**Adsorption of cyanotoxins by Activated Carbon in drinking water**

Hak-sun Kwon, Woohyun Yoon, Young kook Ham, Jae-chan An, Bog-Soon Kim

Seoul Waterworks Research Institute, 716-10, Cheonhodaero, Gwangjingu, Seoul, [sunnychem@seoul.go.kr](mailto:sunnychem@seoul.go.kr)

In recent years, algal blooms occurr frequently in many regions of the world due to surface water eutrophication(Rodriguez & Onstad 2007). A rapid accumulation of algal population may lead to many problems such as taste-and-odor episodes even in tap waters, increased operation costs in drinking water treatment plants, additional formation of precursors of disinfection by-products, and so on(Miao & Qin 2010). Moreover cyanotoxins produced by cyanobacteria, such as microcystins(MCs), anatoxin-a(ATX-a), cylindrospermopsin(CYN), saxitoxin(STX), and nodularine(NOD) have potential risk to human health if they are ingested via drinking water. Therefore development of a simultaneous analytical method for rapid determination of cyanotoxins was required to secure safety of raw and tap waters supplied to Seoulites.

The adsorption of cyanotoxins by six different granular activated carbons(GACs) and powdered activated carbon(PAC) used in treatment facilities was conducted at lab scale experimental. Granular activated carbon was used in the form of powder by grinding, because it takes a long time to reach the adsorption equilibrium. Isothermal adsorption experiments were conducted to evaluate the adsorption removal of five cyanotoxins. In this study, five kinds of cyantoxins are prepared as mixed standard solution using filtered water, concentration of cyanotoxins took into account concentration of 2 μg/L of microcystins containing in raw water in 2000 year.

The effect of activated carbon dosage on the adsorption of five cyanobacterial toxins was varied depending on the type of GACs. As the amount of activated carbon was increased, adsorptive removal of cyanotoxins was also increased. The maximum available dosage of 30 mg/L of PAC in the water treatment facility showed adsorption removal of cyanotoxins of 90% or more. Adsorption of cyanotoxins by GACs have showed in the order : virgin > GAC used two years > GAC used three years > regenerated GAC.

At the range of pH 6 ~ 10 of water treatment, microcystins and nodularin were found to have not been affected by pH. But Cylindrospermopsin, saxitoxin, and anatoxin-a showed a tendency to increased adsorptive rate with increasing pH. At pH 7.3, microcystin variants were adsorbed in the order: MC-RR > MC-YR > MC-LR > MC-LA. Cylindrospermopsin and nodularine were found to be adsorbed similarly to microcystins. Saxitoxin and anatoxin-a showed a low adsorption removal than microcystins.

The effect of temperature on adsorption, removal of cyanotoxins at 5 ℃ temperature was about 10~20% lower than that of cyanotoxins at 20 ℃ temperature.

The effect of initial concentration of microcystin-LR on the adsorption capacity, it did not show significant differences in the influent concentration in the case of a 2 μg/L and 5 μg/L. For 10 μg/L of concentration, the adsorption capacity of granular activated carbon was reduced by about 10%.