

CO₂ for beverages

Carbon dioxide In the beverage industry, and the relationship with drink dispensers. **By Sam A. Rushing**, Advanced Cryogenics, Ltd.

As I have mentioned in other articles written for *gasworld*, when the ‘man or woman on the street’ thinks of carbon dioxide (CO₂), this is often related to soft drink carbonation, and CO₂ in the atmosphere. In the gases industry, however, it is a very important component of the merchant market worldwide.

Toward this end, many of the US markets for carbonated CO₂ demands are largely flat; and they represent near 20% of the CO₂ demands in the US merchant market. On the other hand, the demands in most of the emerging economies, or developing world, are highly geared toward the soft drink industry. I have worked in Africa and the Middle East, for example, and their comfort zone today is to steadily pursue the soft drink industry; primarily serving the demands of the ever-present, and growing Coca-Cola and Pepsi carbonation demands.

However, over time, this stance surrounding a predominantly soft drink supply, rather than developing a widely expanded range of applications is only slowing down progress.

There are a few new soft drink brands attempting to gain some traction in North America, and this is helping to keep the demands for CO₂ usage in soft drinks to either stay static or enjoy a slight market growth. Where natural carbonation is possible, as a few highly successful US brands have experienced, this trend will continue; even if the product is ‘naturally’ carbonated with ‘natural’ CO₂ well sources, which are plentiful in the US Mid-South, Upper Rockies, and Southwestern US.

I have evaluated unique source types such as biogas in the recent past, and the beverage firms fully reject such sources – even if they happen to be even more chemically pure than some of the traditional raw feedstock sources, once

they emerge from processes downstream of the digester. Consumer perception is absolute, and any stream associated with ‘waste’ (particularly organic in nature) continues to be a real factor for rejection, despite chemical purity.

In any event, from the traditional sources, supplying a refined beverage grade CO₂ to the beverage network, and downstream to the soda fountain markets, has been supported by safety, test methodologies, and a supply of the highest quality. Beyond USP per sé, the beverage grade quality is CGA grade I,

“The microbulk CO₂ cylinder has become the darling of supply...”

or standards established by the ISBT, for example. Other professional organisations have their definitions surrounding such standards for beverage service.

Then we have the beer sector, that being fermentation sources which cater strictly to beer manufacturing specifically. Such larger locations often use their own fermentation by-product CO₂ for carbonation; however, some of these firms have used merchant supplies to supplement the carbonation process; or more commonly to back-pressure their systems only. Downstream of the brewing manufacturers alone, are of course the delivered kegs of beer which are often further supported by a beverage grade CO₂ delivered to the taverns, and similar consuming locations.

Downstream applications

The so-called microbulk CO₂ cylinder, representing up to around 500 pounds of product, has become the darling of the supply means for bars, restaurants, and fast food chains – this far surpasses old-fashioned 50 and 100 pound cylinders supporting a generation or two earlier, and

is the standard for supply today.

As to this supply network via microbulk units, this sector has proven to be highly profitable when well-managed, such as with Praxair’s NuCO₂ business, and the unit operated by Airgas, for example.

When I evaluated the microbulk market for an acquisition some years ago, in many cases the gross margin with the microbulk system versus bulk sales to the soft drink manufacturing plant, delivered into large bulk storage, an eight-fold gross profit difference was often noticed in favour of microbulk sales. Such opportunities are extraordinary, in places where they exist, particularly in a soft drinks market which is not particularly enjoying much overall volume growth.

Therefore, as it is known, kegs of beer, and soft drink products are delivered to the restaurants and bars, along with typically microbulk CO₂, if the customer is of any size. My usual restaurant for lunch has two such microbulk tanks strapped to the back of their restaurant, delivered by a major supplier of gases; and I notice this as common practice among the chain restaurants and fast food providers. Then, with respect to the dispensers, the CO₂ is usually piped into the building to the soda fountain machine, for the actual application, assuming it is in microbulk or bulk merchant storage outside. Some of the smaller demands have smaller bulk cylinders inside, for example. The home-based market for CO₂ cylinders provided by companies with machines for making customised soft drinks, such as Soda Stream, Kitchen Aid, and Hamilton Beach machines, use, recycle and sell micro-sized cylinders of CO₂, which in some cases represent a mere 8g of product – and are ever-more expensive in terms of pricing.

Albeit the home version of carbonating beer and soft drinks often uses micro-sized returnable cylinders of CO₂, at a very high price; the idea of something ‘homemade’ and very convenient has propelled more companies into this market, which should be very profitable with their supply of CO₂ alone.

Wide range of storage capacities

As described, the size and demand for

Typical Specific Chemical Definitions

Source: ISBT

Parameter CO ₂	
Purity	99.9% min.
Moisture	20 ppm max.
Acidity	to pass test
Oxygen	30 ppm max.
Nitrogen compounds	
Ammonia	2.5 ppm max.
Nitric oxide / dioxide	2.5 “
Non – volatile residue	10 ppm max.
Non – volatile organic residue	5 ppm max.
Phosphine	To pass test (0.3 ppm max.)
Total volatile	50 ppm v/v max. of which 20 ppm v/v
Hydrocarbons (methane)	max. of non-methane H/Cs
Acetaldehyde	0.2 ppm max.
Aromatic hydrocarbons	0.020 ppm max.
Carbon monoxide	10 ppm max.
Total sulfur (as S)	0.1 ppm max.
Carbonyl sulfide	0.1 ppm max.
Hydrogen sulfide	0.1 ppm max.
Sulfur dioxide	1 ppm max.
Appearance in water	No color
Odour	Odorless
Taste and odour	No foreign taste or odor in water

(all factors as v/v basis except non-volatile organic residue as w/w)

packaging of CO₂ in cylinders ranging from the micro-sized 8g in typical home-based carbonation units to the growing use of microbulk units, typically sized 400 to 500 pounds in capacity, and onto the much larger 120 tonne vessels used in soft drink carbonation for typical manufacturing plants, is a wide range of storage capacities.

All such units are used over and over again, of course from the stationary 120, and typical 50 tonne units found among soft drink manufacturers, all the way down to the home based 8g capacity micro cylinders. Microbulk units are particularly important in the scheme of things, which are an essential part of the scheme for delivery of CO₂ into the soft drink dispensers of restaurants, bars, and fast food outlets. Of course, within this range, also the smaller 50 and 100 pound cylinders are also important; when the cylinders are more typically located


indoors, closer to the soft drink or beer station, where the product is utilised in the carbonation of all such beverages.

Pricing also can range from, say \$100/tonne for many of today’s US soft drink manufacturing plants, to, say, \$0.40/pound for some of today’s microbulk product; all the way down to a 10-pack of 8g (content) cylinders for \$12.99 from Amazon.

Drink dispensers, per sé, vary from what is typically found in bars, and restaurants, to vending machines which use smaller cylinders, to the home-based machines. The relationship between CO₂ production and supplies and the soft drink beverage machines is significant, while the lion’s share of CO₂ sold to the beverage industry at large is probably more significant in volume with respect to the actual manufacturing plant operations. The relationship between the supply to the soft drink industry and the range of CO₂ dispensers from those found in

bars, restaurants, vending machines, and the home-based applications is very significant, and is growing more rapidly than the large corporate-owned operations such as that of Pepsi and Coca-Cola.

While more consumers are turning to healthier drinks, or those which they produce at home, more of this is found to be growing than products from the soft drink manufacturing plants. Maybe we will find the niche of the home-based drink devices to increase more over time, along with the CO₂ demand associated with this sector; however, the grand total of CO₂ consumption represented in these machines may not be highly significant, due to the cylinders often holding only 8g, but highly profitable.

In the end, all sectors are important, from the commercial soft drink manufacturing plants, to the middle-sector beverage dispensers in bars and restaurants, to the home version. The microbulk business has been a highly profitable sector; however, as more companies, particularly those which and not price disciplined enter this market, prices may weaken. This is yet to be determined. For the gas companies, it is who of these players to cherish all levels of supply, particularly the production plants, and the microbulk sector; along with the smaller cylinder gas sales. Ultimately, what is produced by the gas concerns will end up being sold down the supply chain to the home version of cylinders, made for convenience and self-gratification. 

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