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# Nanostructure Two Dimensional Graphitic carbon nitride as emerging passive sampler adsorbent material for efficient monitoring of Hg2+ in different matrices

**Raghuraj Chouhan**, Jan Gačnik, and Milena Horvat
Jožef Stefan Institute, Department of Environmental Sciences, Slovenia (raghuraj.singh@ijs.si)

Graphitic carbon nitride (g-CN) is emerging as a new research hot topic because of its unique electronic band structure, high physicochemical stability, large surface area, non-toxic nature, and is “earth-abundant”. These and other properties have made it a highly researched material especially for visible light photocatalysis and photodegradation applications and as the starting material from which to develop novel electrochemical sensing platforms, adsorbent materials for environmental and biomedical applications. The proposed work reports the development of a 2 dimensional (2D) nanostructure material-based passive sampler, which binds trace concentrations of mercury ($Hg^{2+}$) by employing ultrathin graphitic carbon nitride (g-CN) nanosheet as an effective adsorbent. The g-CN nanosheets were obtained by exfoliating the bulk g-CN which was synthesized *via* a thermal polycondensation process. The as-prepared samples were characterized by x-ray diffraction (XRD), transmission electron microscopy (TEM), Fourier transforms infrared (FTIR) spectroscopy, and atomic force microscopy (AFM), which confirmed graphite-like structure. The results showed high recovery capacities for $Hg^{2+}$ in different matrices in the following order: Sea < River < Rain < Mili Q water of 89%, 93 %, 97 and 100 %, respectively. Ion interference studies ($Co^{2+}$, $Ca^{2+}$, $Zn^{2+}$, $Fe^{2+}$, $Mn^{2+}$, $Ni^{2+}$, $Bi^{3+}$, $Na^{+,}$ and $K^{+}$) were also performed to check the specificity and selectivity of g-CN towards $Hg^{2+}$. There was minimum or no effect of the presence of ions on the binding efficiency of $Hg^{2+}$ on g-CN nanosheets. The effect of pH (2, 4, 6, 7, 8, and 10) on the binding efficiencies of $Hg^{2+}$ on g-CN was also studied. It was found that g-CN nanosheets showed enhanced binding response to $Hg^{2+}$ in comparison to its bulk counterpart, which could be ascribed to the strong affinity between g-CN and $Hg^{2+}$ through its -NH and -$NH_2$ groups. This allows the detection of $Hg^{2+}$ in aqueous solutions with high sensitivity and selectivity. A mercury analyzer was used in the present work to quantify $Hg^{2+}$ retained on g-CN and supernatant. Such a sampling material reported an efficiency of adsorption that was equal to ~99%. Temperature and relative humidity only mildly affected the material performances. These defined nano-interwoven structures “knitting” seem to be promising candidates for mercury samplers. The nano-knitting structures seem to be promising candidates for mercury samplers, due to the strong affinity with $Hg^{2+}$, and the wide adsorbing surface. These results demonstrated that the g-CN can be used as a potential candidate for detecting trace levels of $Hg^{2+}$ in water and can be used as reference material for inter-laboratory comparisons.