THE MECHANISM OF ACTION FOR HOT PLASMA PULSED RADIATION OF A SPARK DISCHARGE ON PHENOL [[1]](#footnote-1)\*)

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The degradation of phenol under the action for a cold plasma of an electric corona discharge and hot plasma pulsed radiation of a spark discharge was compared. A solution of phenol in water with a concentration of 25 mg/L (2.65 10−4 Mol/L) was treated. To generate active species, a corona electric discharge generator was used, the power released in the discharge was 4.7 J/s, the volume of the treated liquid was 50 ml, and a generator of a spark discharge radiation with a power of 0.4 J/s, the volume of the processed liquid was 10 ml. The absorption spectra of phenol in aqueous solution were observed after action of both sources of active species.

It was found that under the action of a corona discharge, phenol is destroyed directly during treatment, and two days after treatment, practically no changes occur. All changes in the solution under the action of a corona electric discharge occur immediately during processing. The main active species formed in the corona discharge are hydroxyl radicals. During the action of the discharge, hydroxyl radicals immediately react with phenol dissolved in water. When the discharge is turned off, the generation of hydroxyl radicals stops, and the degradation of phenol stops.

Under the action of hot plasma radiation at the time of treatment, practically no changes in phenol are observed. Nitrous acid is generated, the spectrum of which is superimposed on the spectrum of phenol. All phenol changes occur after processing. It was shown that the main product formed during degradation is 4-nitrophenol. The results obtained allow us to conclude that the mechanism of phenol degradation under the action of hot plasma pulsed radiation is nitration. Phenol nitration lasts up to 120 hours. The reason is that the HO2• radicals generated in the discharge cannot oxidize phenol. During the treatment, nitrogen compounds accumulate, with the interaction with which phenol nitration occurs. The nitration reaction is slow, lasting up to 120 hours.

Thus, it has been shown that the mechanisms of phenol degradation under the action of a corona electric discharge and hot plasma pulsed radiation of a spark discharge differ significantly.

Under the action of a corona discharge, phenol is destroyed directly during processing. The main active factor is hydroxyl radicals.

Under the action of hot plasma pulsed radiation of a spark discharge, the destruction of phenol at the time of treatment is impossible, since hydroxyl radicals in water cannot form, and HO2• radicals have insufficient reactivity. Therefore, the main degradation mechanism is nitration with active nitrogen forms, accumulated at the time of treatment. The nitration reaction is slow, almost no changes in phenol are observed immediately at the time of treatment. Nitration occurs for up to five days in reaction with nitrous acid and the decomposition products of the complex (…ONOOH/ONOO−…): peroxynitrite and peroxynitrous acid.

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Pt/ru/HB-Piskarev.docx) [↑](#footnote-ref-1)