Required Training

UC Lab Safety Fundamentals

Required PPE
Lab coat, safety glasses/goggles, nitrile gloves

Equipment

230 mL Deionized Water

Chemicals
20 mL 0.25 M NaHSO$_3$, $MW = 104$ (2.6 g/100 mL) Sodium Bisulfite

400 mL Beaker

100 mL 0.1 M KIO$_3$, $MW = 214$ (2.14 g/100 mL) Potassium Iodate

600 mL Beaker

5 mL 1% Starch Solution (no more than 3 months old)

Procedure:

1. In a 400 mL beaker, add 100 mL 0.1M KIO$_3$, 5 mL 1% starch, and 100 mL H$_2$O
2. In a 600 mL beaker, put in 20 mL 0.25M NaHSO$_3$, and 130 mL H$_2$O
3. Mix the two solutions and after a short delay, the clear solution will instantly turn a dark blue/black (~10 seconds)

Discussion:

Bisulfite anions (HSO$_3^-$) from NaHSO$_3$ reduce KIO$_3$ to form iodide anions (I$^-$), which further react with KIO$_3$ to form iodine (I$_2$). In solution I$_2$ reacts with I$^-$ to form triiodide anions (I$_3^-$). I$_3^-$ is immediately reduced back to I$^-$ by any remaining HSO$_3^-$. Once the supply of HSO$_3^-$ is exhausted, I$_3^-$ persists in solution and reacts with starch molecules to form a dark blue starch-iodine complex. Excess I$_3^-$ is a brown color in solution, and together this produces the dark blue/black color. As the concentration of I$_3^-$ rises extremely quickly, the color change is almost instantaneous. The volume of NaHSO$_3$ solution added to the reaction will change the time required for the color change – larger volumes will increase the delay, and smaller volumes will decrease it.

Hazards:

KIO$_3$ is an oxidizer and should be kept away from flammable materials and reducing agents. NaHSO$_3$ is a strong reducer and should be kept away from acids and oxidizing agents.

SOP
Strong Oxidizing Agent – Potassium Iodate

Strong Reducing Agent – Sodium bisulfite

Disposal (by Storeroom)

While stirring, slowly add solid sodium thiosulfate (Na$_2$S$_2$O$_3$•5H$_2$O) until the mixture is no longer blue. Flush this mixture down the drain with large quantities of water.