VTX Free Radicals and Fenton's Chemistry 101

The classic Fenton's reaction below (oxidation of Fe^{2+}) depicts the production of a hydroxyl radical. It is the hydroxyl radical that is such a powerful oxidizer of organic chemicals.

$Fe^{2+} + H_2O_2 \Rightarrow Fe^{3+} + OH^- + HO^0$

The simple explanation for why hydroxyl radicals attack organic chemicals lies in the fact that the radicals have unpaired electrons that need paired up. The easy way for them to pair their electron is by attacking an electron rich organic group, most likely with a π bond that they can grab, thereby, shuffling around the organic parts and most likely cleaving some part of the organic. Once an organic starts to lose it's parts, it's not as stable as it once was and subject, therefore, to further breakdown.

There are 3 types of radicals; anion, cation and neutral. The hydroxyl radical is neutral... (otherwise the electrochemistry doesn't make sense)

Most of the time, free radicals beget free radicals, which is why a lot of people take vitamin E... to quench free electrons and, hopefully, stop the aging process.

The second reaction in Fenton's chemistry (below) is the reaction which sees the oxidized iron reduced back to ferrous iron by hydrogen peroxide within the same space and time that the hydroxyl radicals are being produced through the oxidation of ferrous iron. This cycling of iron from one valence state to the other is what causes the repeated formation of hydroxyl radicals in the Fenton's process.

$Fe^{3+} + H_2O_2 \Rightarrow Fe^{2+} + H^+ + HO_2^0$

The peroxide molecule formed in this reaction (HO_2^0) is a powerful peroxide free radical which can also oxidize organic compounds.