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# dosage form

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THE EXPANDING ROLE OF EFFERVESCENT  
TECHNOLOGY

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*This article explains the benefits and applications of effervescent technology in solid dosage forms.*

**F**rom beverages to laundry detergent, consumer packaged goods (CPGs) traditionally sold as liquids, are increasingly being offered in effervescent tablet and powder forms. Consumers have embraced these products as convenient, portable, and more environmentally friendly than their liquid counterparts. The trend has captured the attention of large and small CPG manufacturers. Start-ups dedicated to the concept have emerged, and established brands have expanded prod-

uct lines to include tablet forms of familiar household essentials. While these products span a wide range of shapes, sizes, and categories, they all leverage the benefits of effervescent technology.

### The basics of effervescent formulas

Effervescent products can be formulated to deliver a wide variety of functional materials. However, every effervescent formula is built on simple chemistry. When an acid and a carbonate salt are placed in water, they react to release carbon dioxide gas. That's the fizz of an effervescent product. Much has been written about the technical details of this reaction, so we won't go into all the ins and outs that formulators need to consider in this article [1]. Rather, we'll focus on the benefits of this technology and some products that leverage them.

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### The benefits of effervescent products

Effervescent products offer a range of benefits that appeal to consumers in all demographics and are easily marketed.

**Solution uniformity.** Effervescent tablets and powders disperse rapidly and evenly in water, eliminating the settling and clumping often associated with non-effervescent products.

**Rapid delivery of benefits.** Effervescent products are dissolved prior to ingestion, speeding gut absorption of active ingredients. This rapid absorption shortens the product's onset, which is a particularly attractive feature for pharmaceutical and dietary supplement products.

**Stable environment.** The anhydrous base of effervescent products provides an optimal environment for moisture-sensitive active ingredients, essentially eliminating the risk of hydrolysis, a common cause of degradation.

**Convenience.** Effervescent products also appeal to consumers because of their compact size and simplicity of use. Additionally, effervescent tablets and powders are almost always packaged as an individual dose, eliminating the need to measure.

**Well tolerated.** An estimated 40 percent of US adults report difficulty swallowing tablets [2]. Effervescent products offer a great alternative for consumers that dislike or are unable to swallow tablets or capsules, potentially aiding in patient compliance.

**Environmental footprint.** An effervescent product generally has a lighter environmental footprint than a liquid version of the same product. The impact of transporting effervescent products tends to be substantially lower than that of liquid products because they are lighter and more compact. The volume of packaging materials is often reduced as well.

**Fun.** The fizzy reaction intrigues consumers of all ages and makes everyday products just a little more entertaining. Sensory cues such as fragrance release, color change, and bubbly mouthfeel add to the consumer's experience.

### Product categories

Several product types employ the effervescent tablet dosage form.

**Drugs.** Effervescent tablets and powders have been used as delivery vehicles for analgesic, antacid, and cough/cold/flu products for many years. Consumers appreciate the rapid relief they provide, and people who have trouble swallowing tablets and capsules find the pre-dissolved product form invaluable. The Alka-Seltzer brand has a long-established business built on effervescent tablets that treat pain, upset stomach, and cold and flu symptoms. New over-the-counter medications have entered the market, including Blowfish, a hangover relief formula supplied in an effervescent tablet form.

**Dietary supplements.** Effervescent products that deliver vitamins have long been popular in Europe. Airborne brought the effervescent tablet form to the supplement aisle in the US, and Emergen-C introduced vitamin C in the form of an effervescent powder. In recent years, the range of effervescent dietary supplements has expanded as brands look to innovate beyond standard tablets, capsules, and gummies. Numerous new products have been introduced featuring vitamins, minerals, amino acids, botanicals, and other specialty nutrients.

**Beverages.** Lifestyle beverages have also become popular among consumers. These products pair refreshing flavors with functional benefits such as rehydration through electrolytes and/or energy from caffeine and B vitamins. Since these formulas tend to be low in calories and sugar, they've been embraced by health-conscious consumers. Children's hydration products have also become available in stick-pack form, which are easy to store and have on hand.

**Cleaning and household products.** Effervescent denture cleansers are an old mainstay. These products, based on surfactants and oxygen bleach, effectively clean and remove stains. A quick google search will offer a multitude of uses for denture cleanser beyond oral appliances. In recent years, effervescent products have been specifically formulated and marketed as hard-surface and hand cleansers that allow consumers to prepare their own household products. These items effectively leverage consumers' desires to minimize packaging and environmental footprint, and dovetail nicely with the increasing market trend toward e-commerce and subscription models.

**Specialty applications.** Effervescent technology has been used to support a number of unique product concepts. Aromatherapy shower tablets have gained popularity in recent years and provide a great example of how effervescent technology can be modified to fit with a product's specific application. While most effervescent products are developed to dissolve quickly, shower aromatherapy tablets are engineered to dissolve slowly, allowing aromas to be released throughout the duration of a shower. On the other hand, bath bombs are designed to dissolve quickly, dispersing color, fragrance, and skin conditioners to enhance the bathing experience.

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### **Development considerations**

Effervescent products are, by design, chemically reactive. While the chemistry itself is straightforward, its application is tricky. Ensuring product performance and stability requires careful consideration of each ingredient. Parameters such as moisture, particle size, and solubility must be carefully evaluated. Specifications for raw materials need to be fully considered, as "standard" raw materials are often not suitable for use in these products. And, of course, the finished product specifications need to be designed to ensure that the product will deliver the claimed benefits throughout its intended shelf life.

Special attention must also be paid to packaging during the development process. To prevent the effervescent reaction from starting before product usage, it's vital to provide protection from environmental humidity. Moisture-proof foil sachets and stick packs are commonly used for single dose packages. Plastic tubes with desiccant stoppers can be used for multiple doses.

### **Manufacturing considerations**

Manufacturing of effervescent products also requires specialized knowledge and equipment and is neither simple nor straightforward. For instance, to ensure product stability, manufacturers need appropriate environmental

infrastructure that can tightly control temperature and humidity. Also, packaging equipment must be designed and qualified to guarantee moisture-proof seals that can withstand handling and shipment.

### **Market summary**

The market for effervescent products continues to grow at a rapid pace as new products enter the market. These products span a wide range of categories and capitalize on the benefits of effervescent technology to deliver tried-and-true as well as novel applications. Consumers have embraced these products, indicating a consistent willingness to pay for the unique benefits and enhanced user experience inherent in this technology. T&C

### **References**

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