

Brewing the best tea standards

By Andrew Scott, Chair TC 34/SC 8, Tea

Chances are, that someone, somewhere is drinking a cup of tea every minute of the day. If tea is so common and traded as a commodity why do we need standards?

This is a short outline of the historical back drop for tea today, how the tea trade came to work with ISO and independent researchers to develop International Standards so that everyone can be assured that they can enjoy a good cup of tea.

The history of tea

The story of tea is veiled in myths and history providing a romantic aura; lore and legend intertwine to create a karma that resonates in every sip we take. Chinese and Japanese mythology offer a number of accounts of the discovery of tea. Chinese folklore relates how the Emperor Shen Nung first tasted the delights of tea in 2737 BC. Japanese legend tells of a Buddhist saint, Bodhidharma, who fell asleep during his devotions to awake in distress and cut off his eyelids, throwing them to the ground where they took root and grew into a tea bush. Early Chinese literature refers to tea in Shennong's herbalist book where he describes how he found tea infusions to be a beneficial antidote to the noxious herbal concoctions he tasted in his search for medicinal plants (Han Dynasty c. 206 BC - 220 AD) and in Lu Yu's scholarly tea handbook *Ch'a Ching* or *Tea Classic* written circa 780 AD. Tea established itself very early on as part of the fabric of Chinese life as is recognized by the ancient saying, 'there are seven matters to the starting of a family's life: fire wood, rice, oil, soy sauce, vinegar and tea'.

The early plants, or more correctly trees, were found in south-west



Tea - three leaves and a bud

China spreading through Sechuan, Yunnan and the Yun-Gui plateau. There are two varieties of *Camellia sinensis*, the China plant, or jat, (*var. sinensis*) and the India plant, or jat, (*var. assamica*). The China jat is a bush which grows up to 2,75 m tall with many stems and is very hardy. The Assam jat is a single stemmed tree which grows up to 18 m in height and less hardy. Modern cultivars are hybrids of these two varieties, this improves the yield and quality of the Assam jat whilst losing some of the hardness of the China jat.

Tea cultivation quickly spread from China to Japan and was introduced to Java in 1648 by a German naturalist, Andreas Cleyer. Subsequently tea was discovered in Assam in 1823 but its cultivation had to await another decade. The delights of Sri Lankan tea have their roots in disaster, coffee was destroyed by rust in the late 1870's and tea was planted to replace it. Later on in the century, Russia began cultivation of tea in 1847 and cultivation was established in Africa (Kenya, Uganda and Malawi) in the early 1900s.

Tea consumption and the global economy

The importance of tea both to the global economy and to the social order can be seen by the historical record. Countries and Empires, China, Japan, India, Britain and Holland all involve international tea trade and its consumption. Its economic history is illustrated by the earliest tax on tea being imposed in 780 AD by Emperor Tih Tsung in the Tang Dynasty and was very unpopular. Later on, the fortunes of the English East India company were involved with the tea trade from the 1700s for two centuries. In the USA, The Tea Act of 1773 made law in Britain and its colonies included a tax that they refused to pay which resulted in the infamous 'Boston Tea Party' and the making of a nation of coffee drinkers.

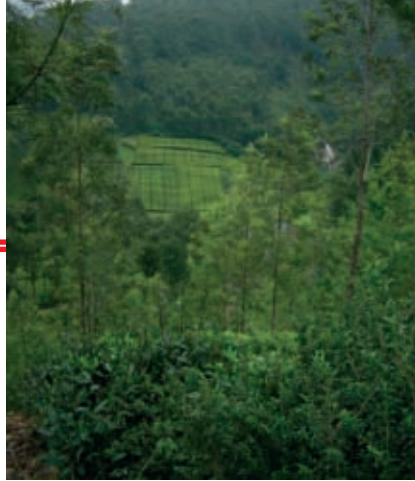
From these early beginnings in China, tea is now enjoyed by consumers all over the world. Over 3 million tonnes of tea is now produced in over 30 countries around the world to pro-

vide over 1000 billion cups of tea a year. Hot drinks represent about a third of all drinks consumed in the world and tea consumption is a quarter of all hot drinks. Over one and a half million tonnes of tea is consumed outside the producing countries and this valued at over USD16 billion in domestic consumption alone. Drinking tea is enjoyed in over 100 countries around the globe with different styles of infusion, by young and old alike, signifying the fundamental nature of tea's universal popularity. The billion dollar trade of tea between producing countries and consuming countries is therefore of major commercial importance and is also of key concern to many consumers. The degree of industrialization in producing countries, in the main, is much less than that in the majority of the consuming countries and tea is plays an import part in their economy. Consumption



Above – Black tea (left) and green tea (right) bushes.

Below – Green tea growing near Hangzhou, China the area famous for the, 'Longjing' (Dragon Well) tea.



Black tea growing at the Tata Tea estates in Munnar, South India.

“International standards are vital to facilitate international trade in tea, to ensure consumers’ expectations are met.”

varies from country to country and can be below 1 kg per capita per annum or over 8 kg per capita per annum.

Tea manufacture

Green tea is predominantly made by hybrid plants from the China jat with a smaller more delicate leaf than those which produce black tea which are hybrid plants from the Assam jat, but this is not a hard and fast rule. The manufacture of tea differs in that for green tea, the leaves are plucked and processed without letting the leaf constituents combine and pursue chemical and biochemical reactions. This is made possible by treating the leaf with a heat process as soon after plucking as is practical. In contrast, for black tea the leaves are plucked and then the leaves are macerated to allow the leaf constituents to mix and pursue chemical and biochemical reactions to create a range of liquors with a characteristic reddish-brown hue and taste which can be enjoyed both with, or without, milk. It is not surprising therefore that this major international trade in tea required some basic guidelines to ensure the producers and the consumers cultivated, sold and purchased tea of a quality which is expected from day to day and from year to year. Being from a plant, tea leaves have natural variations due to climatic and agronomic changes; however, in the main there are basic characteristics which can be measured to maintain the qualities we all expect.



Tea and International Standards

International standards are vital to facilitate international trade in tea, to ensure consumers' expectations are met, to support the development of Good Manufacturing Practice for both black and green tea through minimum compositional specifications and to provide validated methods of analysis. Tea can be grown in some of the world's remote locations, although this is not always the case as can be seen in China and Japan, across a number of continents including Asia, Africa and South America. One of the many challenges in developing standards for tea, particularly in developing methods of analysis, is to ensure those who cultivate and manufacture tea can use the methods equally well to the sophisticated scientific laboratories

About the author



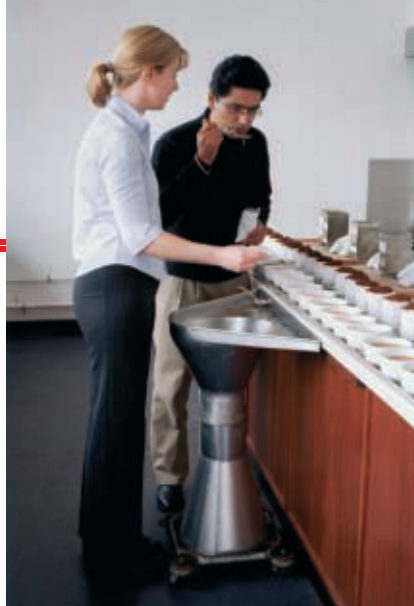
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the Chorleywood and Campden Food Research Association). He joined The Tetley Group, now a subsidiary of Tata Tea Limited, in 1991. He has been head of the company's worldwide Research and Development department and now works with the Group Marketing Development team, bringing innovative new tea products to Tetley markets across the globe. He has been a member of the BSI AW8 Tea Committee since 1991 working on the new standards to measure substances characteristic of tea (total flavonoids and catechins) to be published next year. He has recently been appointed Chair of the ISO/TC 34/SC 8 tea subcommittee to continue this work.

used by the regulatory authorities in the highly consumer oriented countries. Standards developed in this way enable the tea producers to demonstrate that tea is of the quality to be enjoyed by consumers the world over. In addition, the trade expectations are to promote good manufacturing practice, quality conservation during economic transport and suitability of tea for high speed packing for attractive presentation in the supermarkets around the world.

“It is important to develop methods of analysis validated internationally for the measurement of flavonoid and flavanol levels in tea.”

The importance of world trade in tea led to the recognition in the late 1960s and early 1970s that standards for tea quality should be established to smooth the progress of trade and to ensure consumers' expectations are met. So, the tea committee was established and became part of ISO as Working Group 8 in the early 1970's and was fully established as a subcommittee (SC 8) of TC 34 in 1976. The good work of the committee started to make early progress by publishing the black tea standard (ISO 3720) in 1977. This established the basic parameters for good manufacturing practice for guidance with leaf plucking and tea sorting standards, prevent the sale of spent leaf and prevent the use of traditional adulterants. The definition of black tea was developed and provided the basic specifications of extractable solids, fibre and ash. The supporting work developing analytical methods for preparing samples and measuring moisture content, extractable solids, fibre and ash content were developed and validated in ring trials with laboratories representing both producing and consuming countries provided the 7 analytical methods which established the means of measuring the basic tea parameters. These methods form the basis of the international



Tasting tea in the sales room at Tetley using ISO 7516 every day.

trade of tea and are used for auditing purposes and for resolving of differences of opinion.

In parallel with this work, methods for sampling tea (ISO 1839), for the preparation of liquor for use in sensory tests (ISO 7516), and for a glossary of terms relating to black tea were established to aid a common language to be developed in the tea sales rooms. Black tea is manufactured on a daily basis in season and a large volume of this production is sold at auction. This means that samples are distributed to agents and purchasers around the world to evaluate the organoleptic qualities of the tea to determine if it is suitable either for direct sale or for use in the familiar blends of tea we find on the supermarket shelves around the world. These methods are used everyday in the tea sales rooms for tea selection, valuation and purchase. An ISO tea grading nomenclature system (ISO 11286) has also been established to define different sizes and grades of tea leaf which can be used as part of this evaluation process.

The statue of Lu Yu, the early tea scholar, at the tea museum near Hangzhou, China.



The next phase of work involved developing a standard for instant tea (ISO 6079) which is not only used for a more convenient way of preparing tea but is also a key ingredient in iced tea whether in the ready-to-drink form, which is increasingly becoming available, or in the dry mixes form which is available in countries where iced tea is very popular. The analytical methods to support this specification have also been developed and validated by international ring trials with laboratories representing producing and consuming countries.

The advent of bulk packaging and containerization meant that the traditional tea chests became less economically viable, and they were also not ideal for protecting tea from moisture and taint. This stimulated the need for a packaging solution to transporting tea around the world. A major work programme was undertaken to develop a reference sack specification (ISO 9884-1) to provide standard dimensions for efficient use of container space, constructed with materials which ensure adequate strength, protection from moisture and taint together with the methods of test. The second part of the standard (ISO 9884-2) defines the performance specification for the sack. This does not envisage that one sack should be used for the transport of tea, but defines the material characteristics and performance characteristics by which alternatives can be evaluated and found acceptable.

New international analytical methods

The recent work programme has focussed on the development of compositional analytical methods for tea. A method for measuring caffeine in tea and instant tea (ISO 10727) was originally published in 1995 and has been updated to improve the sensitivity for determinations in decaffeinated tea. The two most recently developed methods to determine substances characteristic of tea, part 1 to determine total polyphenol content and part 2 to determine catechins in green tea,

are to be published in 2005. The need for these methods was envisaged in the first edition of the black tea specification but it is becoming even more important because in recent years there has been an increasing interest in the health benefits of tea consumption. Scientific research and epidemiology studies are proposing that consuming tea may maintain a healthy disposition to reduce the likelihood of succumbing to the excesses of cardiovascular disease and some cancers; if it helps



Tea everyday at work

with hydration, it could assist weight maintenance programmes and bone maintenance amongst other benefits. It is therefore very important to develop methods of analysis which are validated internationally for the measurement of flavonoid and flavanol levels in tea. This is not only for compositional analysis to support the black tea standard but also to ensure that the quoted flavonoid contents of teas is meaningful and can be used for comparative purposes by consumers, the trade and legislators alike.

The working group including participants in the UK, Germany, China and initially Malawi who looked at a number of different methods of analysis to form the basis for measuring total polyphenols (flavonoids) in tea before basing its work on the method of Singleton & Rossi's 1965 paper in the *American Journal of Enology and Viticulture*. The challenges were



The famous Longjing (Dragon Well) green tea.

greater when developing a method to measure catechins (flavanols) in green tea because pure, verified chemical standards for accurate quantitation of the catechins are not commercially available. These standards were purified and circulated to the participants of the international ring trial together with HPLC columns filled with chromatographic material from the same batch so that quantitation could be verified and validated. This work has enabled the calculation of relative response factors which means that any analyst can now quantify the levels of catechins in green and black tea without the need to purchase very expensive chemical standards which may vary in their purity. This valuable work means that the methods can now be used equally well by analysts in the producing and consuming countries without placing either at a commercial disadvantage.

The results of measurements with these methods can now also be used by the leading researchers in the

Dr. Scott (centre), recently appointed ISO/TC 34/SC 8 chair, with Professor Luo (right), leader of the Chinese delegation, and her colleague Ms Guo (left) at the recent ISO conference at Hangzhou, China in October 2003.



Food and beverage



field who establishing the health benefits for consumers of tea. It has taken over 10 years to develop these methods, introduce refinements to improve their application and internationally validate their use with the collaboration of over 20 laboratories representing both producer and consumer countries. So it was fitting, and with great pleasure, that Dr Peter Collier, SC 8 Chair 1988-2003, presided over the ISO TC 34/SC 8 meeting which confirmed the proposal to publish these two methods as ISO standards in Hangzhou, China in October 2003.

Achievements of TC 34/SC 8 and the future

The ISO Tea Committee, SC 8 which forms part of TC 34, has diligently worked for nearly 40 years to provide 19 international standards and provide technical expertise and support to ISO to ensure consumer expectations are met, to facilitate the international trade in tea, estimated to be worth over USD 25 billion, and to provide the guidance and common understanding of good manufacturing practices for black and green tea. The work is not complete, the two new compositional methods of analysis are ready for publication early next year and we are now ready to embark on the work to develop a green tea standard, long awaited by our Chinese colleagues. In addition, we are planning to develop a method for the analysis of theanine in tea and evaluate its use, because it is thought to be useful as an additional constituent in tea which might benefit health and because it is also a potential authenticity marker for tea.

So when you raise your cup or glass of tea to your lips, you can rest assured that many experts in the trade are working with the officers at ISO to ensure you enjoy a good "cuppa!" ■