Table 44.2 Classical techniques for quality control

Standard	Technique	Purpose
Sampling	Selecting representative samples for analysis. Pharmacopoeias may suggest the number of samples from large consignments.	To ensure all analytical data obtained truly represent the characteristics of the batch
Preliminary investigation	Organoleptic testing; observation of colour, odour, taste	Observation for evidence of poor quality or adulteration, to ensure high quality of final product
Foreign matter	Observation for excreta, mould, etc.	To ensure high quality of final product
Moisture content	Loss on drying at 100–105 °C, Dean & Stark measurement, GC, Karl Fischer method, IR, UV, NMR spectroscopy	Inhibit or minimize enzymic or microbial degradation
Extractive values	Water soluble extractive, ethanol (45–90%) extractives, range of non-polar solvent extractives	To determine whether low levels of compounds of specific polarity are present or even absent
Ash values	Incineration at 450 °C for total ash	Indication of level of inorganic matter or silica
Insoluble ash values	Water- and acid-insoluble ash contents	Indication of level of contamination with earth or silica
Crude fibre	Defatting followed by boiling	Confirmation of normal level or detection of excess material, stalk for example
Macroscopical analysis	Comparison with botanical description	Initial identity of material
Microscopical analysis	Description of cells, inclusions and structures	Identification of material
Tannin content, bitterness value, swelling index	Quantitative measurements	Used for specific plants, containing either tannins, bitter substances or those used for swelling ability, e.g. laxatives
Microbiological contamination	Limits for levels of specific organisms	Check for levels of organisms above 10^3–10^4 microorganisms per gram

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range of components without the need for standards.

In addition to these chromatographic techniques, a number of spectroscopic techniques are widely used such as visible, infra-red (IR) and ultraviolet (UV) spectroscopy for determining semi-quantitative levels of constituents. In addition to these latter techniques, assays for specific constituents have been devised using NMR spectroscopy, immunoassay, radioimmunoassay (RIA), enzyme-linked immunosorbent assay (ELISA) and fluorescence analysis. Near infra-red spectroscopy (NIR) has recently been used for routine analysis of dry plant material and formulated products (both liquid and solid) and has the added advantage that it is non-invasive and can therefore be used for quality control in production and in packaging lines.

Herbal remedies often contain numerous herbal extracts, in many examples numbering more than 10. This creates analytical difficulties and this challenge, associated with the increasing usage of all herbal remedies particularly traditional and complementary medicines (TCM), has inspired analysts to produce more inclusive techniques, such as chemical pattern recognition, spectral correlation, etc. (Liang et al, 2004). DNA fingerprinting has recently been used to establish the identity of highly expensive raw materials, particularly prone to substitution.