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Industry perspective
PACKAGING/DISPENSING TECHNOLOGY

Bag-on-valve (BOV) technology in cosmetic products

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BOV SYSTEM STRUCTURE

The BOV system comprises an aerosol valve heat-welded to a poly-laminated aluminium bag (Figure 1), into which the product to be dispensed is injected, through the valve channels, after the valve has been crimped to the aerosol container.

When the valve is being crimped to the container, the crimp head inserts compressed air into the external area between the bag and the can (Figure 2).

The final pressure is obtained after filling the bag with the product to be dispensed, by expansion of the bag, which compresses the air in the area between the bag and the can, and brings the system to the final user pressure.

The final pressure is obtained by optimising the initial pressure of the air inserted from the crimp head, which is usually regulated to a pressure of 3.8-4.2 bar, to obtain a final pressure of 8.5-9 bar.



Figure 1.



Figure 2. Components of the Bag-On-Valve system.

FILLING THE BOV SYSTEM

The BOV system can be filled with almost all substances used in aerosols, with the exception of powder products, paints with pigments that are deposited at the bottom and need to be shaken, products with little gas propellant (such as hair mousse, shaving foam and foam products in general) and products that separate into two or more phases (for example water-based insecticides). This technical limitation is due to the fact that the bag is completely filled by the product and it is not possible to shake the contents to obtain a uniform mixture.

Any other fluid or viscous substance can fill the BOV system, bearing in mind that in all cases it will have to be inserted through the valve stem.

The fundamental difference compared with traditional aerosol systems, consists in the fact that the enclosed product is not in contact with the propellant in the can, and the propellant is not dispensed with the product, as is the case with other aerosols.

This basically means that the product will not be atomised as with other aerosol products with propellant gas, but will be released into the air after being dispensed only as a result of the mechanical effect of diffusion through the valve dispenser.

This is of fundamental importance for the choice of formula to use and the choice of dispenser.

In conventional aerosol products with gas propellants, the gas is released from the can with the product, evaporates immediately, and causes the mechanical breakage of the product into micro particles that form the typical aerosol atomisation (or foam) that we know.

As this doesn't occur with the BOV system, care should be taken over choosing the substance, in order to make the product inserted into the BOV system as fluid as possible, so it is only atomised with the mechanical force of the dispenser. Foam products, such as shaving foam, cannot be obtained without inserting a swelling agent with a low boiling point into the bag, which is compatible with the substance.

In practice, liquids with low viscosity can be inserted into the bag (not greater than 15 Centipoise at 20°C), and high viscosity products (such as shaving gels or all cream products).

Products with viscosity greater than 15 Centipoise cannot be dispensed atomised, but will be dispensed in liquid form, without atomisation.

COSMETIC PRODUCTS USABLE IN THE BOV SYSTEM

- Liquid deodorants with/without alcohol
- Hair lacquers
- Sun products that are liquid, in emulsion, or alcoholic solution
- Body and aftersun lotions
- Body products in liquid form
- Shaving gels with post foaming effect
- Children's products
- Emulsions of any type

ADVANTAGES OF THE BOV SYSTEM

The BOV system has the following advantages compared with conventional aerosol systems:

- 1) No contact between the product and the propellant, and any interaction or change made to the substance due to liquid gases or other propellants.
- 2) Product can be dispensed in all positions, with the can horizontal or upside down, without changing valve type; impossible with conventional aerosols where dispensing with the can horizontal is impossible and dispensing upside down requires a special valve.
- 3) Contents of the can comprises the complete active product: the lack of a propellant makes the contents of the bag totally active; the substance that is inserted will be dispensed without being diluted because of the propellant liquid gas found in conventional aerosols.
- 4) Utmost microbiological safety: the contained product cannot in any circumstances come into contact with the outside, and it only has contact with the BOV system bag, and not with the can. If the BOV valve has previously been sterilised with gamma radiation, the inserted product will be in a sterile environment, therefore the only bacteria present could be that which may be present in the product itself, with obvious advantages relating to microbiological safety and stability over time.
- 5) Significant reduction in product flammability: the lack of a highly flammable propellant means the finished product is only flammable if it contains flammable substances (ethyl alcohol for example), otherwise the finished product can be classified as non-flammable, with obvious benefits in terms of safety and storage.
- 6) Minimum discharge 99 percent: without problems in choosing the length of the stem (as can happen with conventional products).
- 7) Empty packaging totally safe: the empty container does not have flammable or explosive products and will not be classified as special waste (with the new waste legislation).
- 8) Possibility of filling with cosmetic products without taking extreme safety measures used for filling conventional aerosol products. In practice, any cosmetic company can set up a filling system for the BOV system, without necessarily having to go to a third party equipped with safety measures for liquid gas propellants that are flammable and explosive. Obviously this choice should be considered depending on the quantities to be produced, after assessing costs for a BOV filling system.

RESCONCEPT® TECHNOLOGY IN THE BOV APPLICATION

Res Pharma, a manufacturing company of raw materials for the cosmetic sector, with significant technological talent in the field of emulsifying agents, has developed a line of emulsions that have proven to be particularly suited to application in BOV products.

The Resconcept® line, created as a result of exclusive production technology, offers ethoxylated and non-ethoxylated O/W fluid emulsions, at an increased level of micronisation and rheologic consistency even at high levels of dilution.



Household, Industrial & Institutional Ingredients Exhibition & Conference

Household, institutional and industrial cleaning products have to fulfil many different requirements depending on the application.

Selection of appropriate ingredients and skillful formulation are a prerequisite for the development of more innovative, cost-effective products. Growing regulatory requirements and health, safety and environmental drivers can restrict the choice of ingredients available to formulators, providing a major challenge to innovate and maintain product performance.

More recently, escalating raw material costs have added further pressures in the search for effective ingredients.

H3i will address many of these issues and more in an exhibition, supplier product profiles presented by selected exhibitors and the BACS H3i Seminars, a range of technical presentations on highly topical issues.

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The Formulators' Event
29 February – 1 March 2012

NMM Exhibition Centre, Birmingham, UK



In association with the British Association
for Chemical Specialities (BACS)

The concentrated Resconcept® emulsions are obtained with special micronisation technology, to achieve controlled dimensions less than the micron or SME (SubMicronEmulsions), characterised by psuedo-Newtonian rheology that influences their behaviour. Despite the fact that viscosity is greater than the conditions traditionally deemed optimum for operation of the BOV system, the Resconcept® emulsions perform extremely well in this application due to their particular flowability, ensuring optimum dispensing action.

During detailed rheologic investigation to compare the concentrated Resconcept® emulsions with equivalent traditional emulsions, tests were carried out at T= 20°C with the rheometer (Rheomat RM 180), and showed that the Resconcept® emulsions behave similarly to a Newtonian fluid (such as water, glycerine and very dilute colloidal systems). The system, when subjected to shear strain action, reacts linearly: the flow speed increases proportionally to the applied force and the emulsifying agent gives a greater interfacial surface (Diagram 1).

To the contrary, many traditional fluids involved in cosmetic technology have non-linear reographs and are not therefore Newtonian: colloidal dispersing agents, emulsions, suspensions, ointments. In particular, a non-Newtonian fluid, subjected to shear strain, reveals flow that can be: plastic, pseudo-plastic or dilatant (Diagrams 2, 3 and 4).

Comparing the progress of viscosity as a function of the Resconcept® product shear rate with a traditional emulsion reveals non-Newtonian type behaviour for the traditional emulsion (psuedo-plastic), unlike the Resconcept® product. It can be observed from Diagram 5 that the viscosity of the psuedo-plastic system decreases on increasing shear velocity. In particular, the non-linearity of the reograph reflects shear strain forces on the molecules.

CONCLUSIONS

Given the extensive versatility and safety of the BOV system, it represents an easy, immediate, safe solution for almost all aerosol products and can be defined as the aerosol system of the future, and all efforts and cosmetic laboratory research studies should concentrate on this technology. The combination of the BOV system with Resconcept® concentrated emulsions, which are versatile, safe and innovative, is a winning choice resulting from scientific research and technology that considers the product and innovative industrial processes in an environmentally-friendly framework.

REFERENCES AND NOTES

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