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Compressed Air for Food and Pharma Grade Plastics

The 4th utility for food grade plastics is Compressed Air.

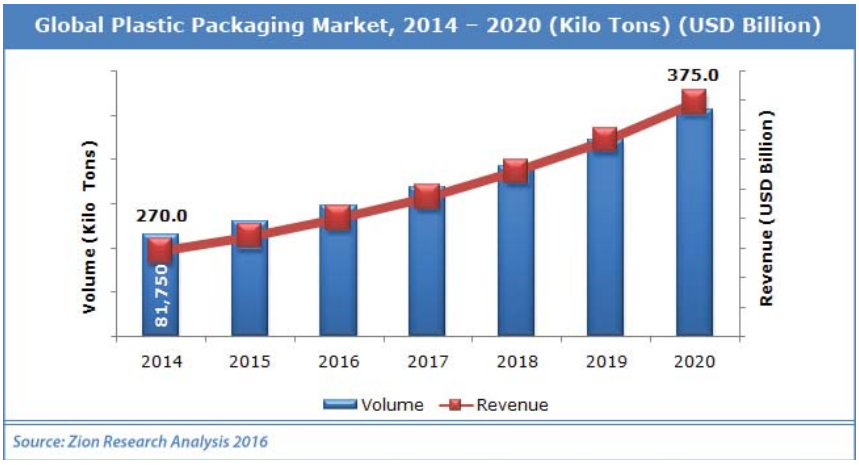
According to a recent report, global demand for plastic packaging was valued at $270 billion in 2014, and is expected to reach $375 billion in 2020, growing at a CAGR of 4.8% between 2015 and 2020. In terms of volume, the global plastics packaging market stood at 81,750.0 kilo tons in 2014.

Published by Zion Research (Deerfield Beach, FL), the report titled, "Plastic Packaging (Rigid Plastic Packaging and Flexible Plastic Packaging) Market for Food & Beverages, Industrial, Household Products, Personal Care, Medical and Other Applications—Global Industry Perspective, Comprehensive Analysis and Forecast, 2014-2020," said among all applications, food & beverage was the largest application segment for plastic packaging market in 2014. It accounted for over 50% share of the entire volume consumption in 2014. Moreover, pharmaceuticals and medical applications are also projected to have growing demand from the end-user application during the years to come.

Rigid packaging was by far the most important product segment, which accounted for largest market share in 2014. Rigid packaging is believed to continue this trend due to the increasing demand from pharmaceutical sector. Flexible packaging is also important type of packaging that is expected to have promising market during the forecast period.

Superior aesthetic value and excellent barrier properties of plastic against moisture and air are another important factor driving demand for plastic packaging. However, fluctuating prices of raw materials is one of the major challenges for plastics packaging manufacturers.

Plastics are used in almost every facet of modern life and due to high demand,



plastics manufacturers are challenged to keep their operations running 24/7 while minimizing costs. Since vast majorities of plastic products are used in applications that require clean, high-quality materials, such as the medical or food processing industries, the compressed air used to produce these materials must be clean and reliable.

What Makes a Plastic Food Grade?

The difference between the plastics in an everyday household item and the type of material we might see going into a food application? Food grade does not mean that it is edible. It also is different from environmentally friendly, sustainable, or biodegradable. Food grade means the material (like plastics) can come in direct contact with the food we consume as part of the harvesting, processing, or packaging of the food.

There are several things that go into qualifying plastics as a food grade material. An item can be certified by the FDA, NSA, or 3A Dairy as some examples. A compliance agency like the FDA takes a close look at the chemical composition of

the plastic material. They want to make sure there is nothing in the material that can harm the food supply. In addition, if anything affects the color, odor, or taste of the food, it will automatically fail the compliance rating. Next they take a close look at how the plastic material performs from conditions of use standpoint. Things like how the material handles temperature ranges, alcohols, and greases are evaluated and documented. Conditions that may limit use are noted and cataloged for future reference.

Once a material has been approved for direct food contact or food grade use, now the plastic material needs to be run by a reliable manufacturer who is ISO 9000 certified and practices good manufacturing processes. This ensures that they are not only using high quality materials but are also processing them via a high quality process that will provide a safe product. Once a material is manufactured to the required specifications, certifications are generated and the final material supplier must be capable of maintaining chain of custody between the material and its applicable certifications.

Food Grade Plastic Processes Using Compressed Air

Compressed air contamination is a real problem for the food industry. In today's modern production facilities, the use of compressed air is often pivotal to manufacturing processes. Irrespective of whether the compressed air comes into direct contact with the product or is used to automate a process, provide motive power, package products, or even to generate other gases on-site, a clean, dry, reliable compressed air supply is essential to maintain efficient and cost effective production.

Once hazards are identified, measures must be put in place to remove the hazards or reduce them to acceptable levels. So what level of compressed air contamination is deemed acceptable in the food industry.

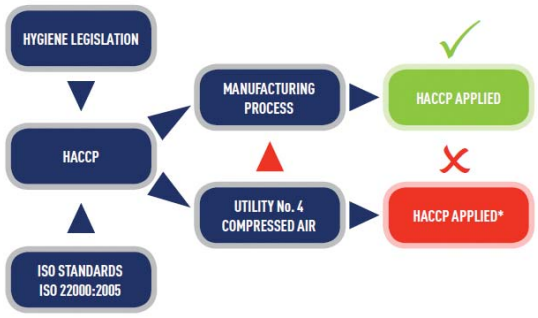
Unlike compressed air that is used for breathing or medical purposes, NO standards or laws exist that define a minimum acceptable level of cleanliness (quality) when the compressed air is used for food manufacture. As food manufacturers have a duty of care to protect the consumer and compressed air systems are known to carry large quantities of contamination, what actions should be taken?

Introducing the Food Grade Compressed Air Code of Practice In the United Kingdom, the British Compressed Air Society (BCAS) who are the governing body for compressed air and the British Retail Consortium (BRC) who represent the retail industry, have jointly developed a Code of Practice for Food Grade Compressed Air in order to assist food manufacturers . This Code of Practice evolved because of the absence of compressed air quality standards or legislation specific to the food manufacturing industries. The Code of Practice gives minimum purity (quality) standards for compressed air and defines allowable levels for dirt, water and oil, in line with air quality levels specified in ISO8573-1 the International Standard for compressed air quality.

Food Grade Plastic Compressed Air Code of Practice

The code of practice references complimentary international standards for air purity, gives recommendations on installation, testing and maintenance of compressed air systems, but most importantly, defines a minimum acceptable purity (quality) for compressed air used in the food related industry.

The interconnection between hygiene legislation, food safety management systems and compressed air



* The HACCP principle is often applied to the main manufacturing facility but not utilities such as compressed air
- In most manufacturing scenarios, compressed air is viewed as a utility and for this reason is ommited from the Hazard Analysis (risk analysis)
- Additionally, many users are unaware of the contamination present in compressed air and the sources of that contamination , again leading to compressed air being omitted from the Hazard Analysis.

Applying the HACCP principle to compressed air

HACCP PRINCIPLE	HOW HACCP PRINCIPLE RELATES TO COMPRESSED AIR
ANALYSIS HAZARDS Identify potential hazards (contaminants) to foods safety	10 contaminants present in a typical compressed air system
IDENTIFICATION OF CCP'S Establish Critical Control Points throughout the production process where hazards (contaminants) can enter	Every point in the manufacturing process where compressed air is used
CCP PREVENTION MEASURES A prevention measure is established at all CCP's	Installation of Filtration & Drying (Purification) Equipment
MONITORING OF CCP PREVENTION MEASURES A system is established to monitor prevention measures at a CCP	Regular Air Purity Sampling of the compressed air system
CCP NOT MET Establish what must be done when the CCP prevention measures are not met	Documented process for staff to follow in the event of a quality incident
HACCP & CCP LOG Maintain a log system of all the CCP's, control methods and actions taken to correct potential problems	Details of Hazard Analysis, all CCP's and relevant sampling / testing recorded and available for inspection

ISO 8573-1:2010 Compressed Air Contaminants and Purity Classes

Class	Particles				Water			Oil
	By Particle Size (maximum number of particles per m^3) See Note 2			By Mass	Vapor Pressure Dewpoint		Liquid	Liquid, Aerosol, & Vapor See Note 1
	0.10 – 0.5 microns	0.5 – 1.0 microns	1.0 – 5.0 microns	mg/m^3	°C	°F	g/m^3	mg/m^3
0	As specified by the equipment user or supplier and more stringent than class 1							
1	20,000	400	10	-	≤ -70	≤ -94	-	< 0.01
2	400,000	6,000	100	-	≤ -40	≤ -40	-	< 0.1
3	-	90,000	1,000	-	≤ -20	≤ - 4	-	< 1
4	-	-	10,000	-	≤ +3	≤ +37	-	< 5
5	-	-	100,000	-	≤ +7	≤ +45	-	-
6	-	-	-	0 – 5	≤ +10	≤ +50	-	-
7	-	-	-	5 – 10	-	-	0.5	-
8	-	-	-	-	-	-	5	-
9	-	-	-	-	-	-	10	-
X	-	-	-	> 10	-	-	> 10	> 5
	Microbiological Contaminants				Other Gaseous Contaminants			
	No purity classes are identified				No purity classes are identified Gases mentioned are: CO, CO_2, SO_2, NOX, Hydrocarbons			

To comply with food hygiene legislation, the food manufacturer is required to follow the principles of HACCP (Hazard Analysis and Critical Control Point) and a risk analysis must be carried out on the entire manufacturing process.

As compressed air is seen as a utility, it is often missed as a potential source of contamination. To be fully compliant, the compressed air system must be included as part of the hazard analysis and anywhere compressed air is used, classified as a Critical Control Point and subject to the air purity (quality) recommendations.

Contact: Air that comes into direct contact with ingredients, finished food, packaging materials, storage vessels or the manufacturing machinery.

Non-Contact: Air that will never come into contact with ingredients, finished food, packaging materials, storage vessels or the manufacturing machinery.

Non-Contact High Risk: Air that is not supposed to come into contact with ingredients, finished food, packaging materials, storage vessels or the manufacturing machinery, but may inadvertently do so.

Cost Effective System Design

To achieve the stringent air quality levels required for today's modern food manufacturing facilities, a careful approach to system design, commissioning, installation and operation must be employed. Treatment at one point alone is not enough and it is highly recommended to treat compressed air prior to entry into the distribution system (usually in the compressor room or at point of generation) to a specification that will provide contaminant free air.

The Code of Practice does not make any specific recommendations regarding compressor type with both oil lubricated and oil-free compressors being acceptable choices. Regardless of whether oil lubricated or oil-free compressors are installed, the purification equipment required to achieve the purity levels stated in the Food Grade Compressed Air Code of Practice is identical.

As Compressed air comes into direct contact with many plastics manufacturing applications, to ensure the finished product maintains the high-quality standard the customer requires, CompAir offers plastics manufacturers the Oil-Free Pureair compressor series, which provides ISO 8573-1 Class 0 oil-free air. A robust compressor design paired with low lifecycle operating costs ensures plastics manufacturers receive a reliable and cost-effective compressed air supply. For more information please visit http://rastgar-co.com/Air-Quality/

Industry Solution

Oil-free compressed air allows plastics manufacturers to maintain high-quality standards and minimize operational spending. ◆

Air Quality Recommendations	Dirt (Solid Particulate) Max Number of particles per m^3			Humidity (Water Vapour)	Total Oil (Aerosol + Vapour)	ISO8573-1:2001 Equivalent	ISO8573-1:2010 Equivalent
	0.1 - 0.5 micron	0.5 - 1 micron	1 - 5 micron				
Contact	100,000	1000	10	-40°C PDP	<0.01 mg/m^3	Class 2.2.1	Class 1.2.1
Non - Contact	100,000	1000	10	+3°C PDP	<0.01 mg/m^3	Class 2.4.1	Class 1.4.1
Non - Contact High Risk	100,000	1000	10	-40°C PDP	<0.01 mg/m^3	Class 2.2.1	Class 1.2.1

The contaminant values for dirt and oil are those at the 'Reference Conditions' in ISO8573-1 at a temperature of 20°C, absolute atmospheric pressure of 1 bar and relative water vapour pressure of zero. Humidity is to be measured at line pressure.

It is important to look at each contaminant in detail, as due to the diversity of the contamination present, a number of purification technologies must be employed for its removal.

	Contamination Reduction / Removal							
Purification Equipment Technologies	Bulk Condensed Water	Water Vapour	Water Aerosols	Atmospheric Dirt & Solid Particulate	Micro-organisms	Oil Vapour	Liquid Oil & Oil Aerosols	Rust & Pipescale
Water Separators	•							
Coalescing Filters			•	•	•		•	•
Adsorption Filters						•		
Adsorption Dryers		•						
Refrigeration Dryers		•						
Dust Removal Filters				•	•			•
Microbiological Filters*					•			