Lignin depolymerization results in low-molecular weight aromatic monomers, which can be converted to value-added chemicals via chemical and biochemical catalysis. Direct and selective hydroxylation of lignin monomers has the potential to upgrade these compounds to key intermediates in the synthesis of commodity chemicals and pharmaceuticals. Here, we explore the biochemical hydroxylation of lignin-derived monomers using pterin-dependent aromatic amino acid mono-oxygenases. In nature, pterin-dependent aromatic amino acid mono-oxygenases catalyze the hydroxylation of phenylalanine, tyrosine, and tryptophan. Due to the structural similarity between these amino acids and lignin-derived monomers, we hypothesized that these enzymes could also hydroxylate lignin-derived aromatic monomers. Specifically, we investigated the use of the pterin-dependent tyrosine mono-oxygenase in the whole-cell catalysis of lignin-derived monomers. To do this, we leveraged an engineered yeast strain that produces tetrahydrobiopterin and expresses tyrosine mono-oxygenase. In preliminary results, we see apparent hydroxylation of two compounds. This work represents the first attempt to use pterin-dependent enzymes to hydroxylate compounds other than aromatic amino acids, and opens the door for systematic biological upgrading of lignin-derived aromatic monomers.