

## INDIRECT ROUTE FOR THE ELECTRO-SYNTHESIS OF FINE CHEMICALS, PHARMACEUTICALS, DRUGS AND DYE INTERMEDIATES

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An elegant electrochemical method employing indirect electro-synthesis route which is more economical than the conventional chemical methods has been developed by CECRI. According to Pathy, Udupa and Chidambaram, a two-stage process is in general a more feasible approach for electro-organic oxidations involving inorganic reagents. In the indirect route, an added inorganic reagent, for example  $Mn^{+2}$ ,  $Cr^{+3}$ ,  $IO_3^-$ ,  $Ce^{+3}$  is anodically converted to a higher oxidation state which in turn oxidises the organic compound outside the cell.

In this paper, the electro-synthesis of organic compounds such as benzaldehyde and a number of substituted benzaldehydes, *o-m-* and *p-*tolualdehydes, anthraquinone, saccharin, *p*-nitro benzoic acid and dialdehyde starch by the indirect electro-oxidation route are discussed. Also the electro-synthesis of aniline, *o*-toluidine, *p*-toluidine and *p*-aminobenzoic acid using the redox system  $Ti^{+3}/Ti^{+4}$ , which involves an "in-cell" process are also discussed. The preparation of 4-4' diaminostilbene disulphonic acid using the redox system  $Ti^{+3}/Ti^{+4}$ , by an "out-cell" process is also discussed in detail.

**Keywords :** Electrosynthesis; Fine Chemicals; Pharmaceuticals; Drugs; Intermediates; In-Cell and Out-Cell Processes

### Discussion

R. NARAYAN (*Department of Chemistry, Indian Institute of Technology, Madras*): One stresses the fact that the electrochemical approach makes the process easier and less complicated. There must be cases when the reverse 'more complication' is also true. Can you mention the difficulties that arise in the electrochemical approach and when the approach failed to yield the desired products? What were the reasons for failure?

M. S. V. PATHY: The reasons for the failures in electrochemical approach is mainly due to distribution of current density, diaphragm difficulty and proper cell design to get the desired products.

S. GURUSWAMY (*Central Electrochemical Research Institute, Karaikudi*): I find you have chosen lead and copper as the two electrodes in the study and application of the reactions. Is there any theoretical reason for this or is this based purely on practical experimentation?

M. S. V. PATHY: To get a better yield, we have used copper as cathode. Perhaps the better yield may be due to catalytic effect.

G. A. TEDORADZE (*Institute of Electrochemistry, Academy of Sciences of the USSR, Moscow*): Is it necessary to separate the organic substances from the inorganic oxidant to carry out the two stage oxidation studies described in your paper? Is it possible to separate?

M. S. V. PATHY: It is necessary to separate these to get a better current efficiency during the regeneration of the oxidant in the electrolytic cell. It is possible to separate for example, *p*-nitrobenzoic acid is a solid which is removed from the solution before the chromium sulphate solution is sent to the electrolytic cell for regeneration.