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Electroreduction of Some Diazine and Triazine Pesticides at the Dropping Mercury Electrode

Petr ZUMAN, Marina PRIVMAN
Department of Chemistry, Clarkson University,
Potsdam, NY 13699-5810 USA
Masami SHIBATA
Department of Chemical Engineering, Yamanashi University,
Kofu-JAPAN
Jiri LUDVIK
J. Heyrovsky Institute of Physical Chemistry,
Academy of Sciences of the Czech Republic,
Dolejškova 3, 182 23, Prague 8,
Czech-REPUBLIC

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Authors

chem@tubitak.gov.tr

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Abstract: Electroanalytical methods enable determination of electroactive species in nonhomogeneous systems, as limiting currents are little affected by the presence of solid and colloidal particles. An example of such applications of electrochemical methods are studies of binding of toxic substances, such as pesticides, on slightly soluble polymers, such as lignin. To successfully apply polarographic methods for following free pesticides in a slurry of lignin, it is first necessary in principle to elucidate the electrochemical processes involved. In aqueous buffered solutions the electron transfers, in which organic compounds participate, are in the majority of cases accompanied by chemical reactions. To elucidate the nature of the electrochemical process, it is necessary first to find the pH-region in which the given pesticide is electroactive, i.e., gives a wave on the current-voltage curve, and to determine the number of electrons transferred. Further information is obtained from dependences of limiting currents and half-wave potentials on pH. Such investigations, combined with spectrochemical determination of equilibrium constants and identification of products formed by controlled potential electrolyses, enable recognition of the sequence of chemical and electrochemical steps. In the examples presented, the reduction of the ethylenic bond in maleic hydrazide (I), and reductions of azomethine bonds (\(> \) C=NH\(^{+} \)-\) in some diazine and triazine pesticides, are accompanied by acid-base equilibria, by covalent addition of water to C=N double bonds, and by a ring opening. Such studies are demonstrated by elucidation of the pattern of reduction of some 2-aminopyrimidines (sulfometuron methyl, II), a 1,3,5-triazine(hexazinone, III) and two 1,2,4-triazines (metamitron, IVa and metribuzin, IVb).

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