CHEMICAL IMBALANCE

As a teacher of high-school chemistry, I was intrigued by the article "Experiments in Electrochemistry" by Stanley A. Czarnik (**Popular Electronics**, June 1991). The suggested experiments are interesting and can easily be performed by an experienced chemistry teacher. Students can also carry out the exercise under appropriate supervision.

There does appear to be an error, however, in the explanation of the formation of sodium hydroxide during the electrolysis of brine. The sodium ions are *not* discharged at the cathode forming metallic sodium, which then immediately reacts with water to form the base.

According to *Chemistry: Experiment and Theory* by Bernice G. Segal, "If an aqueous solution of NaCl is electrolyzed using inert electrodes, chlorine is produced at the anode, but sodium metal is not produced at the cathode. Instead, $H_{2(g)}$ is formed at the cathode. The reason is simply that water contains hydronium ions, and $H^+_{(aq)}$ ions are a stronger oxidizing agent than Na^+ ions, and are therefore more easily reduced. The cathode reaction for the electrolysis of an aqueous solution of NaCl (or $ZnCl_2$, $CaCl_2$, $ScCl_3$, KCl, and so on) is:

$$2\,H_2O + 2e^- \rightarrow H_{2(g)} + 2\,OH^-$$

so that the products of the electrolysis of aqueous NaCl are $H_{2(g)}$, $Cl_{2(g)}$, and a solution of NaOH."

I hope that the above quote serves to clarify the chemistry occurring during the electrolysis of alkali or alkaline earth cations.

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