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Removing Molybdenum with the Microalgae Extracted from the Wastewater in Semiconductor Plants

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It has been well recognized that algae biomass can treat highly contaminated water in an effective way. Algae can grows in the natural environment without any care and can be efficiently cultivated. Both of living algae and dry algae biomass have been tested to absorb many kinds of toxic pollutants, because there are multiple functional groups on the algae surface capable of binding molybdenum. Therefore, algae become a good choice for the treatment of molybdenum in contaminated waters. In addition, in Taiwan, semiconductor industry is highly developed in the recent three decades. Subsequently, it is believed that some pollutants, such as molybdenum in this study, have become a threat to the surface water, groundwater and even the whole environment. In the previous studies, molybdenum is a well-known essential nutrient for the algae; therefore, the potential to remove molybdenum with algae from the wastewater is worth to be evaluated. The algae species, *Chloroidium saccharophilum*, was extracted from the wastewater in semiconductor plants for the study of removing molybdenum. A few sorption experiments have been conducted for evaluating the efficiency of removing molybdenum under different values of pH and molybdenum concentration.

The absorption of *Chloroidium saccharophilum* can reach equilibrium in short times, which are 60 and 120 mins for molybdenum concentrations of 600 and 1200 ppb, respectively. The sorption experiments would accept the duration of 120 mins as the contact time and were performed at pH values of 6, 4 and 2 with different concentrations of molybdenum diluted by deionized water. The experiment data confirms that the isotherm has an excellent agreement on Langmuir adsorption model with the correlation coefficients (r^2) of > 0.97. It demonstrates that the adsorption capacity (q_{max}) has an inverse relationship with pH value, which are 826, 2564 and 4761 $mgkg^{-1}$ for pH 6, 4 and 2, respectively, while those of net enthalpy of adsorption (K_L) are 3.98, 2.98 and 1.5×10^{-5} $mgkg^{-1}$. In addition, a similar experiment was also conducted with domestic sewage instead of deionized water under pH=6 and obtained a much higher value of q_{max} (1923 $mgkg^{-1}$) than that with deionized water. It is believed that the cations in the domestic sewage, such as Ca^{2+}, Mg^{2+}, Na^{+} and K^{+}, are capable of replacing H^{+} from the algae surface, which can decrease the pH value of water and subsequently promote the absorption of MoO_4^{2-} as the aforementioned. FTIR was utilized for determining the functional groups on algae surface in this study. There are five major absorption bands, which are corresponding to -O-H, $-COO^{-}$, C-O-C, Mo-O and Mo-N. However, the responsible functional group to absorb MoO_4^{2-} is still uncertain and the comparison of absorption behaviour of molybdenum among different algae species should be also evaluated. More researches will be studied in the future.