Determination of the Activity of Aqueous Bromine-Containing Solutions By Iodometric Titration

Background
Under acidic conditions, the active ingredient in aqueous bromine-containing solutions quantitatively liberates iodine from excess potassium iodide. The iodine is titrated with a standard solution of sodium thiosulfate, and a starch indicator is introduced near the endpoint. The volume of titrant required is used to calculate the activity of the bromine-containing solution.

Apparatus
Digital burette capable of dispensing in single increments of 0.01 ml with accuracy +/- 0.2%
Erlenmeyer flask (125 ml)
Magnetic stirrer and stir bar
Analytical balance capable of reading 0.001 g

Reagents
De-ionized or reverse osmosis water
Potassium iodide crystals, ACS
Glacial acetic acid, trace-grade 99.7% min.
0.100N sodium thiosulfate, Na₂S₂O₃ *
Starch indicator solution, 1%w/v, for iodometric titrations

Procedure
(1) Accurately weigh (4 decimal places) approximately 0.2 g of aqueous bromine-containing solution to a 125 ml Erlenmeyer flask.
(2) Dilute with 50 ml de-ionized or reverse osmosis water and add a magnetic stir bar.
(3) Add 5 ml glacial acetic acid and 1 g potassium iodide
(4) With stirring, titrate the liberated iodine with 0.100N sodium thiosulfate (Na₂S₂O₃) until the solution turns a faint straw color.
(5) Add 1 ml of starch indicator solution, and add the titrant dropwise to discharge the blue coloration. Record the volume (Vₐ/ml).
(6) Perform a blank determination by repeating steps (2)-(5). Record the volume (Vₐ). Note that Vₐ may be zero.

Calculation
To express the results as weight % available Cl₂ use:

Wt % available Cl₂ = \( \frac{(Vₐ - Vₐ)}{Wt. of sample/g} \times N \times Na₂S₂O₃ \times 0.03545 \times 100 \)

* The 0.1 N sodium thiosulfate must be standardized using ASTM or ACS procedures.