Tollens’ test, also known as silver-mirror test, is a qualitative laboratory test used to distinguish between an aldehyde and a ketone. It exploits the fact that aldehydes are readily oxidized (see oxidation), whereas ketones are not. Tollens’ test uses a reagent known as Tollens’ reagent, which is a colorless, basic, aqueous solution containing silver ions coordinated to ammonia \(\{[\text{Ag(NH}_3]\}^{2+}\}\). It is prepared using a two-step procedure.

**Step 1:** Aqueous silver nitrate is mixed with aqueous sodium hydroxide.

\[
\begin{align}
\text{AgNO}_3 + \text{NaOH} &\rightarrow \text{AgOH} + \text{NHO}_3 \\
2\text{AgOH} &\rightarrow \text{Ag}_2\text{O} + \text{H}_2\text{O}
\end{align}
\]

**Step 2:** Aqueous ammonia is added drop-wise until the precipitated silver oxide completely dissolves.

\[
\text{Ag}_2\text{O} + 4\text{NH}_3 + \text{H}_2\text{O} \rightarrow 2\text{Ag(NH}_3\}^{2+} + 2\text{OH}^-
\]

Tollens’ reagent oxidizes an aldehyde into the corresponding carboxylic acid.

\[
\begin{align}
\text{CH}_2\text{CHO} + 2\text{Ag}^+ &\rightarrow \text{CH}_2\text{COOH} + 2\text{Ag} \nonumber \\
\text{Ag}_2\text{O} + 4\text{NH}_3 &\rightarrow 2\text{Ag(NH}_3\}^{2+} + 2\text{OH}^-
\end{align}
\]

The reaction is accompanied by the reduction of silver ions in Tollens’ reagent into metallic silver, which, if the test is carried out in a clean glass test tube, forms a mirror on the test tube. eg:

![Silver mirror](image)

**Figure \(\PageIndex{1}\):** Tollens’ test for aldehyde: left side positive (silver mirror), right side negative

Ketones are not oxidized by Tollens’ reagent, so the treatment of a ketone with Tollens’ reagent in a glass test tube does not result in a silver mirror (Figure \(\PageIndex{1}\); right).

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