In this work, a new diimine-dioxime compound (N,N'-bis[1-biphenyl-2-hydroxyimino-2-(4-chloroanilino)-1-ethylidene]-1,4-phenylenediamine) was synthesized and characterized by a combination of elemental analyses, FT-IR, $^1$H- and $^{13}$C-NMR spectra. The extraction ability of the new compound has been examined in chloroform by using several transition metal picrates such as Mn(II), Co(II), Ni(II), Cu(II), Zn(II), Pb (II), Cd(II) and Hg(II). It has been observed that diimine-dioxime compound shows a high affinity to Hg(II) ion. The electrochemical measurements of the compound were performed by cyclic voltammetry in acetonitrile solution at room temperature, and two irreversible oxidation waves were observed. A Hg(II)-selective electrode based on the diimine-dioxime compound has been developed. The electrode showed linear responses with Nerstian slopes of 33 ±1 mV per decade over a wide concentration range (1.0×10^{-2}- 8.0×10^{-6} M). The limit of detection was 2.4×10^{-6} M. The electrode has a response time about 10-15 s and it did not show a considerable divergence in its potential response over a period of 1 month. The proposed electrode revealed selectivity towards Hg(II) ion in the presence of various cations. The electrode could be used over a wide pH range of 4.0-9.0. The electrode can be successfully used as an indicator electrode for potentiometric titration of Hg(II) with EDTA.