

Hydroxymethanesulphonate

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Key Findings of the Study:

- **Hydroxymethanesulphonate Formation:** Hydroxymethanesulphonate, a **secondary aerosol**, forms when **formaldehyde** reacts with **sulphur dioxide** in the presence of **liquid water**.
 - Traditionally thought to occur only in **clouds and fog**, but found to occur in **aerosol particles** in Fairbanks winters.
- **Role of Temperature:** Extremely low temperatures (around **-35°C**) cause **supercooling** of aerosol particles, where liquid water remains unfrozen below its freezing point.
 - Supercooled aerosols allow **hydroxymethanesulphonate** to form within them.
- **Aerosol acidity dynamics:** Aerosol acidity depends on the **relative concentration** of:
 - **Sulphate ions (SO_4^{2-})** → Increase acidity.
 - **Ammonium ions (NH_4^+)** → Neutralize acidity.
- **Post-2022 sulphur fuel ban in Fairbanks:**
 - **Sulphate ion concentrations** dropped.
 - **Ammonium ion levels** increased, reducing aerosol acidity.
- **Ammonium dynamics in cold weather:** In low temperatures, **ammonium ions** are less likely to evaporate into **ammonia gas**. This buildup of ammonium ions further reduces acidity, creating favourable

conditions for **hydroxymethanesulphonate** formation.

Key Concepts

- **What are Aerosols?**
 - **Aerosols:** Tiny **solid or liquid particles** suspended in the air.
 - Examples: Dust, smoke, fog, or chemical particles like sulphates and ammonium.
 - **What is PM2.5?**
 - **PM2.5:** Fine particulate matter with a diameter **less than 2.5 micrometres (µm)**.
 - **Significance:**
 - Penetrates the lungs and bloodstream.
 - Causes reduced **lung function**, **asthma aggravation**, and **premature deaths**.
 - **Supercooling:** Process where **liquid water** remains unfrozen even at temperatures below **0°C**.
 - Allows formation of **hydroxymethanesulphonate** in aerosol particles at very low temperatures.
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Q.1. What are the main contributors to Delhi's air pollution?

Vehicular emissions (51.5%), crop stubble burning (8.19%), dust (3.7%), and industrial pollutants are key contributors. Winter weather worsens the pollution.

News: [New chemical pathway found to worsen air quality in harsh winters – The Hindu](#)

Source: <https://vajiramandravi.com/current-affairs/hydroxymethanesulphonate/>

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