Table 44.1 Single chemical entities available after extraction from plant sources

Chemical entity	Current prescription medicine application	Plant source
Atropine	Antispasmodic, ophthalmic	Atropa belladonna
Codeine, morphine	Analgesic	Papaver somniferum
Colchicine	Gout treatment	Colchicum autumnale
Digoxin	Cardiac glycoside	Digitalis lanata
Ephedrine	Bronchospasm, nasal congestion treatment	Ephedra spp.
Galanthamine	Alleviation of Alzheimer's disease	Narcissus spp
Pilocarpine	Treatment of xerostomia, myotic	Pilocarpus jaborandi
Quinidine	Treatment of ventricular fibrillation	Cinchona succiruba
Sennosides	Laxative	Cassia senna
Vinblastine, vincristine	Anti-cancer agents	Catharanthus roseus

include fresh and dried plant material, acellular products, a wide range of types of extracts including standardized extracts, and pure and in-vitro biotechnology-derived individual compounds. A range of conventional single-component pharmaceuticals derived from plants is listed in Table 44.1.

The problems involved with the use of collected wild plant material include dramatic variability in quality as a result of the genetic variability of the wild stock, poor knowledge of the plants' life cycle and the effects of differing habitats on levels of active constituents. Uncontrolled collection from the wild has led to devastation of certain supplies.

In order to control the influences of agro-ecological factors on levels of active constituents with the plant, cultivation is employed for production of the best quality raw materials. Medicinal plants should ideally be grown from homogeneous, genetically selected strains chosen for high yield of the relevant constituent(s) or other useful traits such as insect/fungal resistance.

Transport delays between collection and processing is a particular problem with the use of fresh plant material, which further compromises quality, leading to the possibility of degradation of the active constituent(s) as a result of microbial infestation, oxidation, reduction, hydrolysis and numerous other reactions. In spite of these disadvantages herbalists are still convinced of their benefits.

Quality control of crude plant drugs

Quality control (QC) techniques are described in a range of monographs in national and international pharmacopoeias, as well as in herbal and homoeopathic pharmacopoeias. QC procedures should be applied to the herbal starting materials, their extracts and the finished products. Quality control techniques used for plants and their extracts are outlined in Table 44.2. Modern chromatographic techniques are also used for separation and quantification of specific individual constituents. This chapter will not detail the specific analytical techniques described and the reader is referred to other texts for this information.

Plant preparations are often considered to be active due to their *combination* of constituents, and these often complex mixtures can be identified by a semi-quantitative proof of content, such as a chromatographic fingerprint in combination with an appropriate assay of major constituents (Vlietinck et al, 2009). A combination of data from three types of chromatography are able to provide much qualitative and quantitative information.

Thin layer chromatography (TLC) is a semi-qualitative technique using specified standards. By determination of R_f (retardation factor) values, this technique allows comparison between extracts of different origins and composition with known standards. This will give evidence for the presence of the component(s) of the standards, plus indicative quantitative data as to their levels in the materials being tested.

To obtain true quantitative data either high-performance liquid chromatography (HPLC) or gas chromatography (GC) should be used. These techniques are predominantly used for assays of either polar or volatile constituents, respectively. GC is increasingly widely available coupled with mass spectroscopy (MS). This GC-MS combination allows identification and quantification of a wide