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Development of Printed Ion-Selective Electrodes for the Measurement of Calcium in Bovine Blood

Hypocalcemia, or milk fever, is characterized by a low level of calcium in cows. It is one of the most significant disorders that afflicts dairy cows; almost a quarter of all dairy cows will develop this condition. A single case of hypocalcemia can cost up to \$500 to treat, and the cost can rise from the problems that develop after recovery. The death of the cow can cost even more since thousands of dollars have been spent to raise it to maturity. At present there is no cow-side test that exists for a farmer to establish that a cow is at the first stage of milk fever. It can be time-consuming to send blood samples to a laboratory for testing. Printed ion-selective electrodes have the potential to solve this problem and create a portable and efficient way for dairy farmers to test their cows right at the farm. In this study, the development of printed calcium ion-selective electrodes to measure calcium levels in bovine blood was the major focus. The method of acidification of the blood to a pH of 3.5 using acetate buffer was used to unbind calcium from its complexes in blood so total calcium levels could be measured. A standard calcium ion-selective electrode and printed calcium ion-selective electrodes were used to measure the calcium concentrations in the blood samples obtained to compare results. Both types of electrodes produced varying results.