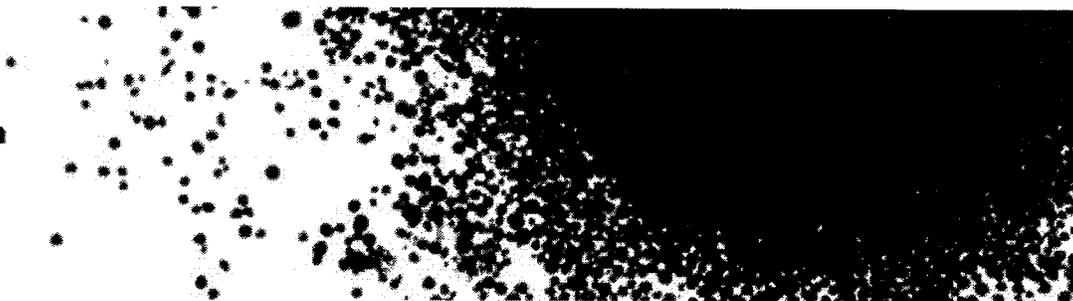




**International Carbon
Black Association**



What is Carbon Black?

Carbon black [C.A.S. NO. 1333-86-4] is virtually pure elemental carbon in the form of colloidal particles that are produced by incomplete combustion or thermal decomposition of gaseous or liquid hydrocarbons under controlled conditions. Its physical appearance is that of a black, finely divided pellet or powder. Its use in tires, rubber and plastic products, printing inks and coatings is related to properties of specific surface area, particle size and structure, conductivity and color. Carbon black is also in the top 50 industrial chemicals manufactured worldwide, based on annual tonnage. Current worldwide production is about 18 billion pounds per year [8.1 million metric tons]. Approximately 90% of carbon black is used in rubber applications, 9% as a pigment, and the remaining 1% as an essential ingredient in hundreds of diverse applications.

Modern carbon black products are direct descendants of early "lamp blacks" first produced by the Chinese over 3,500 years ago. These early lamp blacks were not very pure and differed greatly in their chemical composition from current carbon blacks. Since the mid-1970s, most carbon black has been produced by the oil furnace process, which is most often referred to as furnace black.

Production

Two carbon black manufacturing processes (furnace black and thermal black) produce nearly all of the world's carbon blacks, with the furnace black process being the most common. The furnace black process uses heavy aromatic oils as feedstock. The production furnace uses a closed reactor to atomize the feedstock oil under carefully controlled conditions (primarily temperature and pressure). The primary feedstock is introduced into a hot gas stream (achieved by burning a secondary feedstock, e.g., natural gas or oil) where it vaporizes and then pyrolyzes in the vapor phase to form microscopic carbon particles. In most furnace reactors, the reaction rate is controlled by steam or water sprays. The carbon black produced is conveyed through the reactor, cooled, and collected in bag filters in a continuous process. Residual gas, or tail gas, from a furnace reactor includes a variety of gases such as carbon monoxide and hydrogen. Most furnace black plants use a portion of this residual gas to produce heat, steam, or electric power.

The thermal black process uses natural gas, consisting primarily of methane or heavy aromatic oils, as feedstock material. The process uses a pair of furnaces that alternate approximately every five minutes between preheating and carbon black production. The natural gas is injected into the hot refractory lined furnace, and, in the absence of air, the heat from the refractory material decomposes the natural gas into carbon black and hydrogen. The aerosol material stream is quenched with water sprays and filtered in a bag house. The exiting carbon black may be further processed to remove impurities, pelletized, screened, and then

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packaged for shipment. The hydrogen off-gas is burned in air to preheat the second furnace.

Physical & Chemical Properties

Carbon black is not soot or black carbon, which are the two most common, generic terms applied to various unwanted carbonaceous by-products resulting from the incomplete combustion of carbon-containing materials, such as oil, fuel oils or gasoline, coal, paper, rubber, plastics and waste material. Soot and black carbon also contain large quantities of dichloromethane- and toluene extractable materials, and can exhibit an ash content of 50% or more.

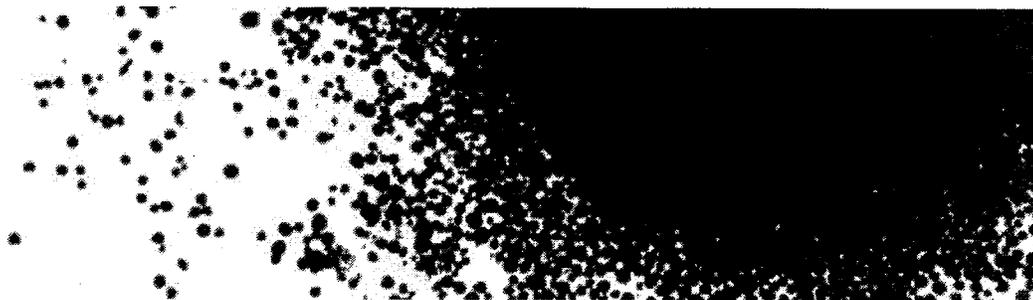
Carbon black is chemically and physically distinct from soot and black carbon, with most types containing greater than 97% elemental carbon arranged as aciniform (grape-like cluster) particulate. On the contrary, typically less than 60% of the total particle mass of soot or black carbon is composed of carbon, depending on the source and characteristics of the particles (shape, size, and heterogeneity). In the case of commercial carbon blacks, organic contaminants such as polycyclic aromatic hydrocarbons (PAHs) can only be extracted under very rigorous laboratory analytical procedures (soxhlet extraction using organic solvents and high temperatures). These extracts, though they may be similar to those derived from soot, are unique, however, because carbon black extracts exist only in extremely small quantities. Water and body fluids are ineffective in removing PAHs from the surface of carbon black and, therefore, they are not considered to be biologically available. Two other commercial carbonaceous products often confused with carbon black are activated carbon and bone black. Each is produced by processes different from commercial carbon black and possesses unique physical and chemical properties.

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Health Information

What is the current IARC classification for carbon black?

In 1995, and more recently in February 2006, an IARC panel of experts conducted a comprehensive review of carbon black. They concluded that there was "sufficient evidence" of carcinogenicity of carbon black in laboratory animals (based on two inhalation studies in laboratory rats), but that there was "inadequate evidence" of carcinogenicity in humans. IARC's overall classification placed carbon black in IARC's Group 2B as a "possible human carcinogen."

Does carbon black exposure present any risk of mutagenicity or genotoxicity effects?

No. The term mutagenicity refers to any damage of the DNA; genotoxicity refers to damage to the genes. At times, damage to the gene can be associated with a health abnormality, but in other cases, damage to the gene may result in no abnormality whatsoever. According to current research, there is no evidence that carbon black is a mutagen (i.e., an agent capable of causing mutagenicity) or genotoxic.

Should I be concerned about the trace quantities of PAHs (polyaromatic hydrocarbons) attached to carbon black particles?

Trace quantities of PAHs are present on some carbon blacks as a result of the manufacturing process. These contaminants are tightly bound to the surface of manufactured carbon black (not the case for soot) and can only be removed after vigorous solvent extraction in the laboratory. Additionally, studies have determined that PAHs are not removed from carbon black by human biological processes.

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Physical Characteristics

Is carbon black a nanoparticle?

While primary particle (near spherical building blocks of carbon black) diameters are generally in the 10-300 nanometer range, carbon black products as placed into commerce (the final product) are agglomerates, which are much larger in size (100 - 1000 nanometers in diameter). These agglomerates do not break down into smaller components (e.g., aggregates) because of the effect of van der Waals forces unless adequate force is applied (i.e., shear force). Thus, as placed on the market, carbon black products are not nanoparticles.

How is carbon black measured in the work environment?

Carbon black is commonly measured in work atmospheres by general gravimetric methods that collect air samples in the breathing zone of workers over a representative portion of the work shift. In work atmospheres that may contain a dust mixture that includes carbon black, specific methods to measure the elemental carbon composition of the breathing zone sample have been developed by OSHA and NIOSH. An industrial hygienist should be consulted to recommend the sampling and analytical method that is most appropriate.

What is the difference between carbon black and soot?

“Carbon Black and Soot: Two Different Substances”, written by Ann Watson and Peter Valberg, and published in the American Industrial Hygiene Association Journal (Volume 62, pages 218-228) in the March/April 2001 edition, summarizes the differences as follows:

Carbon blacks are manufactured under controlled conditions for commercial use primarily in the rubber, painting, and printing industries. In contrast, soots are unwanted by-products from the combustion of carbon-based materials for the generation of energy or heat, or for the disposal of waste. Greater than 97% of carbon black consists of elemental carbon arranged as aciniform particulate, while depending upon the type of soot, the relative amount and type of carbon and the particulate characteristics in soot can vary considerably (< 60% of the total soot particulate

mass is carbon).

Other elements and chemical compounds are associated with the particulate carbon in both substances, though soot has much greater percentages of ash and solvent extractable organic compounds. Additionally, the types of organic compounds found in carbon black are not extractable in biological fluids and are not as biologically potent as those present in soot.

Are Polycyclic Aromatic Hydrocarbons (PAHs) found on carbon black bioavailable?

No. Based on recent in-vitro studies, PAHs contained in carbon black are not bioavailable.

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Regulatory

Is carbon black listed on California Proposition 65?

“Carbon black (airborne, unbound particles of respirable size)” was added to the California Office of Environmental Health Hazard Assessment (OEHHA) list of substances known to the State to cause cancer on February 21, 2003. The listing was triggered by the ‘authoritative’ body mechanism in the California Code of Regulations and is based on the IARC reclassification from 1995/96. All three criteria of the listing must be met for carbon black to be considered a Proposition 65 substance.

What is the status of carbon black with respect to REACH?

*The ICBA, through its member companies, intends to register carbon black under the EU chemical policy called the **Registration, Evaluation, and Authorization of CHemicals (REACH)**. Currently, the ICBA is preparing for the registration process by gathering pertinent data and information about downstream applications.*

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