



TECHNICAL BULLETIN

Activated Carbon

Removal from water of Fluorinated Hydrocarbons

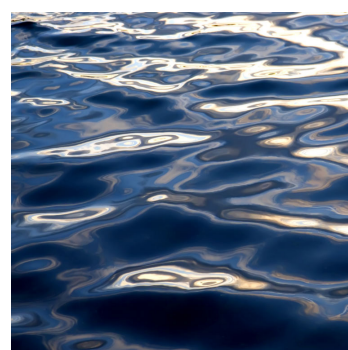
Background

In recent years, various perfluorinated chemicals (PFCs) have come under increasing scrutiny due to their presence in the environment, in animals, and in human blood samples. There are two major classes of PFCs: perfluoroalkyl sulfonates such as perfluorooctanesulfonic acid (PFOS) and long chain perfluoroalkyl carboxylates such as perfluorooctanoic acid (PFOA) and perfluorononanoic acid (PFNA).

While these compounds impart valuable properties, including fire resistance and oil, stain, grease, and water repellency to a number of consumer products, during the 1990's, studies revealed that PFOS was widespread in the blood of the general population and presented concerns for persistence, bioaccumulation and toxicity. This information led to further studies of PFOA which found that it, too, is very persistent in the environment, is found at very low levels both in the environment and in the blood of the general U.S. population, and causes developmental and other adverse effects in laboratory animals.

These studies have led USEPA to place several programs in place to reduce or eliminate the use of these compounds. In 2006, USEPA established a global stewardship program for fluoropolymer compounds, designed to reduce the use of these compounds by 95% in 2010 and completely eliminate them by 2015. Eight major manufacturers of fluoropolymer compounds participate in this program. In addition, a 2009 action plan by EPA addressed other sources of these compounds that fell outside of the stewardship program. Continuing regulation goes on today, with a Fall 2013 ruling on the use of PFC compounds in carpeting materials imported into the USA, and additional regulations planned in 2014.

Despite these successful efforts to eliminate PFCs from entering the environment, these compounds remain present in ground or surface waters as a direct result of prior use in manufacturing operations. They also have been present from fire-fighting operations, where compounds such as PFOS, PFOA and PFNA are added to hydrant supplies as a surfactant.



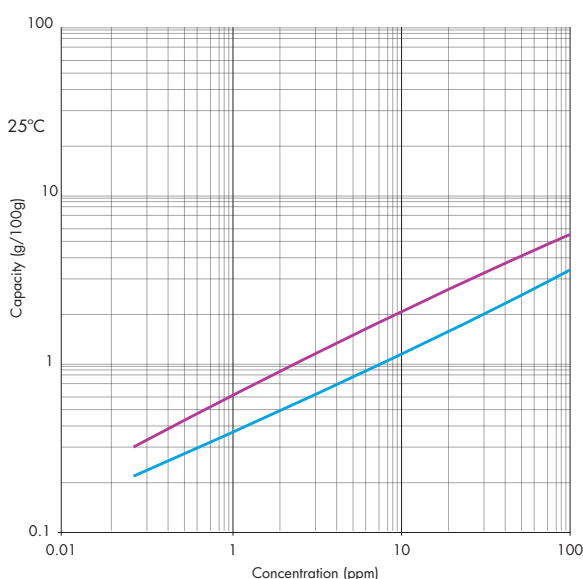


Removal of PFCs with Activated Carbon

Fortunately, a reliable technology exists to remove PFC compounds such as PFOA and PFOS from these water supplies: granular activated carbon (GAC). Isotherm data shown here compares two common types of GAC, using agglomerated bituminous coal and coconut shell as base materials, for these two compounds. As the isotherms show, the coconut shell GAC exhibited a higher overall capacity for both compounds. With a higher percentage of micropores, coconut shell based GAC often exhibits a higher saturation capacity for organic compounds such as PFCs in these types of waters.

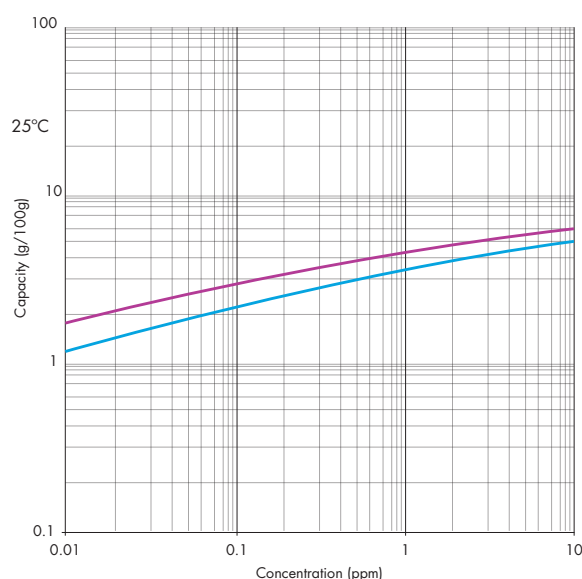
LIQUID PHASE ADSORPTION ISOTHERM 25°C Perfluorooctanoic Acid (pH 7)

— Coconut Shell based GAC
— Agglomerated Bituminous Based GAC



LIQUID PHASE ADSORPTION ISOTHERM 25°C Perfluorooctanesulfonic Acid

— Coconut Shell based GAC
— Agglomerated Bituminous Based GAC



Pilot Testing – Coconut Shell Based Activated Carbon

To further analyze the use of activated carbon for the removal of PFC compounds, a pilot assessment was conducted in Europe by Kruger Wabag in 2009, using coconut shell based activated carbon from Jacobi Carbons. In this pilot test, columns of Jacobi's AquaSorb CX treated approximately 20,000 bed volumes of water over a 4 month period at a contact time of 9.3 minutes. The target compound in this study was PFOA.

To view the results of this testing, please visit Jacobi Carbon's website and complete a one-time registration process (<http://www.jacobi.net/index.php?/site/register>). Once registration is complete, access to this study along with Jacobi's technical library will be granted.

For more information or to contact Jacobi visit: www.jacobi.net

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