coffeeperception

BREWING

Understanding the Coffee Control Brewing Chart

Posted on May 14, 2017 *by* DINUKA BANDARA 5 Comments

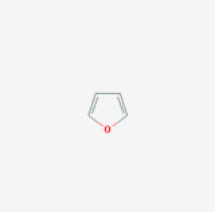
When it is coming to brewing there are few words that rise up, such as extraction, strength, TDS% and so on. All the concepts and techniques of brewing have been developed to achieve an ultimately balanced cup.

Balanced cup can be defined as **"a beverage where we have the balance between sweetness, bitterness and the acidity".**

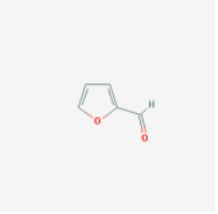
Extraction
Brewing methods are most commonly designed to transform the flavour particles that have been developed within the coffee bean. Therefore, the best definition that can be given to explain extraction process is **"transformation of the flavour components from solid to liquid "**

Few of most common chemical compounds that can be extracted to the liquid are given below.

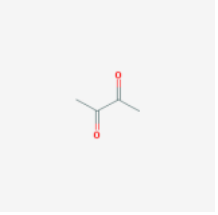
Furan (caramel aroma) – molecular mass 68.07



Furfural- (nutty/roasted aroma) –molecular mass- 96.08



Diacetyl (2,3-butanedione) (Butter like)–86.01 molecular mass



Therefore, these extracted coffee particles also can be **soluble yield** or the percentage of the dissolved coffee (coffee solids). The maximum number of coffee particles that can be dissolved in the water is 30% from the given solid dose. According to the SCAE standards the optimum percentage of soluble yield that we are looking for is **18%-22%**

Strength
Strength is one of the most misused words in coffee trade. It is to be used very carefully. Most commonly it is being used to elaborate the concentration of caffeine, where technically it shall be used to explain the **concentration of the dissolved solids particles (soluble concentration)** within a beverage. According to the SCAE standards the optimum percentage of soluble concentration that we are looking for is **1.2%-1.45%**

Total Dissolved solids (TDS)
The number of coffee solids that have been dissolved in the brewing water can be determined by calculating or measuring TDS level of a beverage. The most important fact that one should understand is the TDS is a **number** where measured by PPM ,(parts per million) in this case dissolved flavour (solid) particles. But **TDS%** is **its concentration** within the brewing water.

There are few key points that can be helped to brew a better coffee.

- Good water quality
- Ideal brewing method
- Ideal filtering method
- Ideal ground coffee particle size
- Temperature of water, water-coffee contact time, turbulence
- Ideal coffee to water ratio

Let`s have a look at few of these points that can help us to understand the brewing chart

Coffee to water Ratio
According to the SCAE standards **coffee to water ratio** that can create correct optimum balance or the gold cup is 50g-65g per 1000ml (1l). Also the other most important fact is while coffee is being contacted with water; most commonly every **1g of coffee absorbs 2ml** of water.
Due to,

- Uniformity of roasting
- Moisture content of the bean
- Origin of the coffee
- Ca2+ and –HCO3 concentration of water
- Age of the green bean…

Some coffee particles can absorb different amounts of water.

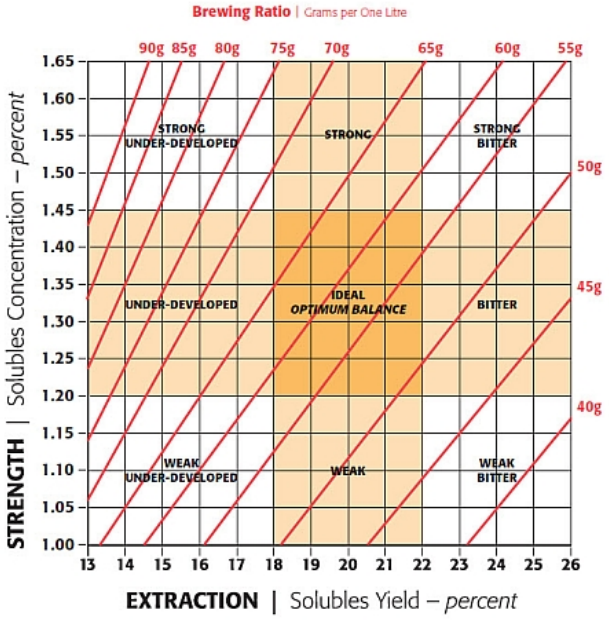
Water Quality
(https://coffeeperception.wordpress.com/2015/03/03/perception-of-water/) When rain fall CO2 molecules start to dissolve in the water and create an ability to dissolve such minerals as calcium carbonate (CaCO3) and create Calcium cation (Ca2+) and bicarbonate anions (HCO3-).

$$CaCo3 + CO2 + H2O \longrightarrow Ca2+ + 2HCO3$$

These bicarbonate anions have the ability to create insoluble CaCO3 molecules once water is being heated up, and that the usual mechanism of lime scales. However when minerals are dissolved in the water, the number of water molecules that has the ability to create a solvation shells are being reduced. Therefore, the number of dissolved solids or TDS, directly affect to the solvating process of the water and also the vaporization process of aromatic volatile particles from the water, as those dissolved solids start to disturb the aromatic vaporization.

Therefore choosing ideal water for coffee brewing (125ppm -175ppm) is much more important as the number of dissolved solids, directly affect to the solvating process of the water and also the vaporization process of aromatic volatile particles from the water, as those dissolved solids start to disturb the aromatic vaporization.

Coffee Control Brewing Chart



Mathematics of Gold Cup Standard

It is very important to understand the mathematics of the brewing chat to understand the chat itself.

Extraction% (soluble yield) if not we can mathematically say that the percentage of the dissolved solid particles out of used ground coffee.
Therefore,

$$Extraction\% = \frac{Yield\ or\ TDS\ (g)}{Dose\ or\ Ground\ coffee\ (g)} \ 100\%$$

Strength (Soluble concentration) (concentration of extraction) – the percentage of the concentration of dissolved solid particles in brewed water.
Therefore,

$$Strength\ \% = \frac{Yield\ or\ TDS\ (g)}{Brewed\ coffee\ (l)} \ 100\%$$

By considering the fact of every **1g of coffee absorbs 2ml** of water if we develop one equation out of those above, we can come up something like that given below where act true for all 1l of brewing parameters.

$$\textbf{Ground coffee (g)} = \frac{\textbf{1000 (TDS)}}{\textbf{Extraction + 2(TDS)}}$$

Let's see if we are mathematically correct,
If we need to brew a beverage that has the TDS% of 1.23 and extraction% of 22. When there is the absence of the chat how do we decide the amount of ground coffee to start the brewing?
By using the above equation,

$$\text{Ground coffee} = \frac{1000\ (1.23)}{\{22 + (1.23 \times 2)\}}$$

Ground coffee = 50.2g (approximately 50g of coffee)

Therefore, the amount of ground coffee we need is 50.2g. By looking at the control chat we can confirm the accuracy of the equation.

Understanding the Different Brewing Profiles

Apart from having understanding the mathematics of the control chat,it is very important to understand the differences between each and individual area that has been covered by the chart **against TDS% and Extraction%**

Weak
Relatively, the amount of the ground coffee particles that have been dissolved in the water is low, Hence TDS% low and **weak**. But, ground coffee has been extracted within the gold cup standards (18%-22%)

Weak Underdeveloped
The amount of the ground coffee particles that have been dissolved in the water is low, Hence **weak.** But ground coffee has not been extracted for correct amount of time, therefore **underdeveloped**.

Weak Bitter
The amount of the ground coffee particles that have been dissolved in the water is low, Hence weak. But ground coffee has extracted for longer period of time than it is needed to be, therefore **bitter**.

Bitter
Ground coffee has extracted for longer period of time than it is needed to be, therefore **bitter**.

Strong Bitter
The coffee solution or the brewed coffee has higher amount of coffee particles being dissolved within, hence **strong**. But Ground coffee has extracted for longer period of time than it is needed to be, therefore **bitter.**

Strong
Relatively the amount of the ground coffee particles that have been dissolved in the water is high, Hence TDS% is high and **Strong**. But, ground coffee has been extracted within the gold cup standards.(18%-22%)

Strong Underdeveloped
The amount of the ground coffee particles that have been dissolved in the water is high, Hence TDS% is high and **Strong**. But ground coffee hasn't been extracted for correct amount of time, (less than it is needed to be) therefore **underdeveloped.**

Underdeveloped
Relatively ground coffee hasn't been extracted for correct amount of time (less than it is needed to be), therefore **underdeveloped.**

Finally, mathematics and science can help us to profoundly understand the art of the coffee and experience it, in a wonderful way. Because where science meets art, wonders come to live.

(Special thanks to http://pubchem.ncbi.nlm.nih.gov/ (http://pubchem.ncbi.nlm.nih.gov/) for pictures of the molecular structures)
{Special thanks to coffeechemistry (https://www.coffeechemistry.com/)and J. Rivera (https://www.linkedin.com/in/josephrivera4?authType=NAME_SEARCH&authToken=bdQn&locale=en_US&trk=tyah&trkInfo=clickedVertical%3Amynetwork%2CclickedEntityId%3A82291440%2CauthType%3ANAME_SEARCH%2Cidx%3A1-4-4%2CtarId%3A1474562298822%2Ctas%3Arive) (Coffee Scientist | Research & Development (R&D)) for the picture of the chart }References: Lingle, T. The Coffee Brewing Handbook. SCAA

Tags: acids, Alkalinity, barista, base, Buffer solution, Caffeine, chemical compounds, chemical reaction, chemical reactions, chemistry, coffee, coffee acids, coffee chemistry, coffee cupping, coffee quality, coffee roasting, coffee science, curdle, decafe, decaffeination, dose, espresso, extraction, flavour, gastronomy, grind, grinder, latte art, Maillard reaction, milk, SCAE, science, sensory triangulation, speciality coffee, taste, TDS, water, water chemistry. Bookmark the permalink.

5 thoughts on "Understanding the Coffee Control Brewing Chart"

RONEY says:
December 5, 2017 at 6:55 am
Great Article. Good formula…

Reply

DINUKA BANDARA says:
December 5, 2017 at 7:35 am
Cheers Roney.

Reply

MAGNUM LEANDRINI says:
July 25, 2018 at 12:10 am
I need some help with it. Where can we talk about it, Dinuka?

Reply

DINUKA BANDARA says:
July 24, 2018 at 11:58 pm
Drop an email magnum , cheers.

Reply

COFFEEANDTEAPERCEPTIONSANDILLUSIONS says:
August 10, 2018 at 5:14 am
https://www.linkedin.com/pulse/coffee-brewing-theory-ian-bersten/

I think the author should read this. Ian Bersten

Reply