FTOX049

Phytotoxicity of p-phenylenediamine, basic red 51 and basic yellow 57 to *Lactuca sativa* L.

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Introduction: Hair dyes are widely used and parts of those dyes are lost during application procedure and the subsequent hair washings. Consequently the dyes can reach the aquatic environment. The assessment of the environmental impact of hair dyes is of great concern since these products contain chemical characteristics that can make them toxic, such as azo bond N=N (Basic Red 51 and Basic Yellow 57), and amine groups (p-Phenylenediamine). If hair dye-containing effluents are not appropriately treated these products can cause adverse effects to biota and human health. **Objective:** The aim of this study was to evaluate the phytotoxicity of three dyes used in hair dyes products using *Lactuca sativa* L. cv Grand Rapids. The end points evaluated were germination, root elongation, and biomass production. **Methods:** The tested dyes were: p-Phenylenediamine; Basic Red 51; and Basic Yellow 57. For germination of *L. sativa*, 50 seeds were placed in Petri dishes, which contained two disks of filter paper moistened with 3 ml of different concentrations of the tested dyes (10, 50, 100, 500 and 1000 mg.L-1), or distilled water used as negative control. The Petri dishes were kept in a germination chamber with a photoperiod of 12h at 20 ± 2 ° C. The endpoints root elongation and fresh biomass, were measured after 72 h of exposition. The end point dry biomass was measured after the plants dehydration, which was performed at a temperature of 45 ° C. Plants were considered to be dried when reached constant weight. The experiment was conducted in a completely randomized design with 6 treatments and 30 replicates. The data were submitted to analysis of variance (ANOVA) and regression test. **Results:** Analysis of variance was performed for the results of each tested dye and was obtained a value of p> 0.05% in all analyzed endpoints, showing that there is a difference between at least one of the tested concentrations. The performed linear regression showed a dose/response relation for the three dyes tested on the all endpoints. The dye p-Phenylenediamine was the most phytotoxic dye evaluated. In highest concentration this dye was observed inhibitions of 89.4% in root elongation, 93.8% in the production of fresh biomass and 79.7% in the production of dry biomass. The dye Basic Red 51 promoted inhibitions of 23.5% in root elongation, 33.1% in fresh biomass production and 26.4% dry biomass. For the dye Basic Yellow 57 the inhibitions were 41.0%, 58.3% and 38.5% to root elongation fresh biomass and dry biomass productions, respectively. The most sensitive endpoint of phytotoxicity was the production of fresh biomass followed by root elongation and dry biomass. **Conclusion:** The three tested dyes were phytotoxic, causing a reduction in the processes of early growth of *L. sativa*. The dye p-Phenylenediamine was the most phytotoxic and Basic Red 51 was less phytotoxicity. All endpoints evaluated were adequate to assess the phytotoxicity of the tested dyes and more sensitive endpoint to its harmful effects was the production of biomass. Tests with other terrestrial and aquatic organisms should be performed to complete an ecotoxicological assessment of these dyes.

Keywords: Hair dyes, *Lactuca sativa* L., Phytotoxicity.

Financial support: FAPEMIG, CAPES.