NOTE ON THE ELECTROLYTIC PREPARATION OF DILUTE SODIUM HYPOCHLORITE SOLUTIONS (DAKIN'S SOLUTION).

BY GLENN E. CULLEN AND ROGER S. HUBBARD.

(From the Laboratories of The Rockefeller Institute for Medical Research.)

(Received for publication, January 22, 1919.)

Although the electrolysis of brine is an old process, information in regard to it is scattered and hidden in the records and patent literature of industrial concerns. Dakin and Carlisle¹ have pointed out its convenience and economy in preparing dilute sodium hypochlorite solutions for disinfection purposes and have designed a simple cell. In instructing army surgeons in the various methods of preparing Dakin's solution, it was desirable for us to determine for ourselves the factors that were of practical importance in its electrolytic preparation. These results are presented for the convenience of other workers.

EXPERIMENTAL.

Choice of Cell.—It seemed desirable to use a cell that could be connected with ordinary 110 volt current, that did not require unusually heavy wiring or power, that was light and strong enough to be transportable with other military hospital equipment, and that was inexpensive. The cell described by Dakin and Carlisle answers these requirements, but we were spared the labor of making this cell by modifying cells already on the market to our purpose. These cells are entirely similar to that described by Dakin and Carlisle, except that the electrode area is smaller in proportion to the volume of solution. The twenty-three intermediate elec-

Electrolytic Sodium Hypochlorite

trodes contained 30 square inches of Acheson graphite. The cell used in these experiments held 10 liters of brine and required between 20 and 35 amperes.

The results are presented as curves, with the omission of the tables from which they were derived.

**Influence of Temperature.**—In order to determine the effect of the initial temperature of the solution, the current through the cell was maintained constant at 20 amperes by an external resistance. This eliminates the influence of current fluctuations due to change in internal resistance. Fig.1 shows the results with initial temperatures of 7, 20, and 39°.

**Influence of Salt Concentration.**—Increase in salt concentration will, of course, lessen the internal resistance of the cell and consequently increase the production of sodium hypochlorite per unit

---

2 This cell was furnished by courtesy of the Electro Chemical Company of Dayton, Ohio.

3 The resistance units used to control the lights in theaters are convenient for this work.
of time. The curves in Fig. 2 show the production of sodium hypo-
chlorite with different salt concentrations under actual operating
conditions, with no external resistance.

The 3 per cent solution approximates sea water, and 6 per cent is
the strength recommended by the makers. More concentrated
solutions may, of course, be used and with them higher concen-
tration of sodium hypochlorite and increased current efficiency
may be obtained.

Fig. 2.

Rate of Decomposition of Electrolytic Sodium Hypochlorite.—In
the experiments shown above samples of solution were removed
from the cell at each of the points shown, titrated, and a portion
was set aside for determination of stability. The solution became
increasingly unstable with increase in hypochlorite concentration.
The results obtained from Curve A, Fig. 1, run at initial tem-
perature of 7°, are plotted on Fig. 3. This increased rate of
decomposition is due to increase in secondary products rather than
**522 Electrolytic Sodium Hypochlorite**

to the temperature at time of sampling, for in one series in which
the samples were all cooled to the same temperature the results
were essentially similar.

**FIG. 3.**

**DISCUSSION.**

It would seem desirable to construct from experimental runs,
curves similar to those of Figs. 1 and 2, for each cell. Then, from
the initial temperature of the solutions, the time required for a
solution of given concentration may easily be determined. Care
should be taken that the cell is not operated beyond the peak of
the production curve. Ordinarily 3 per cent NaCl (or sea water) is
satisfactory, but if necessary to operate with relatively warm solution the salt concentrations should be increased.

Since the solution, as it comes from the cell, decomposes quickly, it must be stabilized for use as Dakin’s solution. As determined in the preceding paper, this can best be accomplished by adding either 0.5 per cent borax, or 0.5 to 1.0 per cent of a mixture of carbonate and bicarbonate of pH 10 to 9.5, or 0.02 per cent sodium hydroxide.

This solution must give no color with powdered phenolphthalein but should give a definite red flash with alcoholic phenolphthalein solution. It should be protected from light and should be titrated frequently.
NOTE ON THE ELECTROLYTIC PREPARATION OF DILUTE SODIUM HYPOCHLORITE SOLUTIONS (DAKIN'S SOLUTION)
Glenn E. Cullen and Roger S. Hubbard


Access the most updated version of this article at [http://www.jbc.org/content/37/4/519.citation](http://www.jbc.org/content/37/4/519.citation)

Alerts:
- When this article is cited
- When a correction for this article is posted

Click here to choose from all of JBC's e-mail alerts

This article cites 0 references, 0 of which can be accessed free at [http://www.jbc.org/content/37/4/519.citation.full.html#ref-list-1](http://www.jbc.org/content/37/4/519.citation.full.html#ref-list-1)