Air Pollution Control Technology

Dynamic Structure of Atmosphere

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Chapter Description

- Aims
  - To promote air monitoring procedure and guidelines required by Malaysia's government

- Expected Outcomes
  - Students are able to briefly explain type of plumes from smokestack that affected from meteorology

- References
  - Valerro, Daniel A. 2008. Fundamentals of air pollution. 4th edition. Elsevier.

Introduction

- Atmosphere consider as an engine where the energy comes from SUN

- Heat input differences between equator and poles provides circulation of earth's atmosphere

- Earth rotated at different heat conductivity of ocean and land effect the weather

Atmospheric Circulation Patterns

- Wind flows from higher pressure to lower pressure areas

- Earth rotates motion cause to Coriolis effect
  - Anticyclone : good weather
  - Cyclone : bad weather e.g. tornadoes and hurricanes

Turbulence
Random fluctuation of wind velocity
(speed and direction)

Mechanical turbulence

Wind speed is zero at ground surface and increase with elevation

Mechanical turbulence influence by mean wind speed

Thermal turbulence

Heating on the ground surface cause turbulence – thermal turbulence

At night, ground radiates heat due to cold sky

- Tendency of atmosphere to resist or enhance vertical motion - *stability*

- 3 stability categories
  - Unstable
  - Neutral
  - Stable

- Atmospheric temperature profile affects the dispersion of pollutants from smokestack
- Smokestack emit pollutant into neutrally stable atmosphere, plume expected to be symmetrically – *coning*
- Unstable atmosphere, rapid vertical movement, up and down – *looping*
- Stable atmosphere – *fanning* plume, spreads horizontally
- Above inversion layer – *lofting*
- Under inversion layer - *fumigating*

- Factors affecting dispersion of air pollutants
  - Emission point characteristics
  - Nature of pollutants material
  - Meteorological condition
  - Effect of terrain and anthropogenic structure

Gaussian Dispersion Model

- Dispersion model is a mathematical description of the meteorological transport and dispersion process

- The model estimates the particular pollutant for specific locations and times

- Parameters required by the models include wind direction, wind speed, and atmospheric stability.

- Physical stack height, diameter of the stack, exit gas temperature and velocity and mass rate emission of pollutants

Conclusion

- Air pollutants dispersion affected by a few factors including meteorological condition, environment condition, pollutants characteristics and sources of emission

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