Limit of Iron and Manganese in Drinking Water

- As per WHO guidelines for domestic water, iron should not exceed the limit of 0.3 mg/l
- Above 200mg/l iron is toxic to human health
- Manganese concentration as per WHO guideline is 0.05 mg/l
- However average manganese level in drinking water range from 5 to 25 ug/l
- At concentration exceeding 0.15 mg/l, manganese imparts undesirable taste

Iron and Manganese

- Presence of excess of iron and manganese in water causes discoloration, turbidity and deposits
- Iron and manganese bearing water have astringent metallic or bitter taste
- Precipitation of iron and manganese imparts colour to water from yellow to brownish black, which becomes objectionable to consumers
- Manganese concentration ranging from 8-14 mg/l is toxic to human
- Excess of iron facilitates growth of iron bacteria which causes blocking of pipes, meters etc.

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Methods for Detection of Iron and Manganese in Water

- Atomic Absorption spectrophotometer (AAS)

- Inductively Coupled Plasma (ICP)

- Colorimetric method

  In colorimetric method iron is detected at wavelength 510 nm and manganese is detected at 525 nm.

1. Iron:- Phenanthroline method
2. Manganese:- Persulphate method

   Periodate method

Determination of Metals

Inductively Coupled Plasma-Atomic Emission Spectrometer

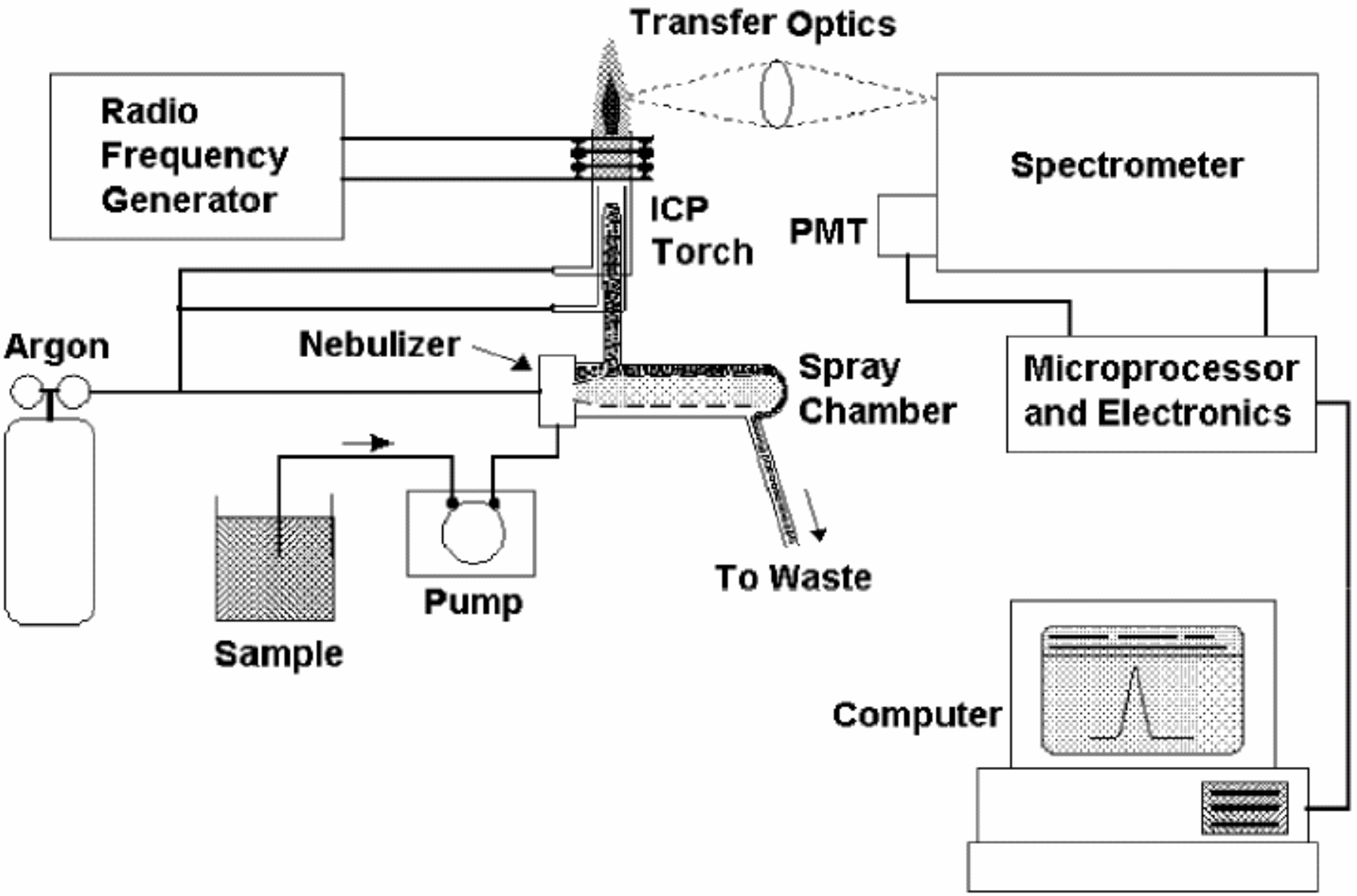
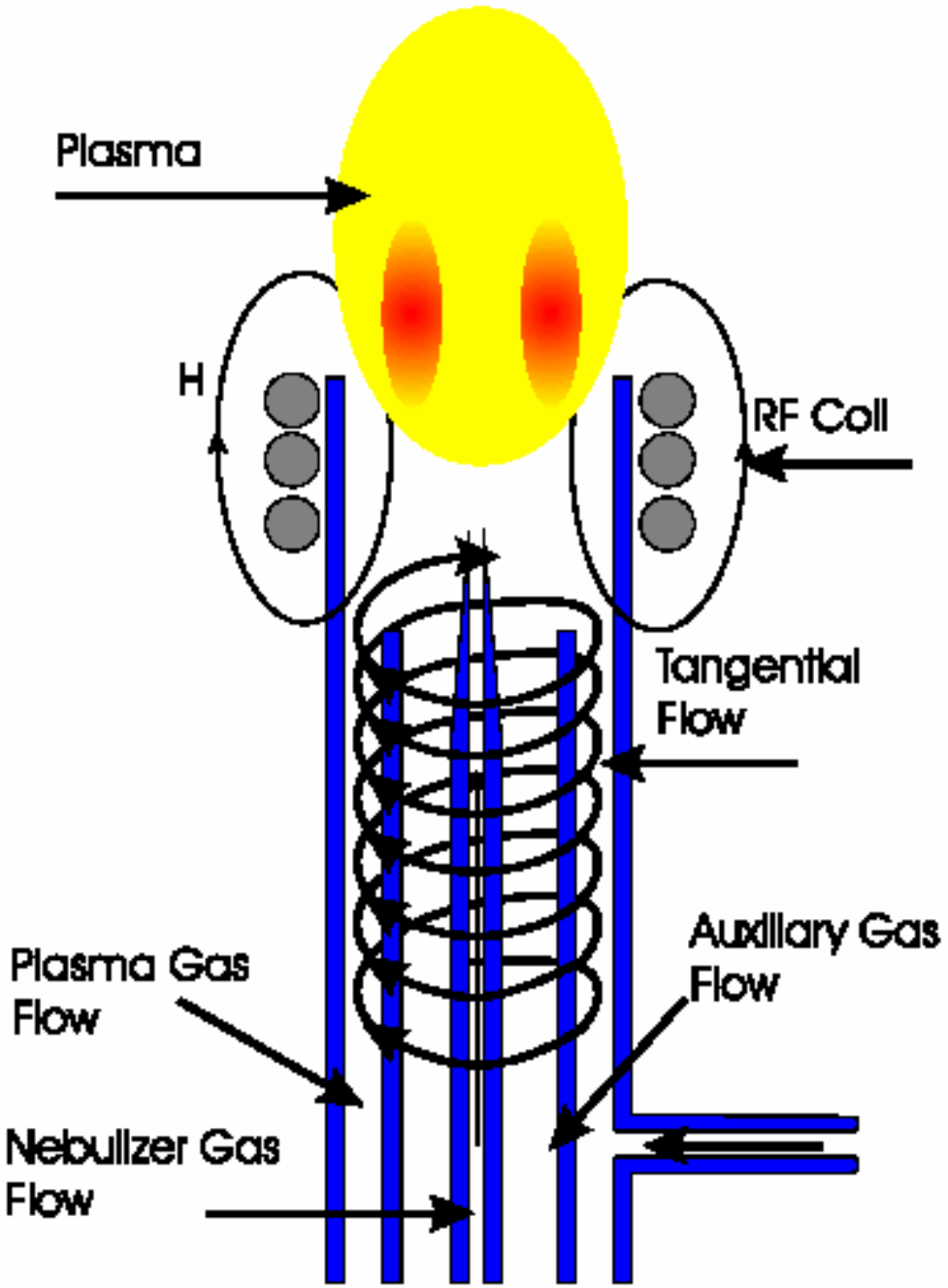


Figure 3-1. Major components and layout of a typical ICP-OES instrument.



ICP TORCH

- Radio frequency

27-49 MHz

700-1599 W

- Gas- Argon

1. Sample Preparation: Some samples require special preparation steps incuding treatment wit acids, heating, and microwave digestion.

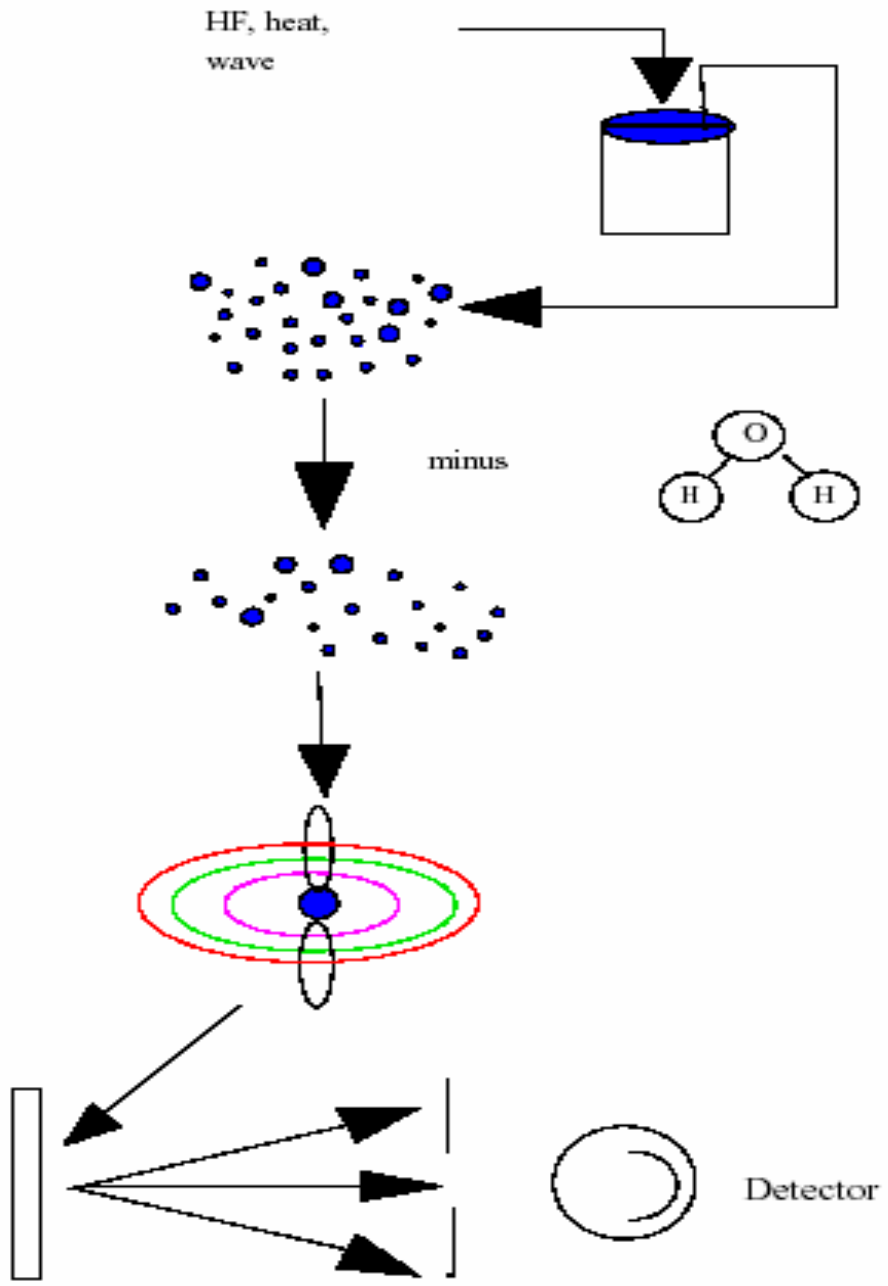
2. Nebulization: Liquid converted to aerosol.

3. Desolvation/Volatization: Water is driven off, and remaining solid and liquid portions are converted to gases.

4. Atomization: Gas phase bonds are broken, and only atoms are present. Plasma temperature and inert chemical environment are important at this stage.

5. Excitation/Emission: Atoms gain energy from collisions and emit light of a characteristic Wavelength.

6. Separation/Detection: A grating dispersers light that is quantitatively measured.



Steps involved in the analysis of aqueous samples by ICP-AES

Procedure

Instrument set up

- Warm up for 30 min
- Check the alignment of plasma torch
- Make Cu/Mn ratio adjustment
- Calibrate instrument using calibration standards and blank
- Aspirate the standard and blank for 15s
- Rinse with calibration blank for at least 60s to eliminate any carryover from previous standards
- Ensure the concentration values within the 5% error

Analysis of samples

•Analysis the samples using calibration blank

•Analyse samples alternately with analyses of calibration blank

• Rinse at least for 60s

•Examine each analysis of the calibration blank to verify that carry over memory effect is no more

•Make appropriate dilutions of the sample to determine concentrations beyond the linear calibration

Instrument quality control

•Reanalyse one or more samples analysed just before termination of the analytical run

•Use this analysis to verify accuracy and validity of the calibration standards