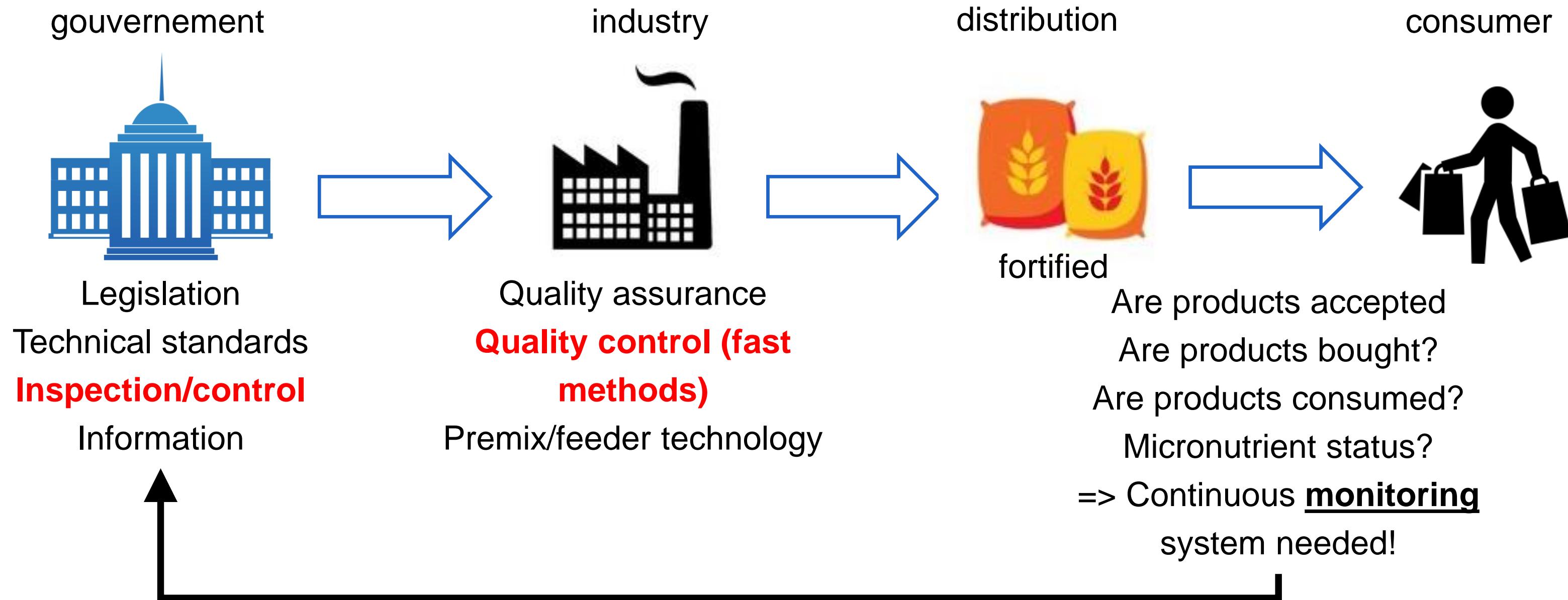


# QUALITY CONTROL TESTS FOR IRON, VITAMIN A AND C, AND FOLIC ACID

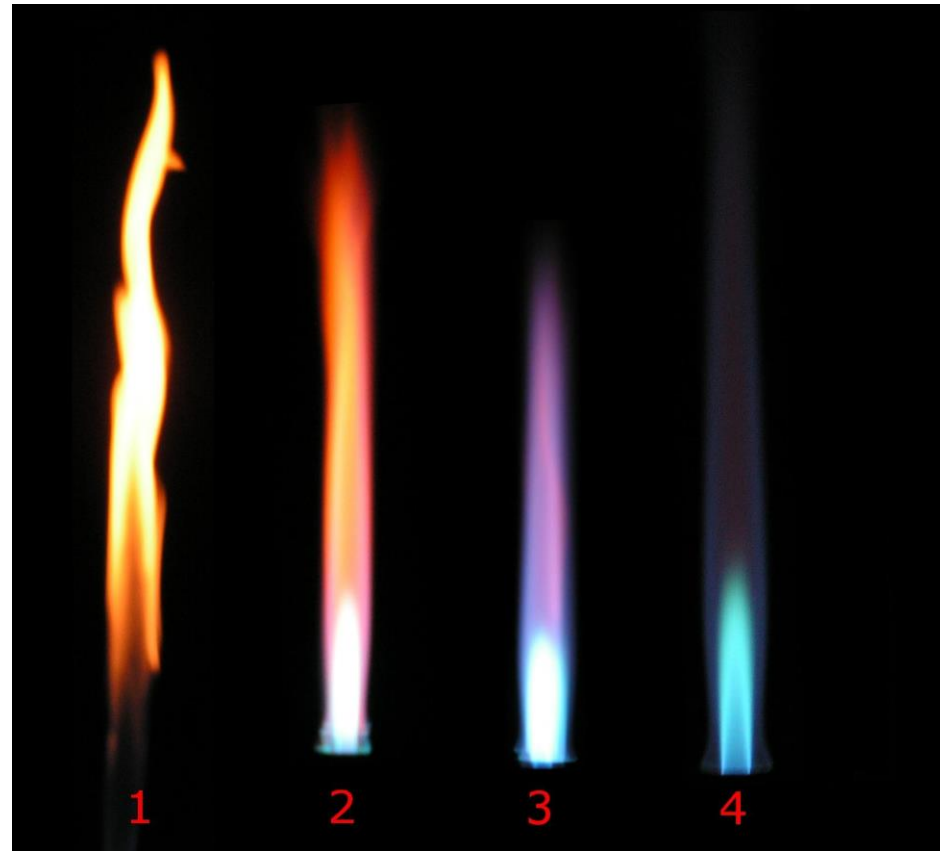
Tom Hellemans, Filip Van Bockstaele, 16-05-2017, QAQC training on flour fortification, Lusaka, Zambia

# FORTIFICATION: CHALLENGES



WHO HAS ALREADY HEARD OF AES, AAS OR ICP?

WHO IS ABLE TO EXPLAIN THESE TECHNIQUES?

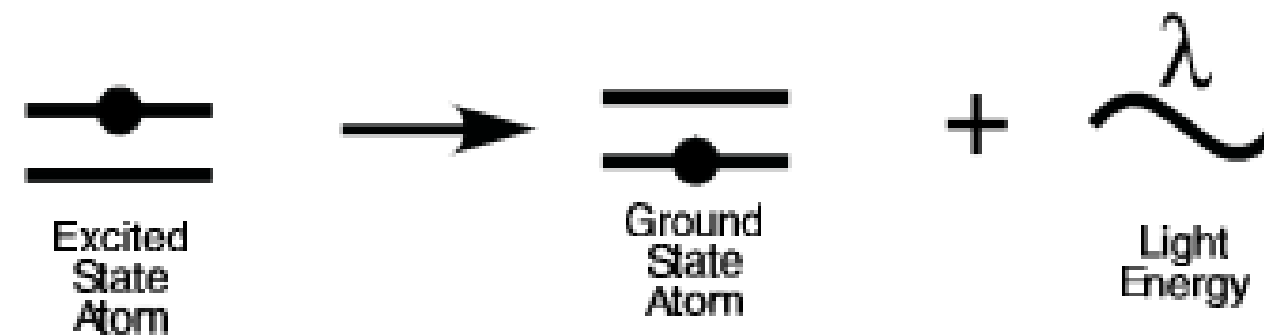


1 = NO OXYGEN ADDED; 4 = 100 % OF OXYGEN

## EXCITATION



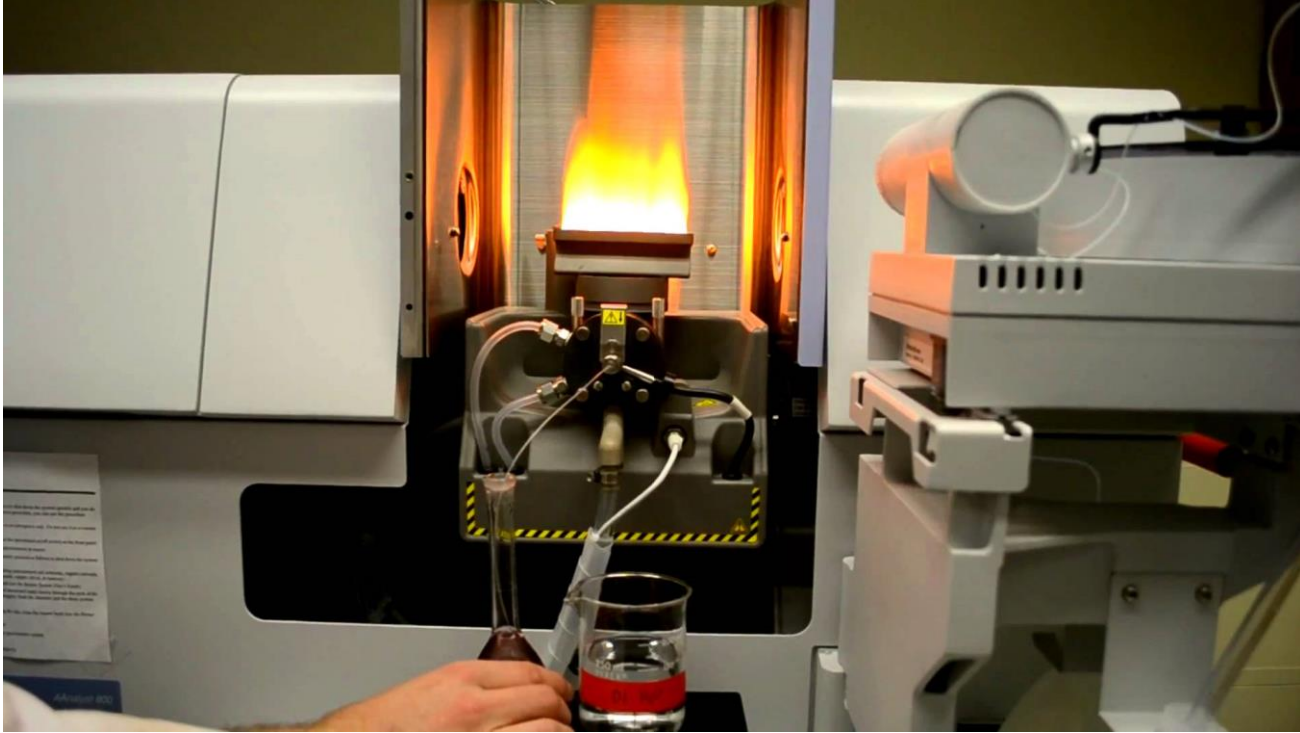
## DECAY



**AES = Atomic Emission Spectrophotometry**

**AAS = Atomic Absorption Spectrophotometry**

# Atomic Absorption Spectrophotometry



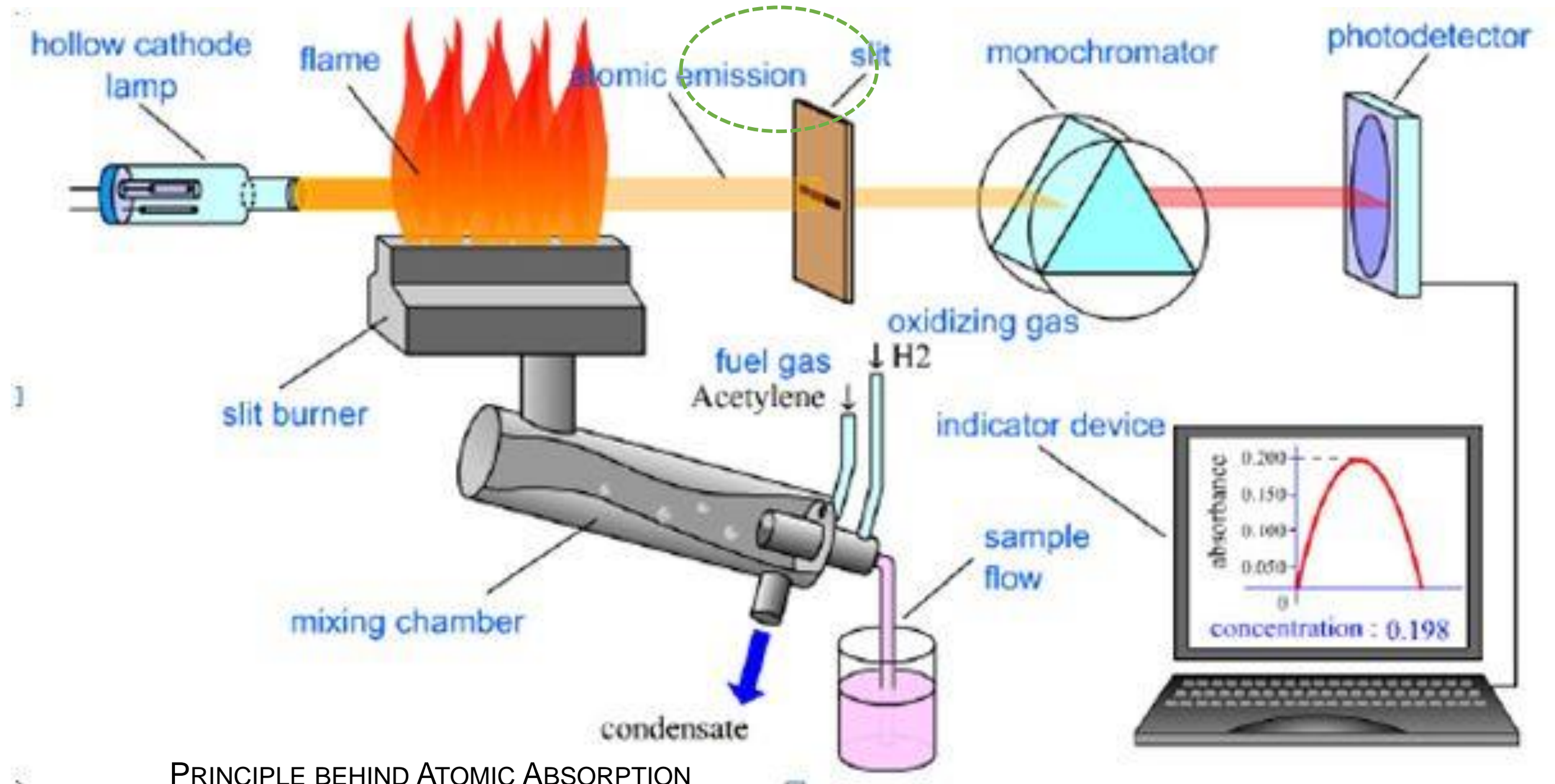
SETUP OF AN ATOMIC ABSORPTION SPECTROPHOTOMETER





# Atomic Absorption Spectrophotometry

Absorption



PRINCIPLE BEHIND ATOMIC ABSORPTION SPECTROPHOTOMETRY

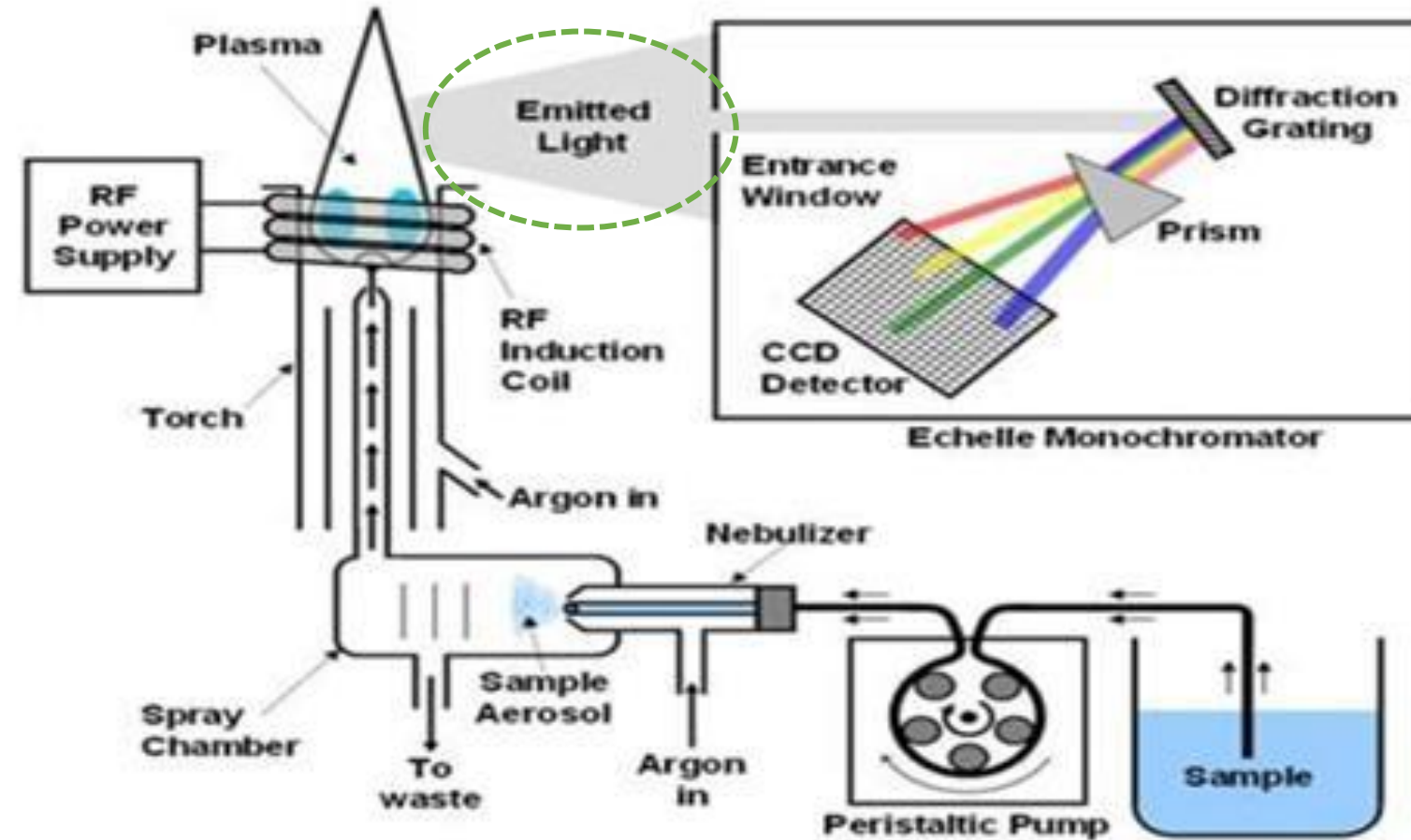
# Inductively Coupled Plasma (ICP)

6000 – 10 000 °C



AES and AAS  
1900 – 3000 °C

## Emission



PRINCIPLE BEHIND ICP-OPTICAL EMISSION SPECTROPHOTOMETRY

## ADVANTAGES

- Many mineral components can be determined in one single run (Fe, Br, Ca, Cu, Mg, Mn, N, K, S, Zn,...)
- Relatively low cost per run
- Sample preparation is not that complex or time consuming
- Accuracy of  $\pm 7$  to  $\pm 30$  %

## DISADVANTAGES

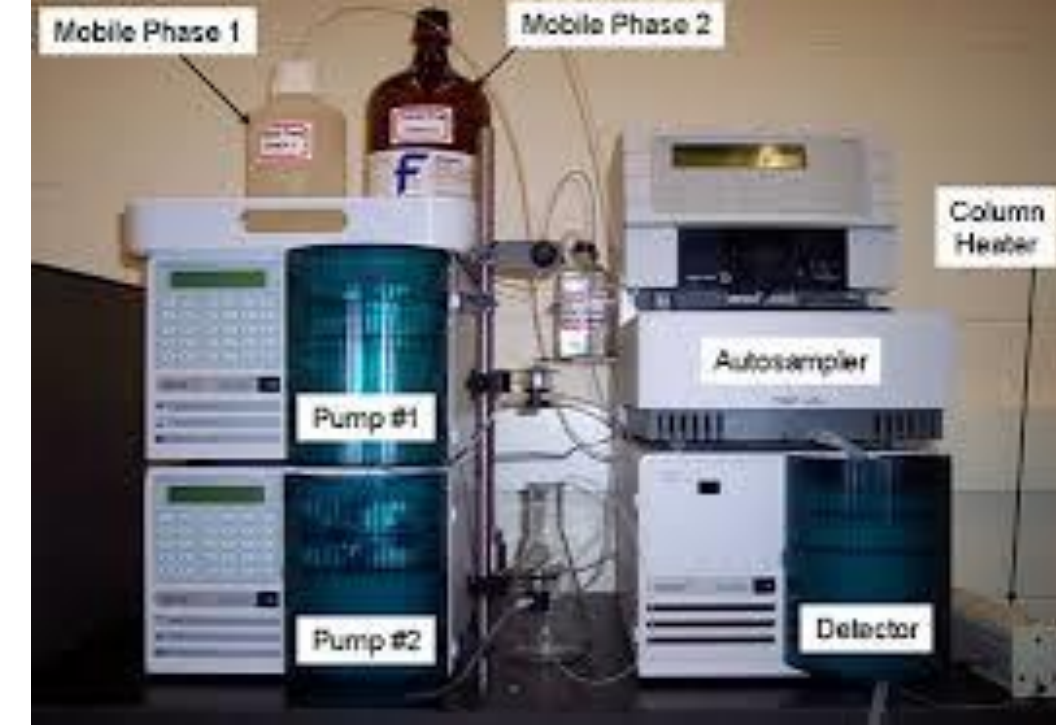
- Device and maintenance costs are very high (> 50000 USD + 1000 USD/year)
- Need for a trained laboratory technician
- Requires standard curve and frequent (elaborate) calibration should be performed





# Vitamin A and B9 (Folic Acid)

HPLC is the most precise way to quantitatively determine concentrations of vitamin A and folic acid



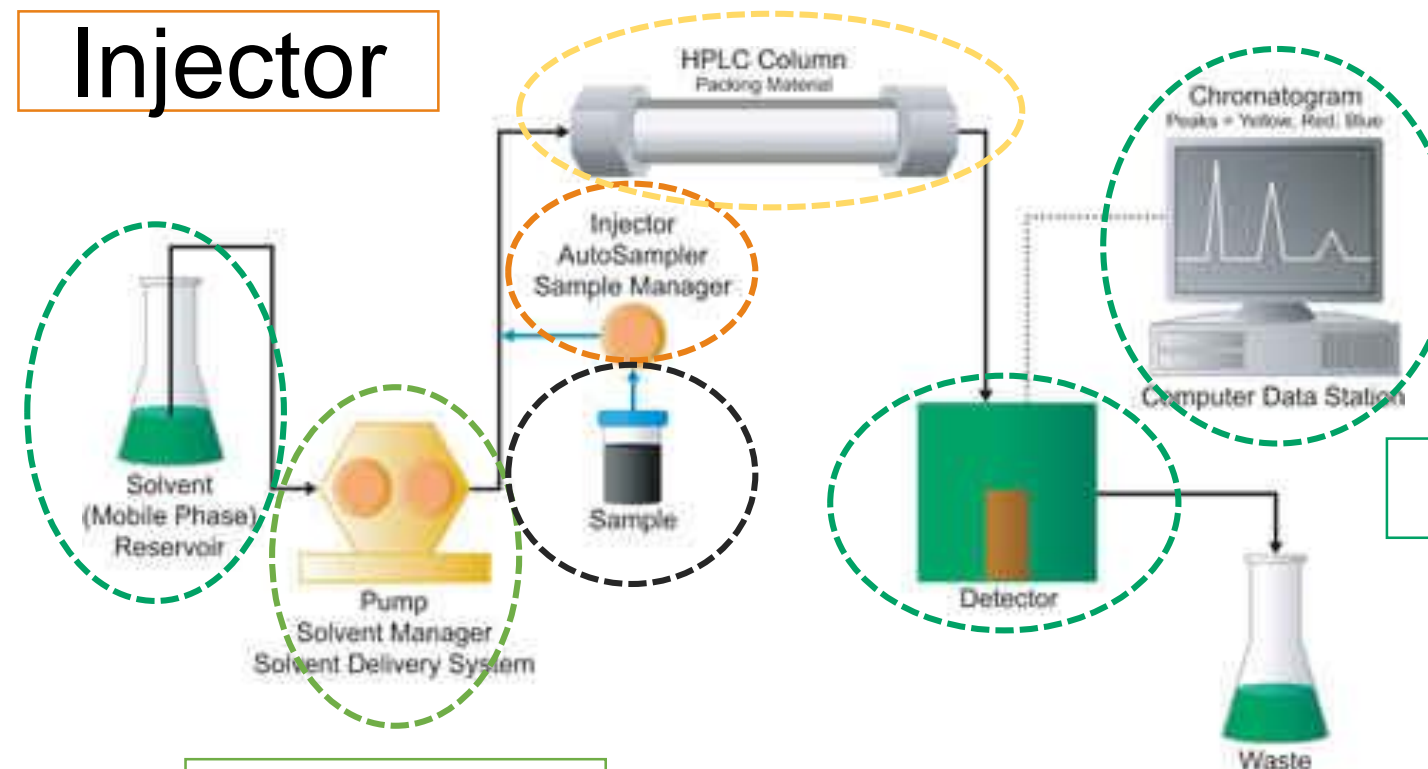
HPLC Column

Injector

Interpretation

Detector

Solvent and solvent reservoir



Pump

Sample preparation

# FAST CONTROL TEST

# Iron spot test

1. Solution A: Thiocyanate / HCl
2. Solution B: hydroperoxide

Ferrous fumarate =  $\text{Fe}^{2+}$

$\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$

$\text{Fe}^{3+} + \text{thiocyanate} = \text{red dot}$

NaFeEDTA =  $\text{Fe}^{3+}$

$\text{Fe}^{3+} + \text{thiocyanate} = \text{red dot}$



Low  
concentration



Higher  
concentration



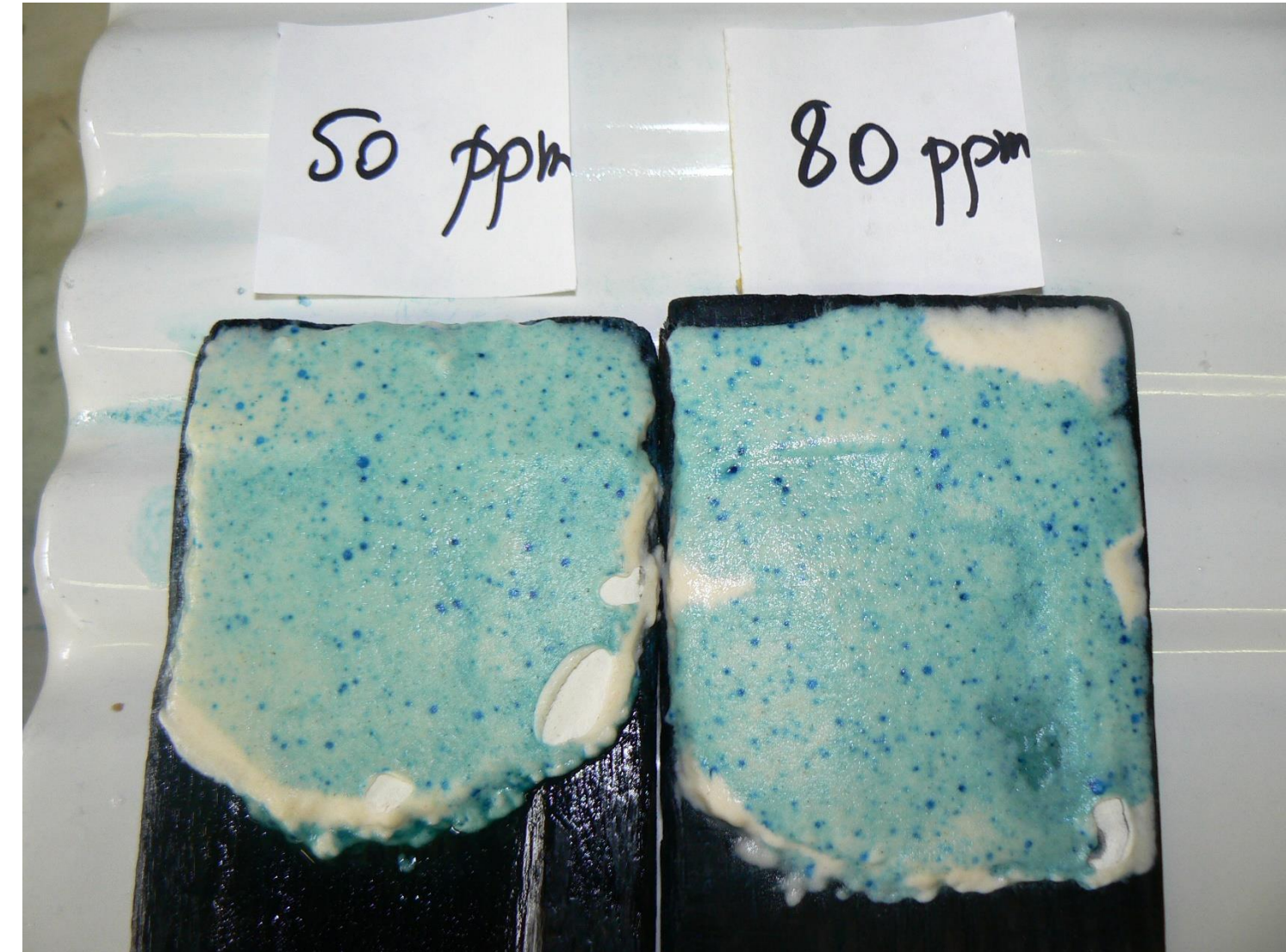
## Vitamin C – Ascorbic acid

1. Solution A: Ferric sulphate and sulphuric acid
2. Solution B: Potassium ferricyanide

Oxidation-reduction reaction leads to the formation of a blue color complex

→ Semi-quantitative

QC check to look if flour improvers are added (correctly). Ascorbic acid is no flour fortificant



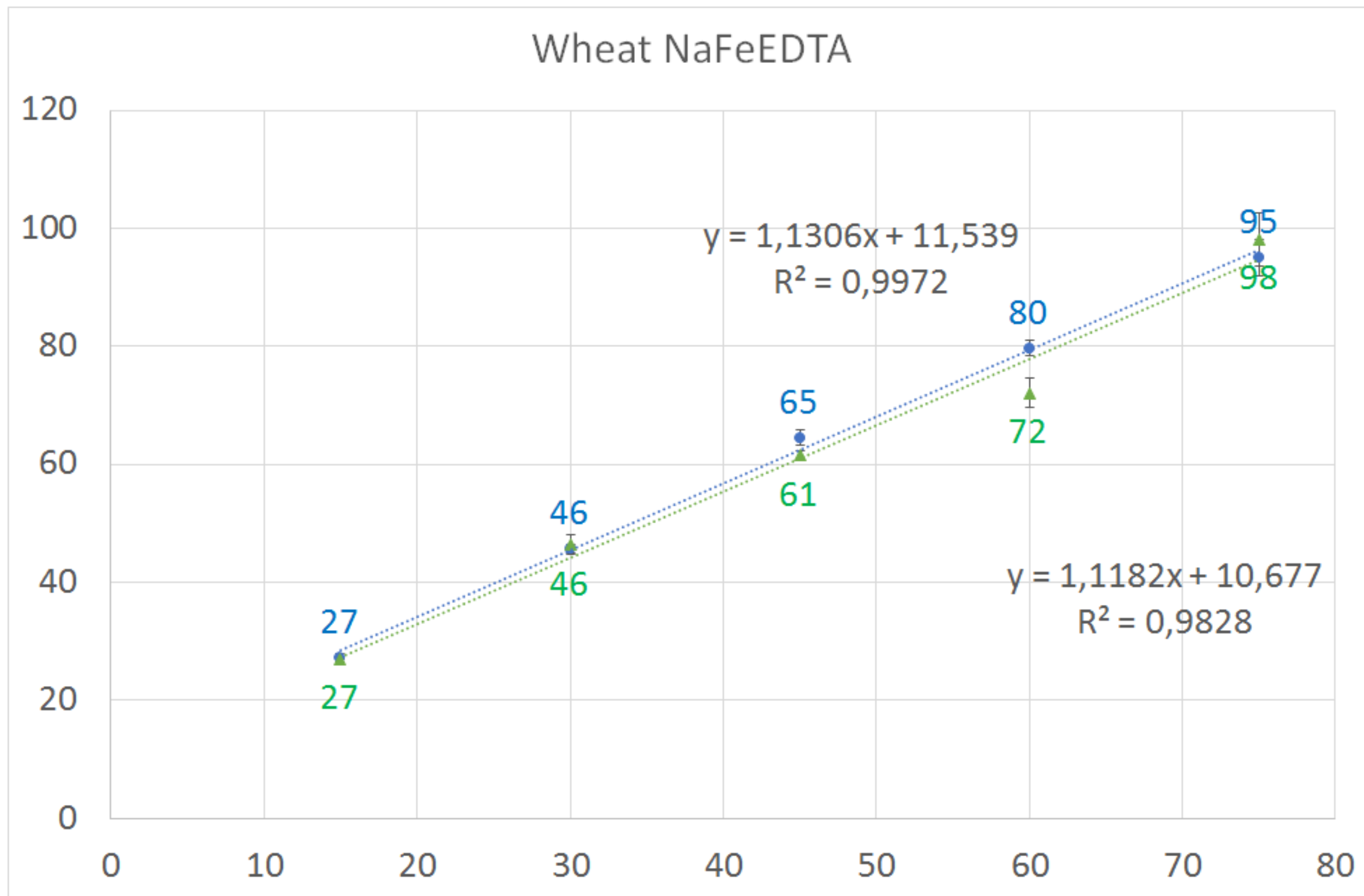


# FAST MEASURING TECHNIQUES FOR FORTIFICANTS



  
**BioAnalyt**  
measure for life

# ICHECK - ICP



# CONCLUSIONS

- Premix is composed of different components
- Every component requires a well established methodology: AES, AAS, ICP, HPLC
- Requires trained personnel
- Fast methods have been developed





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