Bioremediation, a biologically mediated transformation or degradation of persistent chemicals into nonhazardous or less-hazardous substances, has been recognized as a key strategy to control levels of pollutants in water and soils. The use of enzymes, notably oxidoreductases such as laccases, tyrosinases, various oxygenases, aromatic dioxygenases, and different peroxidases (all of EC class 1) is receiving significant research attention in this regard. It should be stated that immobilization is emphasized as a powerful tool for enhancement of enzyme activity and stability as well as for protection of the enzyme proteins against negative effects of harsh reaction conditions. As proper selection of support materials for immobilization and their performance is overlooked when it comes to comparing performance of immobilized enzyme in academic studies, this review summarizes the current state of knowledge regarding the materials used for enzyme immobilization of these oxidoreductase enzymes for environmental applications. In the presented study, thorough physicochemical characteristics of the support materials was presented. Moreover, various types of reactions and notably operational modes of enzymatic processes for biodegradation of harmful pollutants are summarized, and future trends in use of immobilized oxidoreductases for environmental applications are discussed. Our goal is to provide an improved foundation on which new technological advancements can be made to achieve efficient enzyme-assisted bioremediation.