Bulletin of Electrochemistry 6 (4) April 1990, pp 450-451

Electrolytic preparation of persulphates

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Electrochemical method is an acceptable route for the preparation of persulphates and is dependent on concentration of electrolyte, anode and cathode current densities, nature of diaphragm and additives. Results of the experiments carried out in a 20A cell are presented in this paper.

Key words: Persulphates, oxidation, electrolysis

INTRODUCTION

The anodic oxidation of strongly acidified ammonium sulphate solution with platinum anode and graphite or lead cathode with a suitable diaphragm for increasing the current efficiency is the basis for persulphate formation [1,2]. Due to its high oxygen-overvoltage, application of higher anode c.d. is necessitated. Additives like urea and thiocyanate are added to increase current efficiency. Ceramic, cylindrical porcelain [3] or blue asbestos rope wound over cathodes is generally employed as diaphragm. The employment of high anode current density with a diaphragm increases the voltage of the cell and also accelerates the hydrolysis of the product.

EXPERIMENTAL

The cell consisted of a 2 litre pyrex beaker with a PVC cover having slots. Anode was a platinum strip, sandwiched between copper flats. The cathodes were lead sheets wound with blue asbestos rope. A 0-15V, 25A, rectifier was used.

Experiments were carried out to arrive at the optimum conditions for concentration of the electrolyte for the continuous removal of product, anode and cathode current densities, temperature and additives. The cells were operated at 50 to 90% NH_4HSO_4 as electrolyte at anode c.d. of 40 to 120 A dm^{-2} and temperature of 283 to 313 K with different additives.

TABLE–I: Effect of concentration on current efficiency

Addition agent - urea 1g/L Anode c.d. 100A dm^{-2}
Current 20A Temperature 293-298 K

Sl. No.	Concn. NH_4HSO_4 (%)	Voltage (V)	C.E. (%)
1	50	5.1	56
2	70	5.3	72
3	80	5.7	76
4	90	5.9	71

TABLE–II: Effect of anode c.d. on current efficiency

Addition agent: Thiocyanate Electrolyte: 80% NH_4HSO_4 solution
Current: 20A Temperature 293-298 K

Sl. No.	Anode c.d. (A dm^{-2})	Voltage (V)	C.E. (%)
1	40	5.4	67
2	60	5.5	69
3	80	5.6	69
4	100	5.9	76
5	120	6.2	71

TABLE–III: Effect of temperature

Addition agent: Urea. Conc. of electrolyte: 80% NH_4HSO_4
Anode c.d.: 100A dm^{-2}

Sl No	Temp (K)	Voltage (V)	C.E. (%)
1	283	6.3	76
2	293	6.1	75
3	298	5.8	76
4	303	5.7	65
5	308	5.6	40
6	313	5.5	20

RESULTS AND DISCUSSION

Results of the experiments are given in Tables I to III.

CONCLUSION

The electrolytic process is an advantageous route for the preparation of persulphates in spite of its higher capital investment, stringent quality control, power consumption

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and high purification of chemicals involved. The results of the experiments in a 20A cell form the basis for scaling up of the process to a commercial viability.

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