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# GENOTOXICITY OF 4-NONYLPHENOL AND NONYLPHENOL ETHOXYLATE MIXTURES WITH THE USE OF *Saccharomyces cerevisiae* D7 MUTATION ASSAY AND USE OF THIS TEXT TO EVALUATE THE EFFICIENCY OF BIODEGRADATION TREATMENTS

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## Abstract

Nonylphenol ethoxylates (NPnEOs, n is the number of ethoxylic units in the molecule) are non-ionic surfactants widely used in several industrial applications, such as textile and leather processing, paper industry, formulation of pesticides, paints and washing cleaners. 4-Nonylphenol (4-NP), the main product of NPnEO biodegradation, is a toxic xenobiotic compound classified as endocrine disrupter. While numerous studies reported the toxicity and estrogenic activity of nonylphenols, little is known about the mutagenicity of these compounds. In this paper, the genotoxicity of 4-NP and NPnEO mixtures was evaluated by using the D7 strain of *Saccharomyces cerevisiae* as experimental model. The same tests were applied to effluents deriving from laboratory scale packed-bed bioreactors, developed for the treatment of NPnEO contaminated wastewater, in order to evaluate the residual genotoxic potential with respect to the influent waste. The target compounds fed to the bioreactors were 4-NP and NPnEO mixtures possessing an average of 5 or 1.5 ethoxylic units (Igepal CO-520 and Igepal CO-210, respectively). The results showed that 4-NP induced significant cytotoxic effect on *S. cerevisiae* cells at 60 mg/L, as well as mutagenic effects at 15 and 30 mg/L. 4-NP was the most genotoxic compound among those assayed, followed by Igepal CO-210, whereas Igepal CO-520 did not induce genotoxicity at any of the assayed concentrations. The genotoxic effects evidenced on yeast cells treated with 4-NP disappeared after the treatment in the bioreactor. This indicates that the biological treatment is capable of removing not only the pollutant, but also the toxicity associated to the compound and its degradation metabolites. This study represents, to the best of our knowledge, the first report that evaluates the genotoxicity of both 4-NP, NPnEOs and their potential aerobic degradation products on an eukaryotic organism. The obtained results suggest that the *S. cerevisiae* D7 strain is a very effective model to study the induction of genotoxic damage by the compounds under study. In addition, this method is much more simpler and easier to be applied than other tests described in the literature to study genotoxic effects. Moreover, the test described in this work has also proven to be effective in evaluating the toxicity of effluents deriving from laboratory scale biotreatment processes. It would be really interesting to apply the described tests on real wastewater treatment system in order to estimate the detoxification potential of the process applied, which is often not directly correlated with the removal of the target pollutant.