Carbon dioxide Purification – Multi-adsorbent approach versus activated carbon

Summary

Carbon dioxide (CO_2) is used in the beverage industry for carbonation, packaging, and dispense. In soft drinks production the carbonation of the beverage is undertaken by forcing carbon dioxide (CO_2) into the liquid and storing under pressure. The presence of this gas creates bubbles and fizzing in the liquid when pressure is reduced. The CO_2 that is injected into the beverage must be free of particles, microorganisms and unwanted chemical compounds. Existence of these contaminants may result in a Quality Incident. Such an incident may occur where a delivery of out-of-specification CO_2 has been made to the plant or where CO_2 has been contaminated on-site during the production process.

In recent years, there has been an increased awareness of the importance of CO_2 quality and its effects on beverage products. Bodies such as the International Society of Beverage Technologists (ISBT) publish quality guidelines for the CO_2 used in the beverage industry. These guidelines are considered best practice requirements intended to offer protection from contaminants that could result in flavour defects in the beverage or in severe cases damage health.

Protection against poor quality or contaminated gas which may pass through the supply chain and into the beverage is essential. Despite purchasing beverage-grade carbon dioxide and analysing the gas delivered, without a quality protection device in place there is no guarantee that trace contamination can be prevented from entering the bottle filling process.

Loose activated Carbon granules typically installed in a carbon tower. Post filtration is essential as to ensure that no carry over into the bottling process.

A traditional activated carbon tower.

Carbon Towers

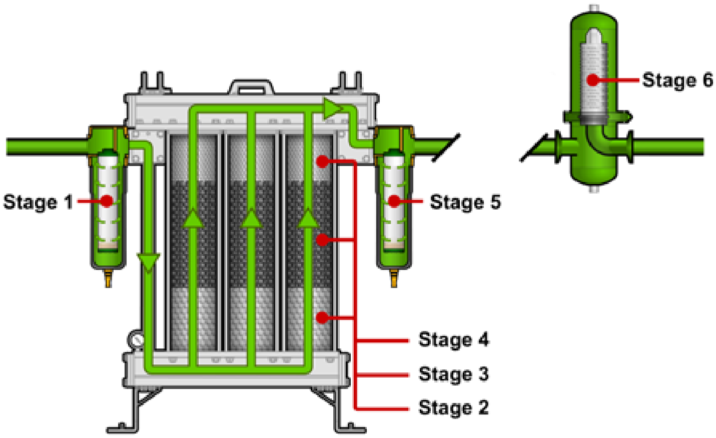
In the majority of beverage bottling plants reputation is placed in the performance of an in-line activated carbon filter vessel. This vessel (or tower) has been a permanent fixture within the production process and quality assurance procedures of many bottling plants for at least the last 25 years. The efficiency of this method of protection is questionable with regards to the total protection against a quality incident.

Activated carbon is a proven adsorbent for hydrocarbons. It therefore covers a range of potential contaminants that may be present within a CO_2 supply.

Activated carbon is however limited with regards to the removal of sulphur compounds such as Hydrogen Sulphides, Sulfur dioxide and Carbonyl sulfide. ISBT CO_2 Quality Guidelines & Analytical Procedure Bibliography, 2010 detail critical limits for sulphur contaminant.

The Parker multi-adsorbent approach

In comparison with existing activated carbon technology, the Parker domnick hunter PCO2 system offers considerably improved protection by way of its unique multi adsorbent construction.



Stage 1
0.01 micron particle filtration
Removal of non-volatile organic residue (NVOR) and other contaminants down to 0.01 ppm

Stage 2
Removal of water vapour and partial removal of hydrocarbons

Stage 3
Primary removal of aromatic hydrocarbons (Benzene, Toluene etc and Acetaldehyde)

Stage 4
Removal of sulphur compounds (COS, H2S, DMS etc)

Stage 5
0.01 micron particle filtration

Stage 6*
Point of use VBACE sterile gas membrane. Hi Flow Tetpor II

* Optional - Sterilizing Grade: consult Parker for operational use

STAGE 1 FILTRATION

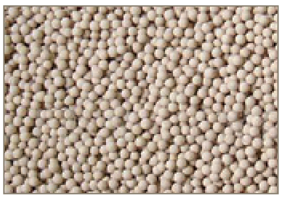
STAGE 2 DRYFILL ADSORBER

Effective at removing:
Water (H20), Aromatic Hydrocarbons, Acetaldehyde, Dimethyl Ether(DME)

STAGE 3 DRYFILL ADSORBER

Effective at removing:
Aromatic Hydrocarbons, Cyclohexane, Acetaldehyde, Ethyl Acetae, Styrene, MIBK, Ethanol, Methanol

STAGE 4 DRYFILL ADSORBER



Effective at removing:
Carbonyl Sulphide (COS), Hydrogen Sulphide (H2S) Sulphur Dioxide (SO2) Dimethyl Sulphide (DMS)

STAGE 5 FILTRATION

For additional product information, FAQs, white papers and support documents relating to Parker PCO2 Carbon Dioxide Quality Incident Protection Systems please visit www.parker.com/gsfe

The Parker '*ADVANTAGE*'

A multi adsorbent system has increased retention ability over an activated carbon bed as the carbon will preferentially adsorb heavier hydrocarbons over the more weakly attracted adsorbents. The Parker multi layered approach means that several types of molecules can adsorb simultaneously on the surfaces, with less competition for active sites than found in activated carbon beds. Although highly polar molecules will displace less polar molecules, from the molecular sieve layer (causing the less polar ones to emerge first) as CO_2 is the least polar of the molecules in this application the 'contaminates' (VOCs, Water etc.) are much more strongly attracted and hence retained within the media bed, so clean CO_2 passes through.

By using the 'Snowstorm' filling technique, Parker ensure that the unique media recipe is optimum packed as to ensure maximum density and the best efficiency of the removal of potential contaminants.

Conclusion

CO_2 usage is subject to stringent active guidelines as to ensure the quality of gas to safe limits for contaminants and impurities. The Parker domnick hunter range of multi adsorbent PCO2 systems will ensure that CO_2 gas meets all active compliance requirements, and exceeds these requirements by a factor of ten in named contaminants and impurities.

It has been independently proven that the multistage purifier effectively removes contaminants specified by ISBT quality guidelines to trace levels. Additionally, the PCO2 system will offer protection against a wider range of contamination than traditional activated carbon adsorption.

 TAPPCO2MULTIBED-01-EN

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Parker domnick hunter

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