Editorial

WHY NOT PUT ELECTRO-ORGANIC CHEMISTRY TO WORK?

ELECTRO-ORGANIC chemistry has been a much neglected field of technology. What has so far been done has mainly been due to the interest of a few organic chemists who have not gone deeply into the electrochemistry of the techniques, and to some extent due to the efforts of electrochemists to explain what has been done by the organic chemists. Attempts to adopt electro-organic investigations for commercial scale production have not been made by technologists to the extent as has been done with other electrochemical processes. Many of the novel techniques have been tried out only on a bench scale. Numerous organic fine chemicals could be produced very elegantly by electrochemical methods if serious efforts are made.

Electro-organic reactions occur primarily at the electrode-electrolyte interface. The conditions at the interface are of great significance in electrode-kinetics, and the reactants must approach and the products must move away from this region. Investigations carried out in recent years using rotating electrodes have revealed it as the most effective method of doing the above. This technique has several other advantages also. Possibilities of using high current densities in many cases without consequent abnormal increase of cell voltages, ease of design of high capacity cells requiring small floor space and ready reproducibility of results make it worthwhile to adopt it for preparative methods not only on a laboratory scale but even on a production scale. Salicylaldehyde from salicylic acid, hydrazobenzenes from corresponding nitrocompounds under alkaline conditions of electrolysis, to convert them later to benzidines, and p-aminophenol rearrangements under acidic conditions of electrolysis from nitrocompounds, have all been studied in recent years using rotating cathodes. Similarly, the advantages of rotating anode in calcium gluconate preparation has also been studied.

Organic oxidation reactions present rather ticklish problems. Direct electrolytic oxidations very often lead to a host of products in addition to destroying organic molecules. Controlled oxidation to give desired product has therefore not often been a successful proposition on a practical scale. The development of two-stage processes of using inorganic reagents for organic oxidations and subsequently regenerating the former in electrolytic cell appears to be of promise in the production of good grade benzaldehyde from pure toluene, tolualdehydes from the corresponding xylenes, dialdehyde starch from starch etc. Many common inorganic reagents which are capable of anodic regeneration, may have specific action on organic compounds to give oxidation products which are otherwise difficult to achieve, and thus may serve to develop attractive preparative methods. Reference must also be made here to the recent developments relating to constant potential reduction technique for the preparation of a number of pharmaceutical intermediates. It is needless to point out the various other potentialities for electro-organic synthesis, which could most profitably be used by this country for production of various fine chemicals, the know-how for the production of which by other methods along with the equipments necessary etc., are to be imported at great costs.

It is understood that there is a need for more than 200 tons of benzidine, 100 tons of tolidine and nearly 60 tons of dianisidme per year in this country. Similarly, more than 50,000 lbs. of p-aminophenol will be required. Direct electrochemical method for the preparation of the above products could save on zinc which is in short supply in this country. Requirement of coumarin is expected to be nearly 10 tons per year for the synthesis of which nearly 12 tons of salicylaldehyde is required. It is needless to refer to the detailed statistics regarding the requirement of the various fine chemicals that would be required in the country in the coming years except to point out that the scope for production is tremendous. The know-how developed for the production of some of the chemicals mentioned above could be made use of by this country as a start in the direction of putting electro-organic chemistry to work.

—H. V. K. U.