The presence of heavy metals in the aquatic environment has been a big concern to scientists owing to their increased discharge, toxic nature, and other adverse effects on receiving water. Even a very low concentration of heavy metals in water can be very toxic to aquatic life. For these reasons, the discharge of this kind of pollutant is stringently regulated in order to reduce environmental impact. In this manner, the present research was aimed at the development of clay-based adsorbent that it can be used in the removal of cadmium(II) ions by adsorption to obtain experimental parameters. The adsorption of cadmium(II) ions onto 2,2'-dipyridyl (DP), which is organic base, modified bentonite were studied in this work by means of the effect of pH’s and adsorption isotherms from aqueous solutions. The surface functional group characterization of both natural and DP-modified bentonite was undertaken using FTIR spectroscopic technique. The pH experiments were carried out at 100 mg dm$^{-3}$ and 20$^\circ$C. The amount of adsorption obtained from pH experiments was found as 49.70 mg g$^{-1}$ at pH=5.5. Langmuir, Freundlich and Dubinin-Radushkevich (D-R) isotherm models were applied to the experimental data. The adsorption data obtained were well described by the Langmuir adsorption isotherm model. The maximum adsorption capacity was found to be 74.57 mg g$^{-1}$ from the Langmuir isotherm model. The results show that DP-modified bentonite is the effective adsorbent for the removal of heavy metal contaminants.