SPEX CertiPrep's Guide to Standard Test Methods for Carbon Black Iodine Adsorption Number (ASTM D1510)

What is Carbon Black?

Carbon black is an almost pure form of elemental carbon. Carbon black is produced by incomplete combustion of primarily petroleum hydrocarbons under controlled conditions resulting in a fine pellet or powder with a high surface-to-volume ratio. The majority of the world's carbon black is produced by either of two methods: furnace black or thermal black. The furnace black method is the more widely used process for producing carbon black. In this process, heavy aromatic oils are introduced by a hot gas stream into a pyrolyzation furnace to form microscopic carbon particles. The particles may be further processed to remove any impurities. The thermal black process uses methane as a feedstock. A pair of furnaces are used to alternate production. The methane is injected into a refractory-lined furnace where, in the absence of air, the natural gas is decomposed into carbon black and hydrogen.

The finished carbon black product is nearly pure elemental carbon (>97%), which differentiates it from what is commonly known as 'soot'. Soot is the residual solid material resulting from the incomplete combustion of carbon-containing fuels such as diesel and wood. The resulting solid material does contain some elemental carbon (<60%), but it also can contain a large amount of other chemicals such as inorganic impurities and organic carbon species including polycyclic aromatic hydrocarbons (PAHs). Carbon black usually contains less than one percent extractable organic compounds, whereas soot can consist of over 50% organic species including PAHs and metals.

INFORMATION & PROPERTIES OF CARBON BLACK	
Chemical Name	Carbon Black
Synonyms	Acetylene black, channel black, furnace black, lamp black, and thermal black
CAS #	133-86-4
Chemical Formula	C
Molecular Weight	12
Physical State	Solid powder or pellet
Solubility	Insoluble in water and most solvents

Carbon black is used in a wide variety of applications including additives for rubber materials, plastic products, printing inks and coatings. It is one of the top industrial chemicals manufactured in the world based on annual metric tonnage. As of 2015, over 12 million metric tons of carbon black were produced worldwide. The majority of carbon black applications are in the rubber industry.

What is the Purpose of the Iodine Adsorption Number Test?

The iodine adsorption number (IAN) is related to the surface area of carbon black. The value of carbon black is, in part, its high surface volume ratio (S-V). The IAN determines the amount of volatile or solvent-extractable substances which can decrease the S-V ratio and also reduce the quality and value of the base material. In the presence of high volatile or extractable species, the IAN decreases and indicates a higher level of impurities within the carbon black material. A lower IAN can also indicate problems in production conditions or aging of the material.

One of the most highly used test methods for IAN is ASTM Method D1510. ASTM Method D1510 outlines two procedures: a manual titration procedure and an alternative procedure using an automated preparation and analysis system such as an automatic titrator.

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Iodine Adsorption Number (ASTM D1510) (cont'd)

ASTM D1510 Method Summaries

The first method (Method A) tests a weighed sample of carbon black that is treated with a standard iodine solution. The excess iodine is titrated with a standardized sodium thiosulfate solution. The second method (Method B) also tests a weighed sample of carbon black treated with a standardized iodine solution. In this method, the sample is treated using an automated sample processor and undergoes automatic titration using a standardized solution of sodium thiosulfate. In both methods, the adsorbed iodine is reported as a fraction of the total mass of the carbon black.

Required Reagents:

Item Description	Item #	Packaging	Volume
0.0394 N Sodium Thiosulfate	182002	Cubitainer	1 gallon
0.0473 N Iodine	183134	Amber Glass Bottle	1 gallon

Solution Stability:

SPEX CertiPrep's manufacturing specifications for our iodine and sodium thiosulfate products meet and exceed the tolerances required by the ASTM method (sodium thiosulfate: 0.0394 ± 0.00008 N; iodine: 0.0473 ± 0.00003 N). SPEX CertiPrep manufactures under ISO/IEC 17025 and ISO/IEC Guide 34.

Iodine and sodium thiosulfate solutions may undergo changes in normalities during storage over time even in sealed containers. Once a container is opened, both solutions may change rapidly due to evaporation or oxidation reactions. Open containers exposed to air may incur bacterial growth over time and must be checked before use. ASTM Method D1510 requires that the blanks are checked daily.

Standardization:

SPEX CertiPrep standardizes the sodium thiosulfate solution against standards traceable to potassium dichromate, NIST Standard Reference Material 136F. The iodine solution is standardized against 0.0394 N sodium thiosulfate as required by ASTM Method D1510.

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