SPECTROPHOTOMETRIC DETERMINATION OF 4,6-DINITRO-o-CRESOL (DNOC) WITH PERIODATE AND COPPER(II)-NEOCUPOINE ASSAYS

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4,6-Dinitro-o-cresol (DNOC) is a selective herbicide used in the cultivation of grain, hops, vines and fruit (insecticide, acaricide, with fungicidal secondary effects). Its commercially available preparations contain formulations of the alkali, ammonia, or amine salts of DNOC which are normally soluble in water. Together with other dinitrophenol herbicides such as DINOSEB (2,4-dinitro-6-secbutylphenol), DNOC has been used for more than 50 years as herbicides [1]. Although the use of once widely applied selective herbicide, DNOC, was cancelled by US-EPA in 1987, it is still found in soil and water due to its slow degradation in the environment. Since solid phase extraction-spectrophotometry combinations are much simpler and cheaper than chromatography/MS based methods and most routine laboratories lack such sophisticated instrumentation, it is desirable to establish novel sensitive, well-established, and field-applicable spectrophotometric methods for the rapid assay of DNOC in water and soil. For this purpose, two distinct spectrophotometric methods utilizing the periodate and copper(II)-neocuproine (Nc) reagents have been developed following Zn/HCl reduction of the pesticide in a microwave oven for 15 s, and validated for DNOC determination at mg L⁻¹ level. The periodate spectrophotometric method yielded the calibration curve: \( A = 1.75 \times 10^{-2} C_f - 7.4 \times 10^{-3} \) (correlation coefficient : \( r = 0.9997 \)) where \( C_f \) was the final concentration of DNOC (mg L⁻¹) in the solution of color development, yielding a molar absorptivity of \( \varepsilon = (3.51 \pm 0.07) \times 10^3 \) L mol⁻¹ cm⁻¹ for DNOC in the periodate method. The Cu(II)-neocuproine spectrophotometric method yielded the calibration curve: \( A = 2.51 \times 10^{-1} C_f + 7.00 \times 10^{-2} \) (correlation coefficient : \( r = 0.9996 \)) where \( C_f \) was the final concentration of DNOC (mg L⁻¹). The molar absorptivity for DNOC was \( \varepsilon = (4.97 \pm 0.1) \times 10^4 \) L mol⁻¹ cm⁻¹. The LOD values were 1.6 and 0.2 mg L⁻¹ for periodate and Cu(II)-Nc methods, respectively. Statistical comparison of the developed methods was made with the aid of high performance liquid chromatography (HPLC) equipped with a C18 (5μm), 250mm×4.6mm ID reversed phase column in conjunction with a UV (264 nm) detector, and a methanol (HPLC grade) + 0.1% glacial acetic acid mixture mobile phase.

References