DAMAGE TO ERYTHROCYTE PROTEINS INDUCED BY PHENOXYHERBICIDES AND THEIR DERIVATIVES

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The effect of commonly used phenoxyherbicides, sodium salt of 2,4-dichlorophenoxyacetic acid (2,4-D-Na) and sodium salt of 4-chloro-2-methylphenoxyacetic acid (MCPA-Na) and their derivatives: phenol, 2,4-dichlorophenol (2,4-DCP), 2,4-dimethylphenol (2,4-DMP) and catechol on human erythrocytes was studied. The oxidation of a fluorogenic label, 6-carboxy-2',7'-dichlorodihydrofluorescein diacetate (H_2DCF-DA) by phenolic compounds in erythrocytes as well as the carbonyl group content and haemoglobin denaturation were monitored.

We noted that sodium salt of 2,4-dichlorophenoxyacetic acid, 2,4-DCP, 2,4-DMP and catechol induced a concentration- and time-dependent increase in the H_2DCF oxidation. We observed also an increase in the carbonyl group content and the changes in the parameter T (denaturation of haemoglobin) in erythrocytes incubated with 2,4-DCP, catechol and 2,4-DMP. The highest level of H_2DCF oxidation was provoked by 2,4-DCP. The biggest changes of proteins in erythrocytes measured as the carbonyl group content were induced by 2,4-DMP, but measured as those of the T parameter were induced by catechol.

It was observed that MCPA-Na and 2,4,5-T-Na and phenol did not oxidize H_2DCF after 3 h of incubation. Statistically significant H_2DCF oxidation by these compounds was observed only after 24 hrs incubation. MCPA-Na and 2,4,5-T-Na increased the carbonyl group content but did not change parameter T. However, phenol did not affect the carbonyl group content but decreased the T parameter (induced denaturation of haemoglobin).

To sum up, substituent in a phenolic ring determines the molecular mechanism of action and extent of damage to erythrocyte proteins by phenoxyherbicides, and their derivatives.