

Production methods used to obtain plant-derived active constituents

The wide variety of medicinal plants, types of plant parts and varying textures of material, makes it impossible to standardize mechanical procedures, from harvesting through to drying, size reduction, or even essential oil extraction. The fibrous texture of *in vivo* or field-grown plant material and also unorganized crude drugs often requires severe mechanical disruption prior to extraction. Table 44.3 outlines the basic processes involved in production of plant extracts. These are applied to both conventional plant-based pharmaceuticals and complementary herbal medicines.

Harvesting

The first stage, harvesting, is strictly an agricultural and not a pharmaceutical process, but it can have a great influence on the quality of the final product. Each procedure requires specialized equipment, often using modified versions of commercial agricultural machinery.

Further mechanical processing techniques are often required, which may include cleaning or washing. Procedures are needed to eliminate

unwanted foreign matter, such as other plant material, minerals, any other organisms and agrochemical residues. In some instances, manual techniques are still superior to mechanization.

Drying

Drying is usually an essential process, as medicinal plant material contains water. This water must be removed to maintain the quality of the raw plant material. Often this degradation is simply monitored by macroscopical investigation of colour, form and absence of microbiological and fungal growth. The moisture content of the raw material is affected by the prevailing humidity; hence there is a greater risk of degradation in crops grown in tropical climates that are subject to higher humidity and high temperature.

Drying is necessary in almost all cases in order to protect the active constituent content. The three main techniques used for drying of plant material are:

- Natural drying – direct sunlight, which may have adverse effects
- Hot air drying – the operational temperature depends on the nature of the active constituents and may range from 40 °C for essential oils to 100 °C for glycoside-containing material. Similar equipment to that used in pharmaceutical operations is employed (Chapter 29)

Table 44.3 The major stages in the conversion of plant material into a concentrated extract

Production process	Purpose	Constraints
Harvesting	Stop metabolism at optimum time	Weather
Drying	Inactivate enzymes, inhibit microbial infestation	Plant part and temperature determine speed. Essential in tropical conditions
Size reduction (comminution)	Increase surface area for effective solvent extraction	Solvent flow impeded if particles too small, possible release of excessive mucilage which hinders later filtration
Extraction of active constituents	Production of most active base for formulation	Financial constraints to complete (100%) extraction
Extract concentration	Minimize volume/weight of extract, for ease of transport, storage, and ease of distribution in the final formulation	As above, but extra investment