Treatment for Monochloramine Using Activated Carbon

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THE CARBON COMPANY

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In order to reduce the formation of disinfection by-products (DBP) from the reaction of chlorine with residual organics in potable water, the application of alternative disinfectants has become increasingly widespread. Although ~200 times less effective than chlorine as a sterilant, monochloramine has emerged as one of the leading alternative disinfectants for municipal water supplies. Monochloramine offers two advantages. Firstly, it is less reactive avoiding the creation of DBP's. Secondly, it is a more persistent disinfectant remaining in the public water supply throughout the distribution system up to the faucet. However, its persistence in the supply and its tendency to form breakdown products below a pH of 7.5 causes taste and odour issues for consumers. This paper details the relative efficiency of commercial activated carbon in the removal of monochloramine and describes the enhanced performance exhibited by special "catalytic" carbons. The paper also describes the relative stability of these catalytic carbons when subject to demands of continuous use providing direction on activated carbon material selection to water treatment professionals faced with monochloramine removal issues.

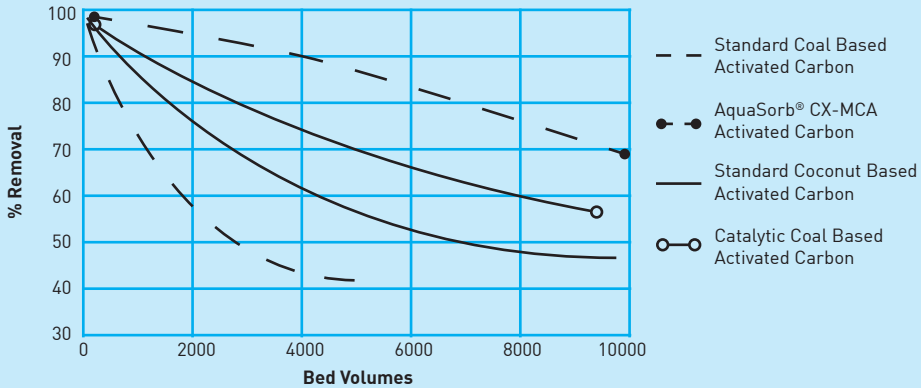
Removal of Monochloramine by Activated Carbons

Reduction
$C^* + NH_2Cl + H_20 \rightarrow NH_3 + H^+ + Cl^- + C^*O$

Catalytic Decomposition
$C^*O + 2\ NH_2Cl \rightarrow C^* + 2H^+ + 2\ Cl^- + H_20 + N_2$

The stoichiometry of the dechloramination reactions on carbon are well known and are shown in Figure 1.1 The dechloramination efficiency of various commercial activated carbons including specialised "catalytic" products was examined utilising extended life column testing. A 25-cm^3 bed of GAC was set up in a 2.5-cm diameter column. Flow rate was maintained at a target flow of 3.3 bed volumes per minute. Challenge water was prepared with reference to ANSI-NSF 42-2002 chloramine testing protocol at pH 9, ensuring that monochloramine was the principal chloramine species at a target concentration of ~3mg/L chlorine. Influent and effluent waters were analysed for monochloramine directly using an indophenol colorimetric method.
Figure 1.2 shows the relative dechloramination performance of a standard coal and coconut based activated carbon, catalytic coal based carbon, and Jacobi Carbons catalytic coconut based activated carbon, AquaSorb® CX-MCA. Comparison of the activated carbons show that AquaSorb® CX-MCA is superior to all activated carbons for the removal of chloramine.

Figure 1.2 Chloramine Removal - Standard and Catalytic Carbons



Relative Stability of Carbons

One of the additional benefits of a catalytic coconut based activated carbon is its stability to chemicals. When subject to sustained chemical attack by aqueous phase oxidising chemical, such as chloramines, the surface of activated carbon degrades releasing fines into treated water. Table 1.1 shows the results of measurements of the suspended solids and turbidity content in the water from the daily backwash cycles of AquaSorb® CX-MCA activated carbon beds during the six days of continuous running required to attain 30000 B.V. Comparison of the data in Table 1.1 shows AquaSorb® CX-MCA produces significantly less backwash fines than the coal based carbon as a direct result of mechanical stability of a coconut shell.

Table 1.1 Release of Fines by of Catalytic Carbons

Suspended Solids (mg/L)					
Carbon	Day2	Day3	Day4	Day5	Day6
Coal Based	382	216	250	284	239
Jacobi CX-MCA	102	118	117	128	71
Turbidity (FAU)					
Coal Based	406	241	288	343	271
Jacobi CX-MCA	113	140	147	140	82

Summary

- Activated carbon is an effective media for the removal of monochloramine with coconut-based products were shown superior to coal based products.
- Specialized "catalytic" products are superior to standard grades offering almost twice the monochloramine removal capacity.
- For specialized "catalytic" carbon products, coconut carbons showed superior chloramines removal performance and mechanical stabilty compared to competitors coal based products.

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ISO 9001 BUREAU VERITAS Certification

CAUTION Activated carbon is a strong oxidizing agent and can remove oxygen from air under wet or humid conditions. Care should be taken when entering confined spaces where wet activated carbon is present. Ensure the use of correct breathing apparatus. Material Safety Data Sheets should be consulted for further details on procedures in the event of contact with activated carbon.

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