Biological Buffers: Countering Ocean Acidification

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The bicarbonate buffer system–a series of equilibrium reactions that function in maintaining the oceans' alkaline pH–has recently been unbalanced by human activity. Increased concentrations of atmospheric $CO_2(g)$ favor the production of H^+ ions, leading to a decrease in pH. The decline of biodiversity is implicated as a serious consequence of this phenomenon. However, marine organisms may be critical in countering acidification's most extreme effects due to their ability to consume CO_2. In simulating the effect of photosynthetic algae in acidified environments, their use as biological buffers was tested. The experimental setup consisted of three water samples, which were initially buffered with $NaHCO_3$. An acid-base generator was used to simulate acidification, pumping $CO_2(g)$ into the designated containers. The experimental sample, which also contained Chlorella culture, was compared to two controls: one with the buffer, representing the ideal, and the other with the buffer and CO_2, representing the acidified state. It was observed that the experimental pH stabilized at a higher value than that of the acidified control; however, these preliminary results could not draw a strong correlation between Chlorella presence and increased buffering capacity. Applying these results to large-scale remediation efforts requires further research, which will focus on expanding the scope and accuracy of the experiment. Areas of improvement include increasing the number and duration of the trials, and testing Chlorella's remediating capacity at varying concentrations. Based on the initial experimental results and potential for future study, the use of bio-buffers as a means of countering acidification remains promising.