Detection of Pesticide Residues in Herbal Drugs

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Herbal formulations are getting popular throughout the world and commercialized extensively for various medicinal properties. WHO has emphasized the need for quality assurance of herbal products, including testing of heavy metals and pesticides residues. **Gas chromatography (GC)** is the most used equipment in pesticide analysis others include **High performance liquid chromatography (HPLC).** GC-MS is usually used in the analysis of mid-polar to non-polar compounds whereas HPLC technique used for polar compounds. Gas-liquid chromatography GC-MS

What is a pesticides?

• A pesticide is any substance that is used to prevent, destroy, or repel pests or reduce the damage pests cause.
• Pesticides even include common household disinfectants like bleach or bathroom cleaner that kill bacteria.
Examples: Dichloro diphenyl trichloroethane (DDT) Hexa chloro cyclohexane; Organophosphorus pesticides: Parathion, Carbaryl, Mesurol, Methyl parathion, Calcium arsenate, Ethylene oxide, Methyl bromide, Lead arsenate.

Types of analytical methods for Detection pesticide residues

There are several approaches which vary in their degree of complexity of pesticides.

• **Multi residue methods (MRMs):** It has been designed to detect band measure a multiplicity of residues in a range of foods.

Multistep contains:

Sample Preparation ⟹ Extration ⟹ Clean up ⟹ Chromatographic Separation

Out of 10 MRMs currently used by FDA and USDA, *8 based on gas chromatography and the *2 based on HPLC.
However, none of these MRMs procedures can detect all the residues on all crop types.

• Single residue methods (SRM):
It has been designed to measure a single analyte and, often, its principal metabolites and transformation products of toxicological importance.

Step contains:

Sample Preparation ⟹ Extration ⟹ Clean up ⟹ Chromatographic Separation

Each step is optimized for the analyte of interest. Generally, they are less time consuming to perform and often provide lower limits of detection than MRMs.

• Semiquantitative and Qualitative methods:

Semiquantitative and qualitative methods range widely in their abilities to estimate the level of a particular pesticides residues in a sample. In general, they are capable of detecting a limited number of somewhat similar pesticides. Also called as Screening methods as they are capable of assaying a large number of samples for the presence of limited number of pesticides residues in relatively short time. Additionally, they are generally robust in character (i.e. less sensitive to small changes in the purity of reagents, quantities of reagent, time, temperature and environmental conditions).

Semiquantitative methods provide an estimate of the concentration ranges for detected residues, Qualitative methods will detect the pesticides if present above some predetermined level.

The principal benefit of these methods are their low cost, relative speed, and simplicity. These methods use TLC, Enzyme inhibition, and Immunoassay.

• **Quantitative methods:** The basic steps of a quantitative analytical method for pesticides residues include the following:

1)Sample preparation: the plant parts are separated into edible and non edible fractions followed by chopping , grinding, or macerating of the sample.

2**)Extraction:** Pesticides residues are removed from most of the samples other constituents by solubilizing them in a suitable solvent. This steps often involves blending the chopped sample with solvent in a homogenizer, followed by a filtration.

3)Clean up: The crude extract is purifies further by removing those co-extractives that can be interfere in the subsequent determination steps.

4)Separation: The components of the purifies extract are further separated by a differential partitioning between a mobile phase (liquid or gas) and a stationary phase.

5)Detection and quantitation: A physical parameter of the separated components in the mobile phase is measured as they pass through a detector, this signal is then related to the quantity of analyte via a quantitation step.