Carbonate hydroxyapatite (CHAP) was synthesized from domestic hen egg shells. The obtained CHAP was characterized by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy and investigated as metal adsorption for Pb^{2+} from aqueous solutions. The effect of various parameters on the adsorption process such as contact time, solution pH, and temperature was studied to optimize the conditions for maximum adsorption. The results showed that the removal efficiency of Pb^{2+} by carbonate hydroxyapatite calcined at 600 °C (CHAPF) reached 99.78 %, with an initial Pb^{2+} concentration of 200 mg·L−1, pH = 3, and a solid/liquid ratio of 1 g·L−1. The equilibrium removal process of lead ions by CHAPF foam at pH = 3 was well described by the Langmuir isotherm model, with a maximum adsorption capacity of 500 mg·g−1 at (25 and 35) °C. The removal mechanism of Pb^{2+} by the CHAPF varies, depending on the initial concentration of lead in the aqueous solution: the dissolution of CHAPF and precipitation of hydropyromorphite ($Pb_{10}(PO_4)_6(OH)_2$) is dominant at low concentration [(20 to 200) mg·L−1], and the adsorption mechanism of Pb^{2+} on the CHAPF surface and ion exchange reaction between Ca^{2+} of hydroxyapatite and Pb^{2+} in aqueous solution is dominant at high concentration [(500 to 700) mg·L−1]. The thermodynamics of the immobilization process indicates an exothermic sorption process of Pb^{2+}