

Effects of NaCN and NaF on Krebs's Cycle

Summary: My group and I tested the effects of Sodium Cyanide (NaCN) and Sodium Fluoride (NaF) on Krebs's Cycle functions to determine whether they interrupt respiration. We did this by using Phenylenediamine, which is oxidized by cytochrome c and serves as a visual indicator for an uninhibited respiratory process. Our results indicate that both NaCN and NaF compounds disrupt Krebs's Cycle functions, by blocking the transport of electrons from cytochrome a_3 to oxygen and inactivating the enzyme enolase in the process of glycolysis, respectively.

Methods & Results: My group and I prepared four test tubes to perform four separate reactions. Tube A contained 1mL of water, tube B contained 0.5mL water and 0.5mL of phenylenediamine (Phd), tube C contained 0.5mL of 0.01M Sodium Cyanide (NaCN) and 0.5mL of Phd, and tube D contained 0.5mL 0.01M Sodium Fluoride (NaF) and 0.5 mL of Phd. We then added 1mL of liver homogenate, which served as a source of enzyme, to each test tube and mixed the solutions thoroughly. All four test tubes were added to a heater block set to $\sim 37^\circ\text{C}$ and we made observations at 10 minute intervals for 30 minutes, noting any changes in coloration.

When phenylenediamine is oxidized it will produce a rose-colored pigment, indicating successful respiration. After warming the mixtures for the specified time, only test tube B showed uninterrupted respiration, with no color changes occurring in test tubes C and D (test tube A was the control). These results are shown in the table below:

Contents	Initial Color	Final Color
Test Tube A 1mL water 1mL liver homogenate	Red-Brown mixture	Red-Brown mixture
Test Tube B 0.5mL water 1mL phenylenediamine solution 1mL liver homogenate	Red-Brown mixture	Red-Brown mixture with Rose-Pink Meniscus
Test Tube C 0.5mL sodium cyanide (NaCN) 1mL phenylenediamine solution 1mL liver homogenate	Red-Brown mixture	Red-Brown mixture
Test Tube D 0.5mL sodium fluoride (NaF) 1mL phenylenediamine solution 1mL liver homogenate	Red-Brown mixture	Red-Brown mixture

This confirms the known effects of NaCN and NaF on Krebs's Cycle functions. NaCN blocks the transport of electrons from cytochrome a_3 to oxygen (Diagram 1) while NaF inactivates the enzyme enolase in the process of glycolysis by attaching to Mg^{2+} ions (Diagram 2).

Diagram 1

Diagram 2

