Sampling and Analysis

In order to control and remove the air pollutants from air, it is necessary to know the sources of air pollution and to collect the sample of emission of gases at sources. The collection of air pollutants samples at various sources is called stack sampling.

Objective of sampling at source

The main objective of the sample collection is

1. To measure the quality and quantity of pollutants produced by the source.
2. To determine the effect of emissions throughout the year and monthly variations in a year.
3. To determine the effect of emission in different zones of the country.
4. To know the nature of pollutants source.
5. To estimate the single pollutant and multiple pollutants' sources

Selection of sampling location

The following points are to be considered in the selection of sampling location:

1. The sampling point should be free from the disturbing agencies like Elbows, bends etc
2. Sampling point should be at a distance of 5 to 10 times the diameter downstream from any obstructions
3. The sampling point should be at a distance of 3 to 5 times the diameter upstream from the obstructions

Sampling point size:

1. The size of the sampling may be varied from 7 cms to 10 cms in diameter.
2. The sample should be collected at various points across the stack.
3. Traverse points are the sampling points from which the samples are collected across the section. These transverse points are to be located at the centre of the small segments in the selected cross section of the stack

Cross sectional area of the stack (m2)	No. of points
Less than 0.1858	2
0.19 to 2.32	12
More than 2.32	20

Devices for sampling

1. Meters

Accurate volume of the sample is determined by the device meters. They are fitted with manometers and thermo meters to indicate the pressure and temperature of the gas stream sample.

2. Probes

These are the tubes suitable for penetrating into the gas stream and should be constructed of non corrosive materials. These tubes can withstand very high temperature. Glass, stainless steel and quartz materials are used for these tubes.

3. Suction devices

Any suction device with suitable volumetric capacity can be used. Vacuum pumps driven by electric motors are commonly used.

4. Absorbers

These are used for the determination of ozone, hydrocarbons and organic solvents

5. Adsorbers

These are used for the determination of Ozone and light hydro carbons.

6. Condensers

These are used collecting the samples of substances which emits bad odours.

7. Collectors under reduced pressures

These materials are used for collecting the samples having high molecular weight like Nitric acid, Nitrogen oxides etc

Methods of Sampling

The particulate matter in the air is sampled by using equipment based on the following principles.

1. Sedimentation
2. Filtration
3. Impingement methods
4. Electro static precipitation
5. Centrifugal methods
6. Solution impinges

Sedimentation

It is one of the simplest method for collection of particulate matters. The method is adopted in general for particles whose diameter exceeds about 10micron. They are known to settle from air and collect on horizontal surfaces and can be sampled completely by placing an open container in an out-door area, that should be free from overhead obstructions. The sedimentation collectors are constructed by using glass, stainless steel or polyethylene, since the inside wall must be inert to atmospheric oxidative flaking.

Filtration

It is the most commonly used method of particulate sampling. It employs the principle of filtration, whereby, particles are quantitatively removed from a gas stream flowing through a dense material, containing sub micrometer pore sizes. The result of the filtration process falls on the selection of suitable filter medium. The following points are considered while selecting the filter medium.

Type of particulates to be collected
Chemical nature of filter
Efficiency of collection

Impingement methods

The basic principle of this method is the separation of particulates from a gas stream , by collision against a flat surface. The instruments used in this method are of two types.

1. Dry impinger
2. Wet impinger

Dry impingers, referred to as impactors, collect particles by impaction on a dry surface.wet impingers collect particles by causing them to impinge liquid submerged surface. Greenburg- Smith Standard Impinger and Midget Impinger are examples of wet impingers.

Electro static precipitation

In an electro static precipitation, the gas passes between two electrodes charges to an electrical potential difference of 10 to 40KV. The electric discharge between the towards the positive electrode plate, thereby separating the particles from gas stream. Collection of 100% particles over a reasonable length of gas path with particles ranging in diameter from 10 to 0.2micron.

Thermal precipitation

It is based on the principle that, if a gas contains suspended particles brought into contact with a heat surface, a dust free space develops between the surface and particles. The thermal force causes the particles to migrate from a zone of high temperature to the low temperature zone. For atmospheric sampling, the collection efficiency of thermal precipitation is almost complete over a great range of particles.

Centrifugal methods

Most of these methods are working on the principle of cyclone. The dust laden moving at high velocity is directed tangentially into the cylindrical chamber, in which it forms a vertex. The centrifugal force tends to drive the suspended particles to the wall of the cyclonic body, from which the drop into dust collection chamber. An axial outlet is provided for the clean gas. The collection of dry and chemically pure sample is possible.

Solution impingers

Solution impingers consist of drawn out tube through which air containing particles flows into a solution where the particles are trapped. This method enables the collection of both particulate matters and vapours together using a suitable solution to trap them. An acidic oxidizing solution is best employed.

Isokinetic conditions

It is defined as the sample condition when the stack velocity is equal to the velocity at the top of the probe nozzle at the sample point.

Indoor air pollutants

We usually think of air pollution as being outdoors. But the air in our house or office may be polluted. Sources of indoor pollution include

- Biological contaminants like mold and pollen
- Tobacco smoke
- Household products and pesticides
- Gases such as radon and carbon monoxide
- Materials used in the building such as asbestos, formaldehyde and lead

Indoor air quality problems cause discomfort and most people feel better as soon as they eliminate the source of this pollution. Some pollutants can cause diseases like respiratory diseases or cancer.