Ammonium sulfate

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Why in News?

Nearly one-third of Delhi's annual PM2.5 pollution is made up of secondary ammonium sulfate, according to analysis by the Centre for Research on Energy and Clean Air (CREA), a Finland-headquartered think-tank.

- **Ammonium sulfate –** It is a ***secondary inorganic aerosol*** formed through the oxidation of sulphur dioxide (SO2) into sulfate.
- **Sources –** Coal-based power plants (major SO_2 emitters), industrial activity (metallurgy, refineries), agriculture (ammonia emissions from fertilisers and livestock).
- **Humidity factor –** Its formation is enhanced under humid conditions, worsening Delhi's smog.
- **India's SO_2 Emissions –** India emits 11.2 million tonnes of SO_2 annually, the ***highest globally, second only to China***, making India especially vulnerable to secondary PM2.5 formation.
- **Seasonal Contribution in Delhi –** Ammonium sulfate accounts for ***49% of PM2.5 pollution*** during the post-monsoon period, 41% in winter, 21% in summer, and 9% in the monsoon.
- **Drivers of Delhi's Severe Pollution –** The severe smog episodes are driven by regional SO_2 emissions & secondary chemical reactions in the atmosphere, rather than only local primary sources.
- **Secondary PM2.5 in India –** Secondary PM is a major contributor to India's PM2.5 pollution, with up to ***42% of India's PM2.5 burden*** formed from gases like SO_2 and ammonia.
- **Highest contributors** – States dominated by ***coal-fired power plants*** - Chhattisgarh (42%), Odisha (41%), and Jharkhand and Telangana (40% each).

  Secondary particulate matter *– Tiny particles formed in the atmosphere from chemical reactions between primary gaseous pollutants like sulfur dioxide, nitrogen oxides (NOx), ammonia and volatile organic compounds (VOCs). SO_2, NOx, ammonia, VOCs.*

- **Other High-Contribution States –** Bihar (39%), Maharashtra, Andhra Pradesh and West Bengal (38% each), as well as Uttar Pradesh and Madhya Pradesh (37% each).
- **Health Risks –** Sulphur dioxide (SO2) primarily harms the respiratory system, causing

irritation, coughing, wheezing, and shortness of breath, as well as exacerbating asthma and lung diseases.

- **Policy Gap –** India's National Clean Air Programme (NCAP) ***focuses heavily on PM10*** (coarse dust), but this study warns that secondary PM2.5 from SO_2 emissions is being overlooked.
- **Urgency –** Controlling SO_2 emissions from coal plants and ammonia from agriculture is critical to reducing Delhi's deadly PM2.5 burden.

Reference

Indian Express | One-third of Delhi's annual PM2.5 pollution is secondary ammonium sulfate