized the idea to separate the active ingredients from the liq-

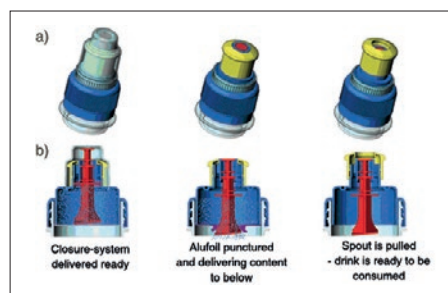


Figure 4. External appearance of ViCap cap a) and schematic representation of the principle of operation of the ViCap cap b)

uid until the time of consumption and thus the world's first dispenser sports cap system was born and Vicapsystems Ltd in Lütisburg, Switzerland was founded (Steeman, 2009).

Another innovative solution for packaging liquid products with the essential role of preserving freshness of content and consistency of components was patented in Bericap, world's famous company that manufactures plastic closures. The company collaborated with Swiss biotech company BioGaia within the framework

of Strategic Alliance Agreement (Strategic alliance treaty) with the aim to promote probiotics for multivitamin drinks, packaged in a unique system of plastic closures. An innovative solution was placed on the market under the name Lifetop Cap. Probiotics are extremely delicate and difficult to keep alive. As a result, most probiotic products today are dairy-based because probiotics tend to stay alive longer in a dairy environment. The problem with these products is that the probiotics will die off in the course of time and it is difficult to determine how many probiotics the consumer actually really gets at the moment of consumption. This is why Bio-Gaia decided to develop a system that dispenses the probiotic strains at time of drinking the beverage.

The dispensing cap, made from LDPE, consists of a plastic screw closure to be used on standard neck finishes (30/25, 38 mm). Sealed inside the plastic closure sits a blister, made from full barrier aluminium laminate, containing the ingredients up to 200 µl in liquid form or 200 mg in powder, offering a unique solution against humidity, supporting a long shelf life of the sensitive ingredients. A flexible dome, protected by a hinged overcap, should be used to press on the blister, to tear off the lower part of the blister and to deliver the ingredients into the liquid in the bottle, Figure 5 (Steeman, 2009).

4. Conclusions

The QFD method is used frequently because of its ability to incorporate both internal and external customer needs in the process of packaging design. The overall goal of QFD is the reduction in the length of product development cycle, including packaging, simultaneous improvement of product quality and lower production costs. Some of the acknowledged benefits of QFD include preservation of the newly established and well-known data about the target product, i.e. packaging, fewer initial problems in product development and shorter development time, elimination of errors during developmental decrease in teamwork, reduction in the amount of required documentation and, above all, the satisfaction of users. In terms of operations it is necessary to meet the wishes and demands of the customers. One way is to use the QFD method. QFD is a method of manifold importance. The most important innovation by the Croatian company Cedevita to market the region, including Serbia, is the project Cedevita GO!. The patented cap can be used in other sectors of the food industry, not only in the packaging of multivitamin drinks. New design and development of advanced technical features of this type of packaging enables the consumption of freshly prepared food on the go.

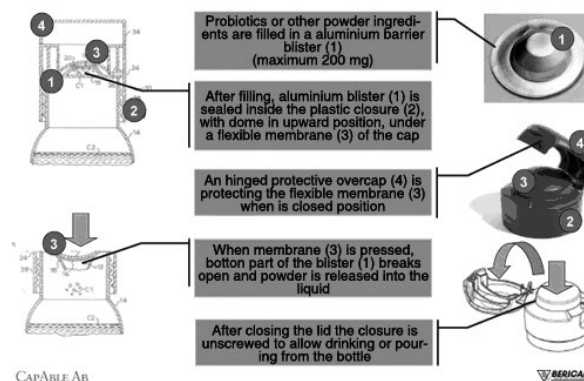


Figure 5. The schematic view of the functioning of packaging i.e. cup patented by Beric's

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