12 Functional drinks containing herbal extracts
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12.1 Introduction

A functional drink can be defined as one that offers the consumer additional perceived benefits besides its primary function, which is hydration – the maintenance of body fluid at a suitable level. The benefits are usually directed towards some aspect of maintaining good health or coping with the pressures of modern lifestyles. A range of functional ingredients, including herbal extracts, is available to the formulator of functional drinks.

Herbal extracts are often used by beverage product developers as a matter of course, without necessarily fully appreciating the differences between extracts and other well-defined and easily specified ingredients such as acidulants, preservatives, stabilisers and sweeteners. This chapter will examine these differences so that formulators using herbal extracts will be aware of the particular characteristics of natural ingredients. They should then be able to make the best use of them in trying to fulfil the expectations of a marketing department providing a new product brief. Brief descriptions of the more commonly used herbs, together with their traditional benefits, are included at the end of the chapter. However, to understand today’s herbal drinks, it is worth looking first at their history, how the present market has developed and briefly at the role played by extracts in the herbal drinks.

12.1.1 History

The date of the first herbal drink is open to debate. Certainly ginseng was recognised as a qi tonic herb about 5000 years ago (Bown, 2003) and one of the traditional ways of using ginseng was to make a tea from its dried root. It is mentioned in Shen Nong’s Cannon of Herbs, which, although not completed until about AD 250, was founded on the work of Shen Nong, a Chinese Emperor believed to have reigned around 3000 BC. Tea (Camellia sinensis) has been drunk in China for about 3000 years (Bown, 2003) for the stimulating effects of its caffeine content. Later, liqueurs, although not soft drinks, were made from herbs by monks for medicinal and tonic purposes. Coffee and chocolate are nowadays simply considered popular because of their tastes, but when they were first discovered they were seen as tonic drinks with various stimulant properties including aphrodisiac effects. Even the world’s most popular soft drink started life promoted as a nerve tonic (Pendergrast, 1993) and in 1899, although it was mainly promoted as a delicious and refreshing drink, it was still also being advertised as relieving physical and
mental exhaustion, curing headaches and benefiting brainworkers. Other adverts talked about the use of the coca leaf by Andeans and the kola nut by Africans. In the mid-1980s a new era of herbal drinks emerged accompanied by a message of sophisticated healthiness just as the drink–drive laws began to take effect in many countries and lifestyle became a significant issue in affluent societies.

12.1.2 Market development over the past 15 years

The first generation of modern-day herbal wellness drinks arguably emerged in the latter half of the 1980s with the UK launch of Aqua Libra. The product proposition for such drinks was one of general healthiness without defining specific benefits except for the early leader, which carried the line ‘restores alkaline balance’ on the label. The product propositions for subsequent generations of herbal drinks became more focused as societal awareness of, and concern for, lifestyle-related health problems grew. Functional drinks, including those containing herbs, now address such issues as ageing, stress and stimulation in its various forms, whether for simple energy or for partying, or for strengthening the immune system and calming.

Initially, these drinks were flavoured with fruit juice and natural fruit flavours and were often pasteurised in the bottle to avoid including preservatives in the ingredients list. Herbal extracts have more recently been put into dilutables, juice-based drinks and, increasingly, bottled waters. A few herbal drinks are coming on to the market with organic certification.

Herbal drinks form part of the functional drinks sector. Some idea of the growing importance of this sector can be gained from the *International Functional Soft Drinks Report 2003* (Zenith, 2003), which covers the United States, Japan and 16 Western European countries. The market has become so sophisticated that the report can define four subsegments:

- Sports drinks are the largest segment in the markets covered by this report.
- Enriched beverages, which are generally juice-based drinks but increasingly also bottled waters, are the predominant segment in Europe.
- Nutraceuticals are well established in Japan and growing quickly in the United States, but are the newest segment in Europe.
- Energy drinks have a firm base in Japan and increasingly so in Europe. They have a smaller share of the market in the United States.

Consumption in 2002 grew in these markets by 11% to over 12 billion litres. Functional soft drinks now account for 6% of all soft drinks consumption by volume in these markets, up from just 4% in 1998 (see Figures 12.1 and 12.2). It follows that herbal extracts have a role to play in this increasingly important soft drinks sector, which can no longer be seen as an insignificant niche market.
12.1.3 The role of herbal extracts in beverages

The role of herbal extracts is primarily a marketing issue rather than a technical one. Part of the reason for using herbal extracts in a drink is that the herbs give the consumer a perceived benefit and therefore a reason to buy the product. To be effective in this role, it is important that the herb is recognised by the consumer. It therefore follows that, when developing a new herbal drink, the herb, besides being compatible with the product proposition, should be chosen for its recognition among the target consumers. The rule is generally that specialist herbs can be used in niche products but that for the mainstream, wider market, the choice of herbs should be limited to those more familiar.

12.2 Overview of the extraction process

This section starts by reviewing the heritage of extracts before proceeding to look at the stages of a basic extraction process, focusing on what makes extracts
different from single-component ingredients. The section also considers the parameters that can affect the resultant extract.

12.2.1 Extraction heritage

Most people probably regard extracts as having their origins in medicinal usage, and it is from this tradition that some of the more established extract manufacturers have evolved. Familiarity with the descriptions of various traditional extracts may help to avoid misunderstandings when contacting extract manufacturers.

12.2.1.1 Infusion

‘Infusion’ is a general term for extracts produced by steeping a herbal raw material in a liquid. Traditionally, infusions were made by pouring boiling water on to the dried herb, leaving it to soak and then straining off the resultant liquor. Modern-day infusions for beverage applications are often carried out at ambient temperature but using some alcohol in the liquor. Because infusion is a very general term, there is no set value for the plant/extract ratio, but in practice 1 part herb yields from 4 to 10 parts infusion. The practical maximum strength is reached when the extracting liquid just covers the plant material being extracted. This maximum depends on the bulk density of the dried herb, but in general is reached with 1 part herb yielding about 2.5 parts extract. Traditionally, most extracts were made from dried herbs, as these were easier to keep in good condition from one crop to the next. If it is necessary to use fresh herbs for extraction, the increased water content, which can be up to 90% with leafy herbs, has to be allowed for. Thus, if fresh herbs with only about 10% dryweight are used in the same proportion as dried herbs, a much weaker extract is obtained.

12.2.1.2 Decoction

Decoction is a variation on the general infusion process in that the herb is steeped in boiling water to which heat is then supplied to keep it at boiling point, simmering gently rather than boiling vigorously.

12.2.1.3 Tincture

Traditionally a tincture is an ambient temperature extract that is made with a high alcohol level in the extraction liquid, typically 60–70% or more. The herb/extract ratio is usually 1 part dried herb to 10 parts tincture, although a few tinctures were specified at stronger ratios (i.e. more herb) in the British Pharmaceutical Codex and British Pharmacopoeia.
12.2.1.4 Liquid or fluid extract
The terms ‘liquid extract’ and ‘fluid extract’ are interchangeable. The extract is traditionally a 1 : 1 yield made by extracting the herb with a succession of fresh batches of extracting liquid, combining these batches and concentrating them to the original weight of the herb. This was done so that liquid extracts could replace dried herbs on a weight-for-weight basis in medicinal formulations prescribed by herbalists. A liquid extract usually contains 20% alcohol, which acts as a preservative, although some are specified at higher alcohol strengths to produce the optimum extraction from the point of view of the actives content. Owing to the heating involved in the concentration stage, a liquid extract is often dark brown in colour with a caramelised odour.

12.2.1.5 Soft extract
A soft extract is produced initially as a liquid extract but the concentration stage is continued until the resultant extract has the moisture content of 30% or less. The extract has the texture of a thick paste or viscous syrup and is usually dark brown in colour and often caramelised in flavour.

12.2.1.6 Powdered extract
A powdered extract is made by replacing the moisture in a soft extract with an equal amount of a substrate such as calcium phosphate, starch or maltodextrin. The moisture is normally removed using a vacuum oven to avoid excessive thermal degradation of the extract.

12.2.1.7 Percolation
Percolation is an alternative to infusion processes whereby the solvent is trickle-fed on to the top of the herb or spice material and collected as it emerges from the bottom of the percolation vessel, which is traditionally conical in shape. This process is sometimes used in the production of natural flavours.

12.2.1.8 Modern extracts
The flavour and modern phytopharmaceutical industries have made big changes to the traditional pharmaceutical extraction processes. Whereas ethanol was really the only significant solvent apart from water used by the traditional pharmaceutical extractors, solvents such as hexane and acetone have been used by flavour companies to make soft-extract oleoresins for natural flavour components. Sub- and supercritical carbon dioxide and also some fluorohydrocarbons are now used to produce some very high-quality extracts. Modern concentration and drying processes such as reverse osmosis, spray-drying and freeze-drying
can yield extracts with less colour and caramelisation problems, but this benefit
does come with a price penalty.

12.2.2 The extraction operation

Rather than an in-depth technical description of the mechanics of extraction,
this section presents briefly a typical infusion process, focusing on the factors
that make extracts different from single-chemical components. Extracts by their
nature are complex mixtures of (often) diverse active compounds contained
within a plant matrix which are brought into solution by the extraction process.
The aim of the extractor is to produce, over a period of time, batches of an
extract meeting a customer’s individual specification with as little variation as
possible. There are parameters over which the extractor has some control, and
these can be used to help achieve product consistency and also to fine-tune an
extract to a particular customer’s needs.

12.2.2.1 Raw materials

The process starts with the herb, which itself starts as a growing plant. Here
there are many variable factors, including climate, terrain and husbandry. The
herbs that are most in demand usually come from cultivated sources, which
bring some control to the growing environment by way of irrigation, fertilisation
and possibly shelter. However, on the downside, cultivated herbs are more
likely to be treated with pesticides or herbicides. Wild herbs which are gathered
directly from their natural growing habitat are less likely to have been treated
with chemicals but are subject to the full vagaries of the weather. They are also
more likely to be subject to post-harvest adulteration and substitution. Both
sources of herbs are also subject to the effects of varying soil type. A compara-
son can be made here with wine. The same variety of grape can produce quite
different wines depending on both the weather from season to season and the
different soil conditions in which it is grown.

The extract manufacturer tries to exercise as much control as possible over
the raw material, but this is not easy. Sourcing from a single wholesaler who can
be exhorted to source from a single merchant in a specified growing region, who
in turn is urged to buy from a single locality, is not really feasible unless the
project is a large one with sufficient funding for the administrative efforts and
the travel necessary to set up a controlled supply line. Even if this were possi-
ble, the weather will still vary from year to year and affect levels and propor-
tions of actives.

The maturity of the plant at harvest can also have a bearing on the actives
content of the raw material. If it is possible to control the supply line, then it may
be possible to control the harvesting of the crop at a specified maturity; otherwise
the crop will probably be harvested by the local people to optimise the yield of bulk crop for best financial return.

Some control can be built in by specifying minimum contents of actives, but this standard is prone to downward revision for reasons of commercial expediency in times when the harvest yields levels of actives that are mainly below the specification. At such times, it is likely that parcels of the herb meeting a particular specification will carry a price premium.

If the herb selected for a given development project is one for which market demand is insufficient to warrant a commercial growing operation, it will probably come from wild sources and will be a spot market purchase subject to variability of price and availability. Probably the best that can be done here is to source from a single wholesaler.

Another option is available when the project is of sufficient size: to set up a contract for the growing of a suitable amount of the desired herb. This contract can be either directly with the grower if conditions and resources allow or through a herbal wholesaler with good contacts in a region where the required herb grows well. This will remove some of the supply variables and should enable a certain degree of control over the husbandry and harvesting of the crop. The difficulty comes at the start of a new project, when it is usually very difficult to predict the volume of sales of a new product and hence the size of the herb crop needed.

12.2.2.1.1 Availability and price. Raw material prices affect the price of an extract. The normal rule of larger volumes attracting a bulk discount does not necessarily hold true when it comes to purchasing herbs. Supply and demand are the governing factors. When a herb is selected for a new project it is advisable to ascertain from the extractor that it is readily available in the quantities needed for the forecast sales volumes. If the anticipated annual demand for the selected herb represents a significant proportion of the prevailing harvest quantity, then the price is likely to be increased by the supply chain until subsequent harvests are increased to meet the greater demand.

12.2.2.1.2 Transit and storage. It is important to consider the condition for transit and storage conditions from field to factory and storage, which can also have an effect on the raw material quality. The first step in the handling process for most herbal materials is the drying process. In the less developed nations, where a number of the herbs used in functional drinks are grown or collected from the wild, this usually consists of spreading the crop out on the ground to dry in the sun, which is a very good, cheap way of drying the herb gently. The problem arises when the drying area is just the dusty ground that is shared with domestic and farmyard animals. This is one of the reasons why some dried herb deliveries have a very high microbiological assay. In cooler growing regions
sun-drying is not an option and air-drying is used. The danger with this method is that, in the interests of efficient usage of expensive drying machinery, a higher temperature than ideal may be is used to speed up the process. This can lead to excessive loss of volatiles or damage to thermally labile actives.

Poorly stored crops may be damaged by insects or other pests, such as rodents. Water damage leading to mould growth can be due either to poor or unprotected storage or insufficient drying. Other problems that can occur are cross-contamination, accidental or deliberate adulteration for commercial benefit and mislabelling. The extractor needs to be aware of these potential hazards and exert appropriate control measures to prevent damaged material from entering the extraction process.

12.2.2.1.3 Summary. It is obvious from the foregoing paragraphs that there is inherent variability in the raw material supply chain before the extraction process itself is even started. This will introduce variability into the subsequent process and influence product costs.

12.2.3 Extraction

The fine details of equipment and procedures are of interest primarily to those actually making the extracts rather than to those using them. In brief, therefore, the extraction process consists of the following stages:

- Receiving the raw material and subjecting it to acceptance examination by quality control (QC).
- A preparation stage such as milling, in order to produce a suitable particle size for extraction.
- Steeping the raw material in the chosen solvent, preferably in a closed container, which is usually made of stainless steel or a plastic capable of resisting attack by the solvent and the plant components. The quantity of solvent used needs to take into account the amount that is absorbed by the dry plant material in order to ensure the desired final yield of extract.
- Standing for a set period of time before removing the liquid from the spent herb, which may subsequently be pressed to recover as much as possible of the extract retained in it.
- Using the resulting basic crude infusion directly or further concentrating it under reduced pressure to make a soft extract, which in turn can be dried to a powdered extract. For the majority of functional drinks the infusion is the preferred form of extract as it is the easiest to dispense and mix into the end product. Figure 12.3 shows a typical infusion vessel.
- Finishing the crude infusion by filtering it, preferably through a final membrane filter of about 0.2–0.4 μm to remove as many as possible of the microbiological organisms in the extract.
Packaging the extract, ensuring that the container used is suitable for the purpose and will not be attacked by the components of the extract, followed by storage in a cool, preferably dark place, away from excessive temperature changes and out of direct sunlight.

Within the process itself, there are several factors that can affect the quality and consistency of the final extract. These include the particle size of the raw material, the extraction time, the extraction temperature and the solvent used. The difference between these variables and those in the raw materials section is that, to a greater or lesser extent, they can be controlled by the manufacturer, so that an extract is produced as consistently as possible, using these variables to fine-tune the final extract to meet the customer’s requirements. The effect that each of each of these controllable parameters has on the final extract is discussed in the following paragraphs.

### 12.2.3.1 Particle size

The particle size of the raw material used in an extraction process is a compromise between rapid extraction times and rapid and easy filtering of the extract when it is removed from the spent herb. The finer the raw material particles, the greater the chances are of producing the most complete extraction possible in a practicably short time, which in turn leads to consistent batch strengths (from identical batches of raw material). Conversely, coarse particles require a longer time for the soluble compounds to dissolve out into the extract, and thus increase the chances of batch-to-batch variation. Fine-particle matter blocks filter pads or membranes sooner than coarse matter, and this leads to potential wastage of extract and extended processing times. Some extract manufacturers buy their herbs in the whole or uncut form and mill them on site after they have passed

![Figure 12.3 Typical infusion vessel.](image-url)
the initial QC acceptance tests, which usually include tests for moisture content and soluble extractive content and microscopic examination. This helps in controlling batch-to-batch consistency of particle size. Purchase of the uncut herb by the extractor also helps to make adulterated and wrongly labelled herbs easier to detect visually. If the herb is purchased ready cut or as a powder then it is essential to specify the particle size to minimise batch-to-batch variability.

12.2.3.2 Time
Extraction is a process in which the solvent penetrates the dried herb and dissolves the soluble components of the plant material. These then diffuse out into the free solvent surrounding the plant material particles. This process eventually reaches a state of equilibrium (Theoretically, complete equilibrium is only achieved at infinite time and the approach to completion is an asymptotic curve; Figure 12.4.) In practice, about 90% of available solids come into solution within 24 hours for a typical leaf herb at ambient temperature, although harder material, such as some dried woody roots and barks, will take rather longer to achieve a satisfactory degree of extraction.

The time allotted to the extraction of a herb by a manufacturer is usually a commercial compromise between getting as close to a complete extraction as possible, which helps achieve consistency, and making effective use of costly extraction equipment and operators. To help achieve batch-to-batch

![Figure 12.4 Typical extraction curve.](image-url)
consistency the extraction time is usually well defined within the manufacturer’s standard operating procedure. For example, an extraction should not be left standing on the herb over the weekend if a 24-h extraction period is specified. The reason for this is that different individual soluble components will diffuse out of the plant matrix at different rates, so an extract that is left to stand for longer than specified may have a higher soluble solids content, and possibly a different ratio of individual components, from those required in the standard specified extract.

It can be advantageous to specify a shorter extraction time than is required for complete extraction in cases where the active being sought from the herb is readily soluble and reaches equilibrium before undesirable components such as brown colours from chlorophyll degradates or bitter-tasting tannins are fully dissolved.

12.2.3.3 Temperature

The effect of increasing the temperature of an extraction is, first, to increase the rate at which the soluble plant materials diffuse into the solvent, consequently shortening the extraction time. This is desirable from the manufacturer’s point of view. Conversely, the colder the process, the slower the diffusion rate and the longer the extraction takes, giving rise to the possibility of a weaker extract due to incomplete extraction within a specified time. It follows that the more consistency is achieved in controlling the extraction temperature, the less variation there will be between different batches of an extract (given consistent raw material, particle size and extraction time).

A second effect of a raised extraction temperature may be to increase the solubility of some of the less soluble plant components. This could lead to hazing and sedimentation since these components slowly come out of solution again on standing during storage. This may not be a problem if the extract is to be used in a cloudy drink.

12.2.3.4 Solvent

The solvent that is most commonly used in the extraction of herbs for soft drinks applications is aqueous ethanol, usually at about 20% abv (alcohol by volume). One of the reasons for this was that herbal beverage extracts were developed in the late 1980s for the (then) newly emerging ‘adult soft drinks’ sector. Manufacturers sought to avoid any synthetic ingredients, thus enabling ‘all natural ingredients’ and ‘preservative-free’ claims to be used on product labels. A concentration of 20% ethanol in the extract liquor not only makes a very good extracting solvent but also preserves the extract effectively, if the microbiological levels have been reduced initially by filtration or other non-chemical means. Wholly aqueous extracts must be preserved, unless the extract has been
sterilised and aseptically packed, as unpreserved extracts provide an excellent growth medium for microbiological organisms.

When choosing a herb for its specific actives, it is important that the extract of that herb is produced using a solvent that is effective in dissolving the desired actives. The properties of some solvents are listed in Table 12.1. Water is an extremely polar solvent and dissolves polar materials such as salts and sugars. Ethanol, propylene glycol and glycerine are less polar, although any water present will tend to dominate the solvent polarity unless its proportion is relatively small. Even less polar solvents such as acetone or hexane dissolve water-insoluble non-polar components such as oils, fats and resins. Given that, in the main, plants function with water as their carrier medium, most plant actives within the plant cell structure are soluble in water to some extent. Likewise, the human body has a water-based system and needs the actives to be water soluble to some degree or else rendered so by the digestion process.

Using solvents at the non-polar end of the spectrum offers a means of selectively extracting specific actives. An example from the nutraceutical sector is the selective extraction of ginkgo biloba with a high level of acetone in an acetone/water solvent mixture, which produces a 50 : 1 extract (50 kg of dried herb produces 1 kg of dried extract) standardised on 24% flavone glycosides and 6% terpenes. Sub- and supercritical forms of carbon dioxide produce very-fine quality extracts, and here again there is the possibility of using the difference in polarity between the sub- and supercritical states to assist in selective extraction.
To overcome the fact that a single solvent rarely completely extracts all the potentially available components from a herb, multi-solvent extracts have been developed. In this process, initial extraction of the herb using a non-polar solvent is followed by extraction using a more polar solvent. The two extracts are then concentrated to remove the solvents. Finally, they are combined using a suitable emulsifier system to hold the two incompatible components together without separating. This will render the extract water soluble (or at the least miscible) without settling-out in the final product.

12.2.3.5 pH
In some instances, where the desired actives to be extracted are of a basic nature (as opposed to acidic), the extraction of those actives can be selectively enhanced by adjusting the pH of the extraction solvent with a suitable organic acid such as citric acid.

12.2.3.6 Summary
These paragraphs suggest the issues that the extract manufacturer faces in production. Given the many different factors, both in nature and within the extraction process itself, that produce variability, it is perhaps a tribute to the extract manufacturers’ combination of technology and art built up over a long time that extracts as sold to customers are as consistent as they are.

12.2.4 Organic extracts

The interest of consumers in the quality of what they eat and drink is increasing, and this has led to the growing use of organic products. The organic designation certifies that no chemical pesticides or herbicides, which can have an adverse impact on the environment, have been used in the growing of these foodstuffs. It is possible to produce a range of extracts that can be certified as organic. First the herb to be extracted must be certified as organic, but this is not usually a problem as most of the herbs appropriate to functional drinks are available from herb suppliers that specialise in offering organically certified herbs. In fact, all the herbs listed in Section 12.5 appear in the list of a single supplier of organic herbs. The problem arises with the extraction process. Any solvents used other than water need to be certified as organic. Currently, organic ethanol is available and this is currently the best option for beverage extracts unless alcohol is not acceptable in the product, for example Islamic markets. If the product is intended for Kosher markets then the organic alcohol will need to be from organic grain as grape alcohol could cause a problem with Kosher certification. An alternative option at this point in time is to use aqueous extracts containing preservatives, where permitted by a local organic certifying body. In the
United Kingdom, the Soil Association allows the use of the preservatives sodium benzoate and potassium sorbate.

It is theoretically possible to produce organic glycerine by steam-splitting organic vegetable oils; however, the author is unaware of any current source of this material. It should also be possible to produce a low-polarity organic solvent from natural organic raw material stock by physical means, which in turn should enable the production of organic concentrated soft extracts reasonably similar to those currently produced using acetone and hexane.

12.2.5 Extract costs

The cost of extracts is not necessarily at the forefront of considerations when developing new products, but it is useful to have a comparative understanding of the issue. There are fixed and variable costs involved in the extraction process. In general terms, the raw material handling costs, plant overheads and technical service costs such as QC are relatively independent of batch size. The main costs that vary with batch size are the raw materials, energy consumption, labour, packaging and delivery. The basic infusion process using readily available herbs, with enough volume demand to enable batch sizes of 250 kg or more finished extract, will result in an economically priced extract. Smaller one-off batches will carry a premium. The higher the raw material price (Section 12.2.2.1.1), the bigger the percentage of the overall extractions cost it represents, and consequently the lower the influence on costs savings made by larger batch sizes.

The yield of the extract is an important factor in the price of concentrated extracts. Low-yield extracts, which have a high concentration of actives in them, will usually carry much higher prices. First, the amount of raw material required to produce a given weight of extract is much higher than for a simple infusion. Second, the process itself may be more complex, involving greater costs for solvents and concentration energy. The equipment used may also be complex and attract significantly higher production overheads.

Certified organic extracts often carry a significant raw material price premium over their non-organic counterparts. Sub- and supercritical carbon dioxide extracts are in general the most expensive because the high-pressure equipment used is very costly to purchase.

12.3 Extract characteristics and their problems

12.3.1 Specifications

An understanding of the factors that make extracts different from single-component ingredients can help to avoid frustration during use. Extracts are
often complex mixtures of components, and their specifications demonstrate this. They do not, for example, have straightforward melting points or meaningful boiling points. They do not have simple spectra or other readily quantifiable properties. But they do have subjective parameters such as aroma, taste and colour. The solvent content may be specified, and dry matter also, although this may not very be high in infusions. Should glycerine be present in an infusion or soft extract, then it is not easy to determine dry solid matter content. Some concentrated extracts may carry an assay of one or more active components, for example, ginsenosides in a ginseng extract, but this still does not necessarily give a good assessment of the quality of the whole extract. For example, in the case of ginseng, the ginsenosides tend to be preferentially located in the hair roots and rootlets rather than the main roots, so that extracts with higher levels of ginsenosides can be made from these rather than the more expensive whole roots that contain other components of the herb.

12.3.2 Stability

Liquid extracts such as infusions will often, over time, produce a fine sediment. There may be a statement to this effect in the specification and on the container label. If the product for which the extract is destined is a cloudy drink or opaque like a fruit juice, then the container can be shaken each time to re-disperse the sediment before weighing out. If it is essential for the extract to be clear, then it must be carefully decanted when weighing out for a production batch. Extracts in storage will often change colour over time. Thus, specifying a colour parameter without a time factor can lead to the situation where a customer’s QC accepts the extract on delivery, as it meets colour standards at the time, but rejects it on retesting later after it has spent some time in the raw materials store – particularly if the drum has been opened and is part used.

12.3.3 Hazing

Another consideration is whether the extract is stable within the finished product. If the product containing the extract is a clouded beverage, then there may not be a problem. If, however, the end product is clear and is packed in a clear, see-through container then hazing can detract from its appearance. The hazing may be due to a difference of pH between the extract and the product: typically, an infusion will have an ambient pH of about 5.5–6.5, whereas soft drinks are typically around pH 3.0. If haze development due to pH difference is an issue, then the extract can be pre-conditioned to the pH of the finished product so that any proteins, or other components that are precipitated by the stronger acid conditions, can be brought out of solution and allowed to settle before the extract is given its
final filter. This way the unstable components are removed by the extractor rather than ending up in the finished product and causing a haze. Another cause of hazing can be significantly differing polarities of the extract solvent and the product matrix. Polarity mismatch can occur, for example, when a high-alcohol extract is used to achieve a specific active level from a herb and is then incorporated into a primarily aqueous soft drink. Resins and other non-polar components such as fixed oils, which can be soluble in high-strength alcohol, can come out of solution on mixing with water-based systems, again giving rise to a haze. Seeds and barks are the main materials containing non-polar components. Kola is a good example of this. Traditionally, it was extracted using 60% ethanol, which dissolved a significant amount of resinous material. This extract needed to be stabilised with glycerine to keep the resins in suspension when the ethanol was removed during concentration and during subsequent dilution in drinks and other preparations.

12.3.4 Availability

The large number of herbs that are available for customers, combined with the relatively low volumes required, means that it may not be economically viable for an extract manufacturer to carry production volumes of large numbers of extracts on the off-chance that someone will want one or two of them before their shelf-life has expired. The usual practice is for extract manufacturers to carry a fairly wide range of dried herbs in sample quantities so that when a customer asks for a sample it can be produced within a reasonably short time. Once a new herbal drink has been developed using samples and perhaps a pilot batch, a production-size batch of extract will be made for the product launch. After that, if the product sells and there is a demonstrable demand pattern, it is possible that the extract manufacturer will agree to make a batch for stock to be called off by the drink manufacturer.

12.4 Extracts and their applications

This section looks at the applications appropriate to the various types of extract available and some of the factors related to the incorporation of extracts into beverages.

12.4.1 Infusions

Infusions made by a local extract manufacturer are normally the extract of first choice for ready-to-drink beverages. As described in Section 12.2.1.1, infusions are the simplest types of herbal extracts and the first stage of most other extracts. Since they are the least processed, they are also therefore the most economical
to use for beverage applications. Unless there are strong economic reasons to use a more concentrated extract, it does not make sense to take an infusion, concentrate it at extra cost, possibly damage it in the process and then return it to a dilute form when the finished product is manufactured.

Concentrated infusions are sometimes economically viable if they are off-the-shelf products. For instance, because of the high demand for it, liquid guarana extracts are available that contain standardised amounts of caffeine. The demand for these is enough to warrant large-scale production in the country of origin. At this point concentration becomes desirable because the extract is being shipped over long distances and transporting solvent is a costly business.

12.4.2 Soft Extracts

The main application for a soft extract in a soft drink product is when the product label claims a relatively high level of a plant active in its formulation. The extract needs to contain a specified amount of assayed active in it to guarantee that the product label claim is met. The technical challenge is to produce a formulation that can mask both the extract’s colour and its taste. A soft extract may be used by someone blending the ingredients of a flavour system for spray- or freeze-drying that was required to contain herbal ingredients. An infusion would have too high a fluid content for this purpose.

12.4.3 Dry Extracts

Extracts dried on to a water-soluble base are useful in the preparation of powdered drinks. Soft extracts tend to contain about 70% solid matter and can be mixed into a slurry with the substrate and spray-dried or dried in a vacuum oven. The substrate is usually essential to prevent the dried extract from reabsorbing moisture and turning back into a hard or sticky mass. The dried extracts can be dry-blended with other ingredients in a powdered drink formulation.

12.4.4 Incorporation of extracts in beverages

In most applications, the extract is incorporated at the premix or syrup stage with other critical ingredients such as flavourings, colours, high-intensity sweeteners and preservatives, where these are used.

12.4.4.1 Fruit-juice-based and fruit-flavoured drinks

Herbal infusions have two features that do not facilitate their use in soft drinks. They have their own flavour, which is not usually pleasant and supportive of the
desired product flavour, and they usually come with a fairly strong brownish
colour. Fortunately, the levels at which infusions are normally added to drinks
are low and thus their flavour contribution does not often cause a problem.
Likewise, the colour contribution does not interfere with the majority of soft
drinks as the light straw-brown colour generated by a diluted extract is usually
covered by the oranges, yellows and reds of most products. Most herbs are
appropriate to this category of drinks, and a theme that is emerging is the use of
flower extracts, which convey a general image of naturalness and wholesomen-
ness without having an overtly functional message.

12.4.4.2 Mineral-water-based drinks
Mineral water with added functional ingredients is currently one of the faster
growing categories within the functional drinks sector. These products generally
have a more focused functional proposition, aimed at commonly recognised
lifestyle issues such as coping with stress, boosting the immune system, relax-
ing after a stressful day at work, calming the mind for a good night’s sleep, and
reviving tired minds and bodies. These products tend to contain a cocktail of not
only herbs but also vitamins and minerals appropriate to the product proposi-
tion. As examples, ginseng (Panax ginseng) is well recognised as helping the
body cope with stress, echinacea (Echinacea purpurea) is widely seen as an
immune-system-boosting herb and chamomile (Chamomilla recutita), passion-
flower (Passiflora incarnata) and valerian (Valeriana officinalis) are all well-
known herbs that calm the mind and prepare the body naturally for sleep.

12.4.4.3 Energy drinks
Nearly all energy drinks have one thing in common other than their calorific
value: a high caffeine content. But not all products in this category contain
herbal extracts; indeed, brand leaders in both Europe and Japan do not. This sec-
tion focuses on those that contain herbal extracts. Herbal extracts used in these
drinks are generally from stimulant herbs of one kind or another. Most com-
monly used is guarana (Paullinia cupana), which is a natural source of caffeine
and is native to Brazil. Other herbs that contain similar amounts of caffeine are
kola nut (Cola acuminata, C. itida and C. vera), coffee (Coffea arabica
and C. canephora – robusta coffee), tea (Camellia sinensis) and maté (Ilex
paraguariensis). The cocoa bean, which is the seed of Theobroma cacao and
which is in the same family of plants as the kola tree, contains the stimulants
theophylline and theobromine, which are similar in structure to caffeine.

Extracts of coffee bean and cocoa bean have been produced experimentally
that contained about 3% of caffeine and 3% theobromine respectively without
the disadvantage of flavour concentration typically associated with those raw
materials. These are potentially alternative natural sources of effective stimu-
lants to guarana and kola. Other supplementary herbs that have a place in energy
drinks are ones that support the concept of exercise or vitality, such as ginseng or Siberian ginseng (*Eleutherococcus senticosus*), or aphrodisiacs such as damiana (*Turnera diffusa*, syn. *Damiana aphrodisiaca*) and muira puama (*Liriosma ovata*) for drinks designed for social occasions, primarily for sale in clubs and bars.

### 12.4.4.4 Regulatory issues

Regulations differ from country to country and vary over time as new legislation is enacted, so it is difficult to give any universal guidance other than to suggest that product development technologists use the food legislation experts at one of their local independent food research organisations, whose role it is to keep abreast of the latest developments in their national regulations.

In Europe and the United Kingdom, there are two issues to address. First, herbal drinks should avoid using levels of herbal extracts that are high enough to render them liable to be considered as a herbal remedy. In simple terms, this means using levels of extracts that avoid delivering cumulative therapeutic levels of herbal actives from a typical daily consumption of the herbal drinks. Information and guidance on these matters should be available from herbal extract suppliers or consultants.

The second issue is that of claims. This subject is difficult to write upon definitively as new or changed regulations are often put into effect. However, the trend seems to be that claims will need some form of substantiation based upon scientific reports. In the future, folklore and anecdotal information about herbs are less likely to be permitted on product labels, advertisements and point-of-sale literature.

For Europe and the United Kingdom, a useful reference work (*Natural Sources of Flavourings*) is published by the Council of Europe. It is commonly known as the ‘Blue Book’ and is gradually being superseded by a series of update volumes with greater detail on safety of use. To date only the first report, which deals with the most commonly used plant materials, has been published. This contains, as the name implies, a list of plants that have been used to generate flavourings for foods and drinks. Many of the plants listed are traditional herbs used before modern medicines for their curative or tonic benefits. The plants in the positive list (there are a few plants listed as being hazardous for use in food and drink) are divided into six categories, which are defined as follows:

- **Category 1** – plants, animals and other organisms or parts thereof consumed as food in Europe: no restriction is made on the parts used under the usual conditions of consumption.
- **Category 2** – plants etc. and parts thereof, including herbs, spices and seasonings, not commonly used as foodstuffs in Europe and considered not to constitute a risk to health in the quantities used.
- **Category 3** – plants etc. and parts of these or products thereof normally consumed as food items, herbs or spices in Europe that contain defined ‘active principles’ or ‘other chemical components’ requiring limits on usage levels.
Category 4 – plants etc. and parts of these or products thereof and preparations derived therefrom not normally consumed as food items, herbs and spices in Europe that contain defined ‘active principles’ or ‘other chemical components’ requiring limits on usage levels.

Category 5 – plants etc. and parts of these or products thereof and preparations derived therefrom for which additional toxicological and/or chemical information is required.

Category 6 – plants etc. and parts of these or products thereof and preparations derived therefrom that are considered to be unfit for human consumption in any amount.

12.5 Some commonly used herbs

This section gives information about some of the more commonly known herbs that have been used in drinks. This list generally excludes herbs and spices that are associated primarily with culinary or flavour use, although many of these will also have some health benefits. Some of the herbs listed below are of European or American origin and are listed in the ‘Blue Book’. The names of listed herbs are followed by their category. Several herbs that have been used in the past, such as St John’s Wort, Ma huang (Ephedra) and Kava-kava, have been omitted as they are currently withdrawn from the European market due to health concerns by the regulators.

Artichoke

Botanical name: *Cynara scoelymus*.
Region of origin: Mediterranean region.
Part of herb used: The fresh or dried basal leaves.
Main actives: Caffeic acid derivatives (c.1%) including chlorogenic acid, flavonoids (c.0.5%) and sesquiterpene lactones (up to 4%) – the major component is cyanaropicrin.
Benefits: The herb is claimed to stimulate the gall bladder and detoxify and regenerate the liver tissues. It has been used to treat dyspeptic problems. It has also been shown to reduce blood lipids, serum cholesterol and blood sugar levels. The high inulin content makes it a valuable vegetable for diabetics.
Folklore: Artichokes were grown as vegetables by both the Greeks and the Romans. It is
only relatively recently that the artichoke has become medicinally interesting with the discovery of its beneficial action on the liver (Bown, 2003; Gruenwald et al., 2002; Tierra, 1998).

**Burdock**

Botanical name: *Arctium lappa*.
Region of origin: Europe.
Parts of herb used: Dried aerial parts and roots.
Main actives: The aerial parts contain flavonoids and the root contains bitter components and inulin.
Benefits: In traditional terms, burdock is used as a blood purifier: it is claimed that it helps the kidneys to remove toxins from the blood.
Folklore: Burdock was traditionally used to treat skin complaints and inflammations. The roots can be eaten raw in salads or cooked like carrots and the young leaf stalks can be scraped and cooked like celery (Bown, 2003; British Herbal Medicine Association, 1983; Hutchens, 1973; Shealy, 1998; Tierra, 1998).

**Clover (red)**

Botanical name: *Trifolium pratense*.
Regions of origin: The herb is indigenous to Europe, Central Asia, India and North Africa.
Part of herb used: Flowering tops.
Main actives: Volatile oil including benzyl alcohol, isoflavonoids, coumarin derivatives and cyanogenic glycosides. It has also been shown to contain genistein, a mildly oestrogen-like compound.
Benefits: Red clover is traditionally believed to have relaxant, expectorant and wound-healing properties.
Folklore: Clover was used to treat coughs and chest problems, especially whooping cough. It was also used to help with skin complaints. Clover was a
very important fodder crop, to the extent that even in the medieval period vari-
eties had been cultivated to improve the persistence and flowering time of the
herb. The solid extract of clover has been used as a flavouring agent in a range
of food products (Bown, 2003; British Herbal Medicine Association, 1983;

**Damiana**

Botanical name: *Turnera diffusa*.
Region of origin: Mexico, Central America and northern South America.
Part of herb used: Dried leaves.
Main actives: Volatile oil, tannins, resins and glycosides.
Benefits: A bitter aromatic herb with a fig/date-like flavour that is claimed to be
a nerve stimulant and was used to treat nervous exhaustion and anxiety of a sex-
ual nature. It is claimed to be a mild irritant of the genito-urinary tract.
Folklore: The Mayans knew this plant as an aphrodisiac (Bown, 2003; British

**Dandelion**

Botanical name: *Taraxacum officinale*.
Region of origin: Europe extending north to
the Arctic region, east to the Orient and south
to North Africa.
Parts of herb used: The fresh and dried root
and leaves.
Main actives: Sesquiterpene lactones, which
are bitter flavoured, triterpenes, steroids,
flavonoids, mucilages and an inulin content
that varies from 2 to 40% in the autumn.
Benefits: The bitter components were used to
promote the flow of digestive juices in the
upper intestinal tract.
Folklore: The French name for this herb is
‘Pissenlit’, which is self-explanatory. The herb is regarded as a good diuretic to
help purify the system by removing toxins. For some time now the roots have
been roasted and then extracted to make a caffeine-free dandelion coffee.
Dandelion has also been used in root beers and soft drinks such as Dandelion
and Burdock (Bown, 2003; British Herbal Medicine Association, 1983;
**Echinacea**

Botanical name: *Echinacea purpurea*.

Region of origin: Indigenous to North America.

Parts of herb used: Fresh or dried rhizomes and roots.

Main actives: Water-soluble polysaccharides and glycoproteins, volatile oil (up to 2%), caffeic and ferulic acid derivatives including cichoric acid (0.6–2.1%), alkamides (0.01–0.04%), polyynes and pyrrolizidine alkaloids.

Benefits: Echinacea is held to be one of the most effective detoxifying herbs in Western medicine for a range of ailments, and is now used in ayurvedic medicine. The polyynes and cichoric acid components are reported to have antibacterial and virostatic effects. Echinacea also demonstrates an anti-inflammatory effect due to the alkamides component. As an immune stimulant, it significantly raises immunoglobulin M levels. Antiviral activities against both the Herpes simplex virus Type I and the influenza-A virus have been observed.

Folklore: *Echinacea purpurea* was used by native North Americans to treat wounds. Its use was greatly promoted by the Eclectic movement from the 1850s until the movement declined in the 1930s (Bown, 2003; Gruenwald *et al.*, 2002; Hutchens, 1973; Shealy, 1998; Tierra, 1998).

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**Elderflower**

Botanical name: *Sambuccus nigra*.

[fruit: Category 3 (with limits on hydrocyanic acid); flowers and tips: Category 1; leaves and extracts: Category 5 (with limits on hydrocyanic acid)].

Region of origin: Europe.

Part of herb used: The dried or fresh flowers.

Main actives: Flavonoids such as rutin, isoquercitrin and quercitrin, chlorogenic acids and volatile and fixed oils.

Benefits: Elderflowers have traditionally been used for colds and fevers as their main action is claimed to be to induce sweating and reduce temperature.

Folklore: Many old superstitions surround the elder. It was considered most unwise to cut down an elder tree without first seeking permission of the ‘elder mother’ spirit in the tree (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973; Shealy, 1998; Tierra, 1998).
German chamomile

Botanical name: *Chamomilla recutita*.
Regions of origin: Indigenous to Europe and northern Africa.
Parts of herb used: Flowers and flowering tops.
Main actives: Volatile oil containing bisabolol compounds, flavonoids, coumarin compounds and mucilages.
Benefits: A bitter aromatic herb traditionally used for its gentle sedative, calming properties. It is also used to calm the digestive system. It is a mild herb that has been used for children’s complaints.
Folklore: German chamomile is used in toiletry and cosmetic preparations as a hair conditioner and lightener (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald et al., 2002; Hutchens, 1973; Shealy, 1998; Tierra, 1998).

Ginkgo

Botanical name: *Ginkgo biloba*.
Region of origin: China.
Part of herb used: Dried leaves.
Main actives: Proanthocyanidins (8–12%), flavonoids (0.5–1.8%), biflavonoides (0.4–1.9%), diterpenes and sesquiterpenes.
Benefits: Ginkgo is highly regarded as a tonic for the circulatory system. Studies have shown that it improves blood flow to the extremities of the body by reducing blood viscosity and dilating the blood vessels. Ginkgo has been shown to help retard the degenerative effects of Alzheimer’s disease on cognitive functions, due presumably to improved blood flow in the cerebral capillaries. Other studies have shown that ginkgo improves memory and learning capabilities. One report has also claimed that ginkgo helps to counter loss of libido caused by antidepressants. It has been used by mountaineers to help counter altitude effects and by mountaineers to keep extremities warm.
Folklore: The ginkgo tree comes from a very ancient order of plants; the modern single species is almost identical to fossilised plants that were growing 65 million years ago – before mammals evolved. Chinese medicine used the seeds of the ginkgo tree, but it was only in the latter half of the twentieth century that Western medicine started to research the properties of the leaves (Bown, 2003; Gruenwald et al., 2002; Shealy, 1998; Tierra, 1998).
Ginseng

Botanical name: *Panax ginseng*.

Region of origin: Indigenous from Nepal to Manchuria.

Parts of herb used: The main root, side roots and rootlets.

Main actives: Ginseng contains a complex mixture of triterpene saponins (0.8–6.0%) and also many ginsenosides, of which the predominant ones are Rb1 (0.15–1.2%), Rb2 (0.06–0.8%), Rc (0.1–1.2%), Rd (0.04–0.7%), Re (0.15–1.5%) and Rg1 (0.2–0.6%). Ginseng also contains water-soluble polysaccharides and some polyynes.

Benefits: Ginseng’s main action is to help the body fight off physical, chemical and biological attacks by raising the body’s own defence mechanisms. In human studies, there was a visible benefit in terms of physical and mental performance. It was also shown to reduce blood sugar levels in Type II diabetics.

Folklore: Ginseng is one of the oldest known tonic herbs, having been in use for about 5000 years in China. It was introduced into Europe several times from the end of the ninth century onwards, but did not become established until the middle of the twentieth century, following studies by Russian scientists that established its adaptogenic properties. Most ginseng is now cultivated since very few plants are found in the wild. South Korea grows a large amount of Ginseng under government control to ensure quality standards are observed (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973; Shealy, 1998; Yeung, 1983).
Guarana

Botanical name: *Paullinia cupana*.

Region of origin: Amazon Basin.

Part of herb used: The seeds, which are purple–brown to black with a characteristic white ‘eye’, contained within a red–orange fruit about the size of a hazelnut.

Main actives: Guarana has the highest known caffeine content of any herb at 3.6–5.8%. It also contains small amounts of theophylline and theobromine, the other stimulant purine alkaloids similar to caffeine. Besides these, guarana contains about 12% tannins and some saponins.

Benefits: The caffeine content makes guarana a strong central nervous system stimulant. It is traditionally used as a tonic for fatigue and to allay hunger and thirst. It also has short-term diuretic effects. The tannin content gives guarana an astringent effect and it has been used to treat diarrhoea.

Folklore: Guarana is traditionally prepared by roasting the seeds to enable the shells to be removed, after which the seeds are crushed and ground into a paste that is fashioned into stick form and dried over a smoking aromatic charcoal fire. The Guaramis and other Amazon Indian groups grated a little of this dried guarana paste into water to make a stimulating drink that enabled them to overcome fatigue and hunger on long hunting trips (Bown, 2003; Gruenwald *et al.*, 2002; Tierra, 1998).

Hops

Botanical name: *Humulus lupulus*.

Region of origin: Europe, but now grown in temperate regions around the world.

Part of herb used: The dried strobile (female inflorescence).

Main actives: About 10% of α and β bitter acids including humulone and lupulone, volatile oil (0.3–1.0%)

Benefits: Hops are a traditional sedative and soporific (sleep promoter). The bitter acids have been shown to be antibacterial and antifungal and also to stimulate the secretion of gastric juices. Hormonal anaphrodisiac effects have also been reported.

Folklore: Hops are primarily associated with the brewing of beer, but many other herbs were used in brewing long before hops came to prominence. Hops were traditionally used to stuff pillows as a way of promoting sleep (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973).
Horehound

Botanical name: *Marrubium vulgare*.
Region of origin: Indigenous from the Mediterranean region to Central Asia.
Part of herb used: The fresh or dried aerial parts of the plant.
Main actives: Diterpene bitter components including marrubiin (c.1%), caffeic acid derivatives including chlorogenic acid, flavonoids and a trace of volatile oil.
Benefits: The herb is an aromatic bitter that has been used to stimulate digestive juices. The herb is also a traditional expectorant.
Folklore: This herb was used as far back as ancient Egyptian times as a cough remedy. More recently it has been made into candy cough sweets. At one time horehound ale was brewed particularly in the East Anglia region of the United Kingdom. The leaves have also been used in liqueurs (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973).

Kola

Botanical name: *Cola nitida* and *C. acuminata*.
[kola and kola nut extract: Category 4 (with limits on caffeine)].
Region of origin: West Africa.
Part of herb used: The seed after removal of the testa.
Main actives: Purine alkaloids – mainly caffeine (0.6–3.7%) with some theophylline and theobromine, tannins, proanthocyanidins and 45% starch.
Benefits: Besides the nervous stimulant effect due to the caffeine, kola is used in its indigenous region to stimulate the digestive system since it is claimed that it helps to break down fat. It has also been shown to have a mild diuretic effect, which is consistent with its caffeine content.
Folklore: Kola is traditionally used in tonics for exhaustion and poor appetite. The tannins have an astringent effect in cases of diarrhoea. In the countries of origin the seed is ground as a condiment for food and chewed before meals to promote good digestion (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Tierra, 1998).
Lemon balm

Botanical name: *Melissa officinalis*.

Regions of origin: Eastern Mediterranean and Western Asia.

Part of herb used: Aerial parts of carefully dried herb.

Main actives: Complex mixture of volatile oils, glycosides of the alcoholic and phenolic volatile components, caffeic acid derivatives, flavonoids and triterpene acids.

Benefits: *In vitro* the herb has been shown to have antibacterial and antiviral effects. It has also been used as a calming sedative for nervous indigestion and is one of the herbs that are given to children for stomach upsets.

Folklore: The oil has insect repellent properties. The herb is used in cooking to impart a lemon flavour to the food. It is an ingredient of a melissa cordial made by Carmelite nuns as well as being included in other liqueurs such as benedictine and chartreuse. Traditionally the herb was seen as an antidepressive. (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Tierra, 1998).

Limeflower

Botanical name: *Tilia cordata* and *T. platyphyllos*.

Region of origin: The tree is common throughout northern temperate zones.

Part of herb used: The dried flowers, extracts of which have a honey-like flavour with astringency.

Main actives: Mucilages (about 10%), flavonoids, tannins, chlorogenic acid and volatile oils.

Benefits: An aromatic mucilaginous herb that has traditionally been used for its diuretic and expectorant properties. It is claimed to calm the nerves, lower blood pressure and improve digestion.

Folklore: Limeflowers were thought to cure epilepsy if the sufferer sat under the tree. The wood of the lime tree is valued for its pale colour and its suitability for turning and carving. It is used in the manufacture of musical instruments (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Shealy, 1998; Tierra, 1998).
Maté

Botanical name: *Ilex paraguariensis*.

Region of origin: South America between 20° and 30° latitude.

Parts of herb used: The dried leaf and leaf stems.

Main actives: Caffeine (0.4–2.4%) and theobromine (0.3–0.5%), caffeic acid derivatives including chlorogenic acid and neochlorogenic acid, flavonoids including rutin and isoquercitrin, saponins and volatile oil.

Benefits: The herb has stimulant effects due to the caffeine and chlorogenic acids. It is also diuretic and reportedly has lipolytic (fat-burning) effects.

Folklore: In South America, a tea brewed from the herb (also called ‘maté’) is served on social occasions as a communal recreational beverage that is very stimulating. The maté is prepared in a bowl that is passed around the assembled people; it is drunk from the bowl by means of a silver straw with a strainer on the lower end to prevent the leaves being ingested (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002).

Meadowsweet

Botanical name: *Filipendula ulmaria*.

Region of origin: Europe.

Parts of herb used: The flowering tops and leaves.

Main actives: Salicin. It was from this plant that in 1838 salicylic acid was first isolated.

Benefits: Meadowsweet has traditionally been used for its astringent and antacid properties. It has long been held that it soothes and relieves pain, especially in joints and the digestive tract.

Folklore: Along with vervain and watermint, meadowsweet was one of the most important herbs for the Druids. It was also a popular strewing herb in medieval times (Bown, 2003; British Herbal Medicine Association, 1983; Shealy, 1998).
Nettle

Botanical name: *Urtica dioica*.
Regions of origin: Common throughout the temperate zones of the world.
Part of herb used: Fresh or dried aerial parts of the plant.
Main actives: The fresh leaves and stems are rich in vitamins A and C and iron. They also contain histamine, serotonin, acetylcholine and formic acid in the stinging hairs. The dried herb contains Flavonoids (0.7–1.8%) including rutin and isoquercitrin, silicic acid (1–5%), a trace of volatile oil and potassium and nitrate ions.
Benefits: Significant antirheumatic and antiarthritic actions have been demonstrated in several studies, some with large groups of participants. Diuretic properties have been reported in connection with prostate problems and in cases of lower urinary tract infections.
Folklore: The name urtica is believed to be derived from the Latin verb ‘urere’, to burn, most probably referring to the stinging action of the plant. Nettle is a fibrous plant and was used in cloth manufacture from the Bronze Age until the early twentieth century. The fresh young plant tops have been cooked as a spinach-like vegetable dish, and used to be brewed into a nettle beer in certain parts of the United Kingdom. The herb was known as a blood purifier which, in current terms, is a detox herb. The herb has a high chlorophyll content and has been used as a source for extraction of this natural colour (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973; Shealy, 1998; Tierra, 1998).
Passionflower

Botanical name: *Passiflora incarnata*.
Region of origin: South-eastern United States to Argentina and Brazil.
Part of herb used: The aerial tops of the stems, comprising leaves, flowers and fruit.
Main actives: Flavonoids.
Benefits: The flavonoids have led to this herb’s longstanding use as an effective, non-addictive sedative that does not cause drowsiness. Passionflower is an ingredient in many herbal sedative remedies.
Folklore: Spanish missionaries in South America regarded the flower of this herb as a symbol of Christ’s passion, the three stigmas representing the nails, the five anthers the wounds and the ten sepals the apostles present. The herb was used in native North American medicine, especially by the Houma tribe, who put it into drinking water as a tonic. It became popular as a treatment for insomnia in the nineteenth century and was included in the US National Formulary from 1916 to 1936 (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973; Tierra, 1998).

Rooibos

Botanical name: *Aspalathus linearis*.
Region of origin: Western Cape region of South Africa.
Parts of herb used: Leaves and stems of new growth shoots.
Main actives: A range of polyphenols.
Benefits: Japanese studies in the 1980s showed that the polyphenol components had antioxidant properties similar to superoxide dismutase (SOD), an enzyme that is a free radical scavenger and is thought to slow down the ageing process. The herb has less tannin than oriental tea, so tastes less bitter, and it is caffeine free.
Folklore: Locally, the herb is used in cases of allergy, such as eczema, hay fever and asthma. It is also used in schnaps and liqueurs (Bown, 2003).
**Rosehip**

Botanical name: *Rosa canina*.
Region of origin: Europe.
Part of herb used: Fruit.
Main actives: Vitamin C (0.2–2.4%), fruit acids (3%), pectins (15%), sugars (12–15%), carotenoids and flavonoids.
Benefits: A source of natural vitamin C that has been used in cold and influenza preparations.
Folklore: Rosehips are also used to make syrups for babies and young children. Traditionally rosehips were made into preserves to retain their health benefits into the winter months (Bown, 2003; British Herbal Medicine Association, 1983).

**Sarsaparilla**

Botanical name: *Smilax regelii, S. aristolochi-aefolia, S. febrifuga*.
Region of origin: Tropical and subtropical Central America.
Parts of herb used: The dried rhizomes and roots.
Main actives: Steroidal saponins (0.5–3%).
Benefits: Sarsaparilla has long been used for skin complaints such as psoriasis; it is also believed to be a good diuretic and diaphoretic so it has been used as a blood purifier and for kidney complaints.
Folklore: Although there are steroidal compounds present in sarsaparilla, the rumoured presence of testosterone, which made it of interest to body-builders, has not been substantiated. The root has been used in soft drinks and root beers. Sarsaparilla was introduced into Europe following the Spanish colonization of South America. It was regarded as a cure-all and was established in pharmacopoeias until the early twentieth century (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Tierra, 1998).
Schisandra

Botanical name: *Schisandra chinensis*.
Region of origin: China.
Part of herb used: Fruit.
Main actives: Essential oil, fruit acids, sugars and resin; the seeds contain schizandrins, sitosterol, vitamins C and E, resin, tannins and sugars.
Benefits: A sweet and sour herb that is claimed by Chinese herbalists to control the secretion of body fluids, thus moistening dry and irritated tissues, and to act as a tonic for the nervous system and the circulatory system.
Folklore: The herb was mentioned in Chinese texts during the Han dynasty (AD 25–220). Its Chinese name is Wu Wei Zi, which means five-flavours fruit, because it has both sweet and sour flavours in the fruit skin and flesh, and acrid, bitter and salty flavours in the seeds. It was used by both men and women as a sexual tonic, and by women to improve the complexion (Bown, 2003; Shealy, 1998; Yeung, 1983).

Siberian ginseng

Botanical name: *Eleutherococcus senticosus*.
Regions of origin: Siberia and northern parts of China, Korea and Japan.
Parts of herb used: The dried root and root bark.
Main actives: The main constituents are triterpene saponins, steroid glycosides, hydroxycoumarins, caffeic acid derivatives, lignans, steroids and polysaccharides.
Benefits: The actions of Siberian ginseng are similar to those of *Panax ginseng* but stronger. Indigenously it is used as a tonic for strength and revitalisation. The polysaccharides in the herb have been shown to have a good immunostimulatory action.
Folklore: Siberian ginseng was brought to prominence when Russian researchers were investigating *Panax ginseng* and looked at other plants in the same family to see whether they had similar properties. Several Eleutherococcus species have been used in Chinese medicine for 2000 years (Bown, 2003; Gruenwald *et al.*, 2002; Shealy, 1998; Tierra, 1998; Yeung, 1983).
Valerian

Botanical name: *Valeriana officinalis* [roots: Category 5].

Regions of origin: Europe and temperate regions of Asia.

Parts of herb used: Fresh or carefully dried rhizomes and roots.

Main actives: Valepotriates (0.5–2.0%), volatile oil (0.2–1.0%) and valeric acid (0.1–0.9%).

Benefits: Valerian has been used as a daytime sedative to reduce anxiety and stress and it has been demonstrated to reduce the time it takes to fall asleep. Valerian root extracts and volatile oils are used as components in the flavour industry, especially in alcoholic beverages such as beers and liqueurs and in soft drinks such as root beers. They have also been used in tobacco flavours.

Folklore: The aroma of valerian is very attractive to cats and rodents, and it has been used as bait in traps. It is thought that valerian was the basis for the story of the Pied Piper of Hamlin ridding the city of rats (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Hutchens, 1973; Shealy, 1998; Tierra, 1998).

Vervain

Botanical name: *Verbena officinalis*.

Region of origin: Mediterranean region.

Part of herb used: Aerial parts of the herb.

Main actives: Iridoids, flavonoids and caffeic acid derivatives.

Benefits: The herb has been used for its astringent, cough suppressant and lactation promoting properties. Traditionally it has been used as a diuretic and to calm the nerves and improve the liver and gall bladder functions.

Folklore: In Western medicine, vervain has been used mainly for nervous complaints. Vervain is one of the herbs most commonly used to make herbal teas and is also an ingredient in liqueurs (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald *et al.*, 2002; Shealy, 1998; Tierra, 1998).
Wolfberry

Botanical name: *Lycium barbarum*.  
Region of origin: China.  
Part of herb used: Fruits, which are bright red when first dried but darken with age.  
Main actives: Carotenes, vitamins B1, B2, B3 and C, β-sitosterol and linoleic acid.  
Benefits: In traditional Chinese medicine, wolfberry is used as a nourishing herb for convalescence; it is also used in cases of impotence. It has been reported to lower blood pressure and blood cholesterol levels. It is also reported to be a liver and kidney tonic, inhibiting the deposition of fat in liver cells and promoting the regeneration of liver cells. 
Folklore: Although of Chinese origin (referred to as Gou Qi Zi as early as 200 BC) the plant has been established in Europe for some centuries and, in Britain, was known as the Duke of Argyll’s tea-tree. It was also known as matrimony vine because if planted near the home it was said to create discord between husband and wife. In traditional Chinese medicine it is combined with Schisandra and if taken for one hundred days is believed to develop sexual stamina (Bown, 2003; Shealy, 1998; Tierra, 1998).

Wormwood

Botanical name: *Artemesia absinthium*. [Herb: category 4 (with limits on eucalyptol, methyleugenol and thujone); essential oil: category 4 (with limits on eucalyptol, methyleugenol and thujone)].  
Region of origin: Mediterranean zones.  
Parts of herb used: The upper shoots and leaves.  
Main actives: Volatile oil (0.2–1.5%) containing thujone and bitter sesquiterpene compounds, including absinthin (0.20–0.28%) and artabsin (0.04–0.16%).  
Benefits: The herb is described as an aromatic bitter, and as such is used to stimulate the appetite. It has been shown that the bitterness on the palate automatically stimulates an increase in
secretion of digestive juices in the stomach. Also, it has been shown to increase liver function in patients with liver disorders.

Folklore: Wormwood has traditionally been used for digestive problems, including expelling intestinal worms. The essential oil of wormwood was used in the distillation and production of the aperitif absinthe, starting around the end of the eighteenth century. The thujone in absinthe created some problems in Europe and the United States, as it emerged that it was addictive and could cause hallucinations in cases of overindulgence. This led to the drink being outlawed in certain countries (Bown, 2003; British Herbal Medicine Association, 1983; Gruenwald et al., 2002; Hutchens, 1973; Tierra, 1998).

References and further reading

Hutchens, A.R. (1973) Indian Herbalology of North America. Shambala, Boston, MA.