

**Does my Coffee Grinder  
affect my Coffee's Taste?**

**Scott Will**

Modern Process Equipment

# Presentation Outline

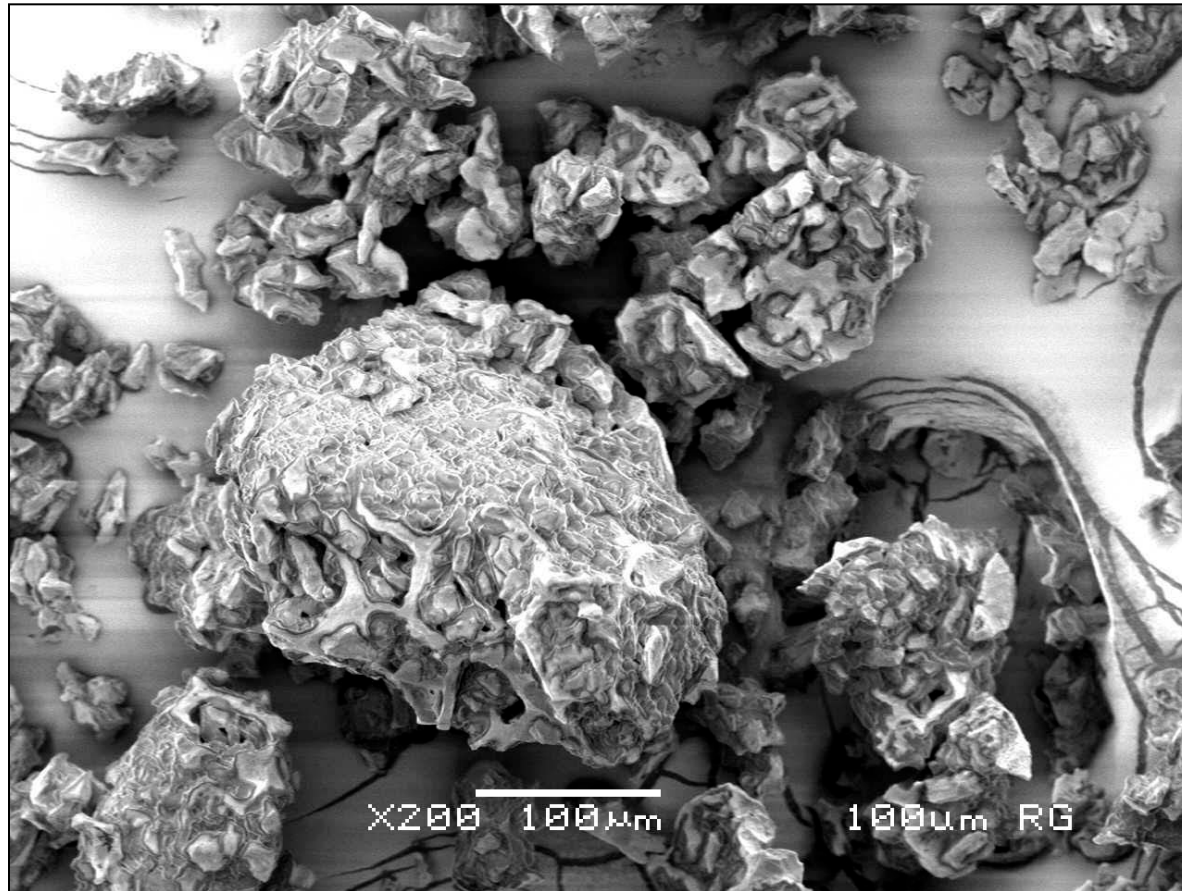
- What we are trying to Extract from the Bean
- Grind Size and it's part in Coffee Extraction
- Grinder Analysis
  - Blade Grinder
  - Cone Grinder
  - Roller Grinder



**Questions and  
Discussions**

This is a much magnified view of a ground coffee particle using an electron microscope.

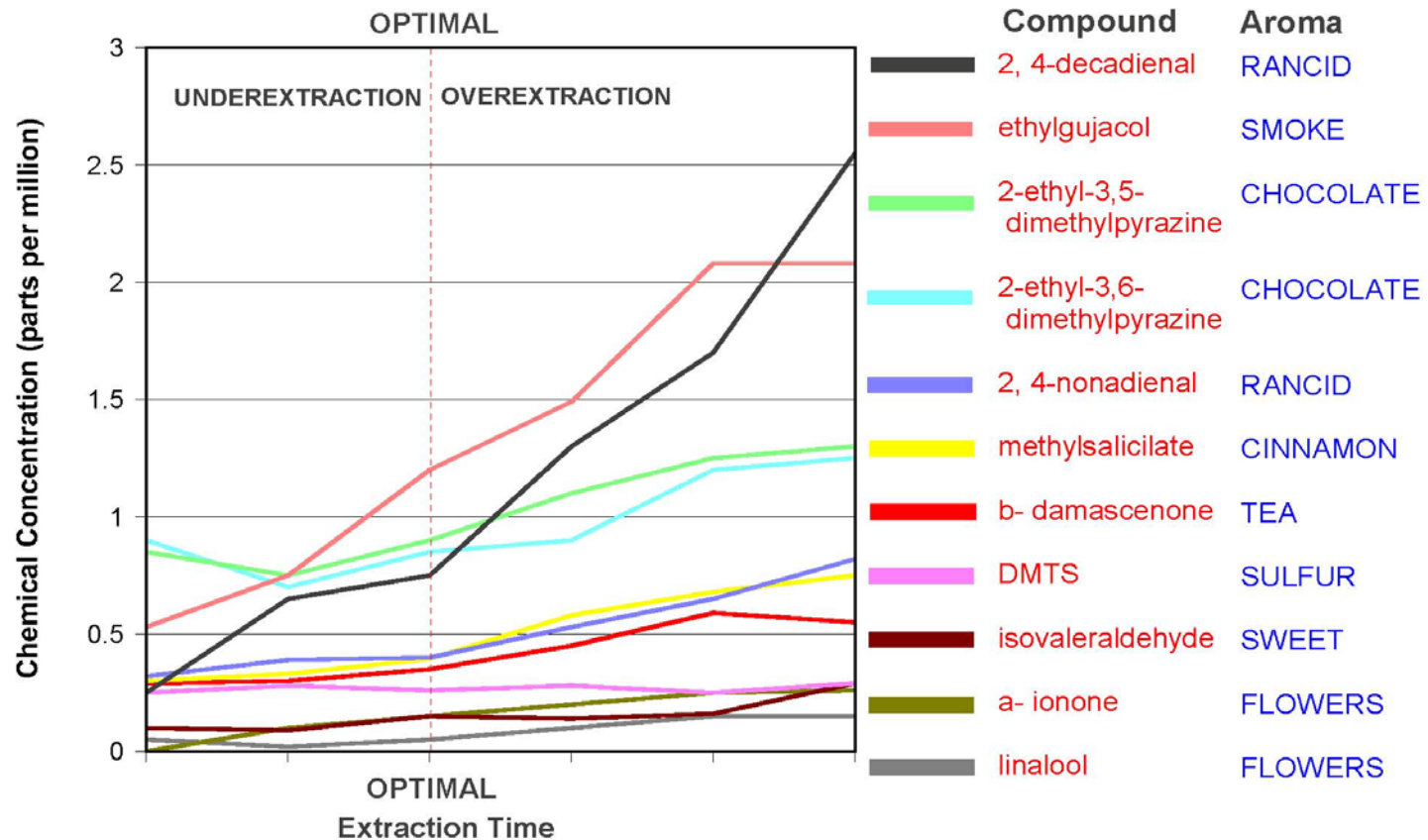
The cellular walls are about 30 microns in diameter, and the colloidal material fills the voids within the ground coffee and cellular structures. Part of this colloidal material is what we want to extract, but with a limit.



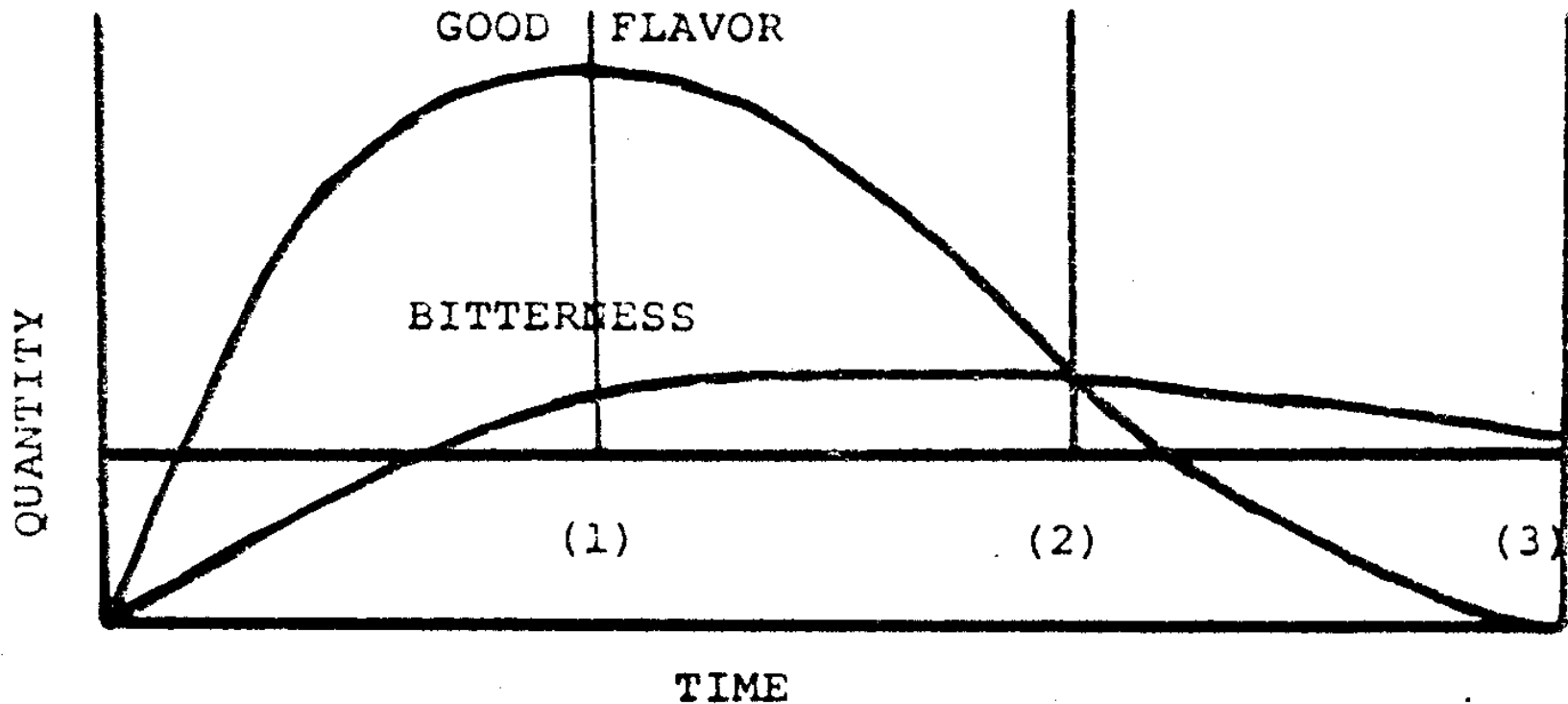
# Effect of Extraction Time on Taste

## Cumulative Chemical Composition of Brewed Coffee with Increased Extraction Time

The overextraction of brewed coffee (beyond the recommended brewing time) leads to the incorporation of undesirable and less soluble aromatic compounds into the drink (printed in blue).



# Effect of Cycle Time on Taste



# How do we obtain this “Optimal Extraction”?

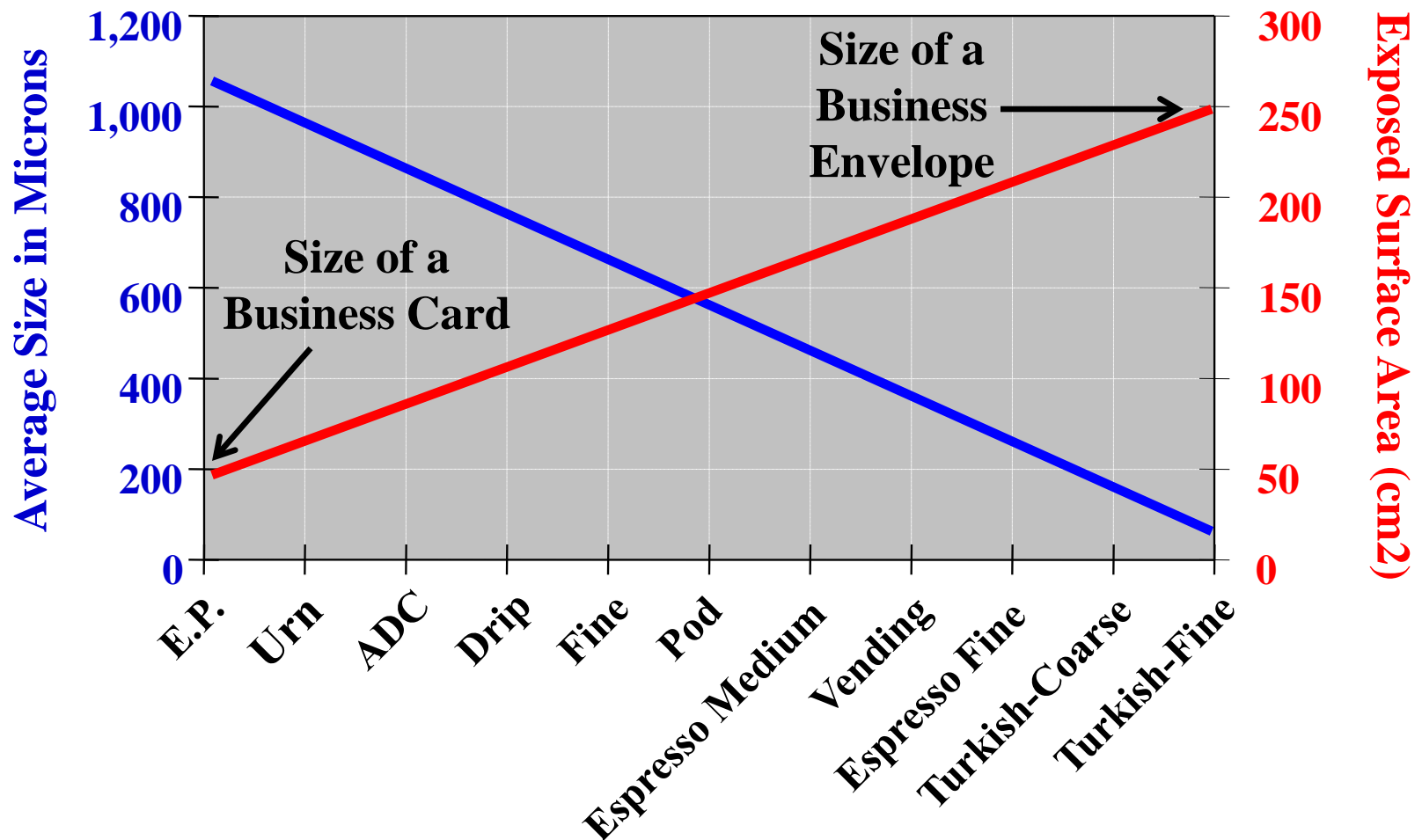
It Depends on the Brew Method, but Optimal Extraction is always a function of:

1. **Grind Size**
  2. **Grind Uniformity**
  3. **Hot Water Exposure Time**
  4. Amount of Coffee Used when brewing
- 
- A dashed blue bracket is positioned to the right of the first three items of the list, grouping them together. It consists of a horizontal dashed line at the top, a vertical dashed line on the right, and a horizontal dashed line at the bottom, with small arrows pointing left towards each item.

# Average Size vs. Surface Area

(1 Bean = 3.4 cm<sup>2</sup> = Size of a Postage Stamp)

**Surface Area Increases as Brewing Time Decreases!**



# Grind Technical Points

- The rate of soluble solids extraction is directly related to the amount of exposed surface area to the hot water.

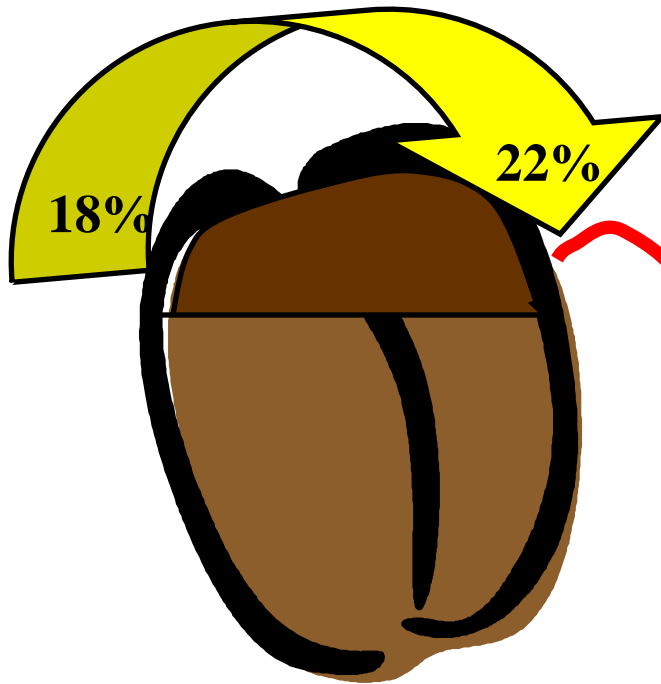
*Think of how sugar dissolves into water.*

- Fine Sugar – Quick Dissolution
- Coarse Granular Sugar – Slow Dissolution

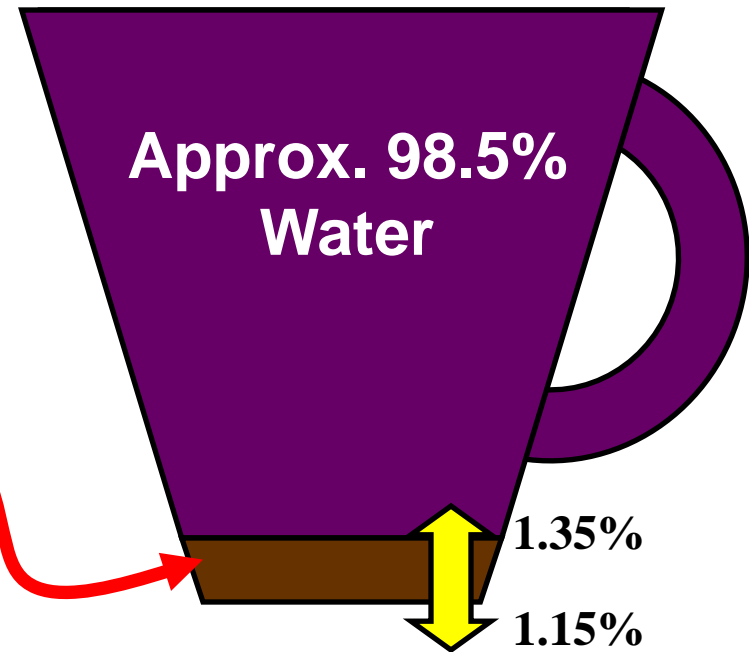
- If particle size, uniformity, brewing time, and amount of coffee used are matched correctly, one can achieve an optimal 20% extraction.



# Proper Extraction and Strength

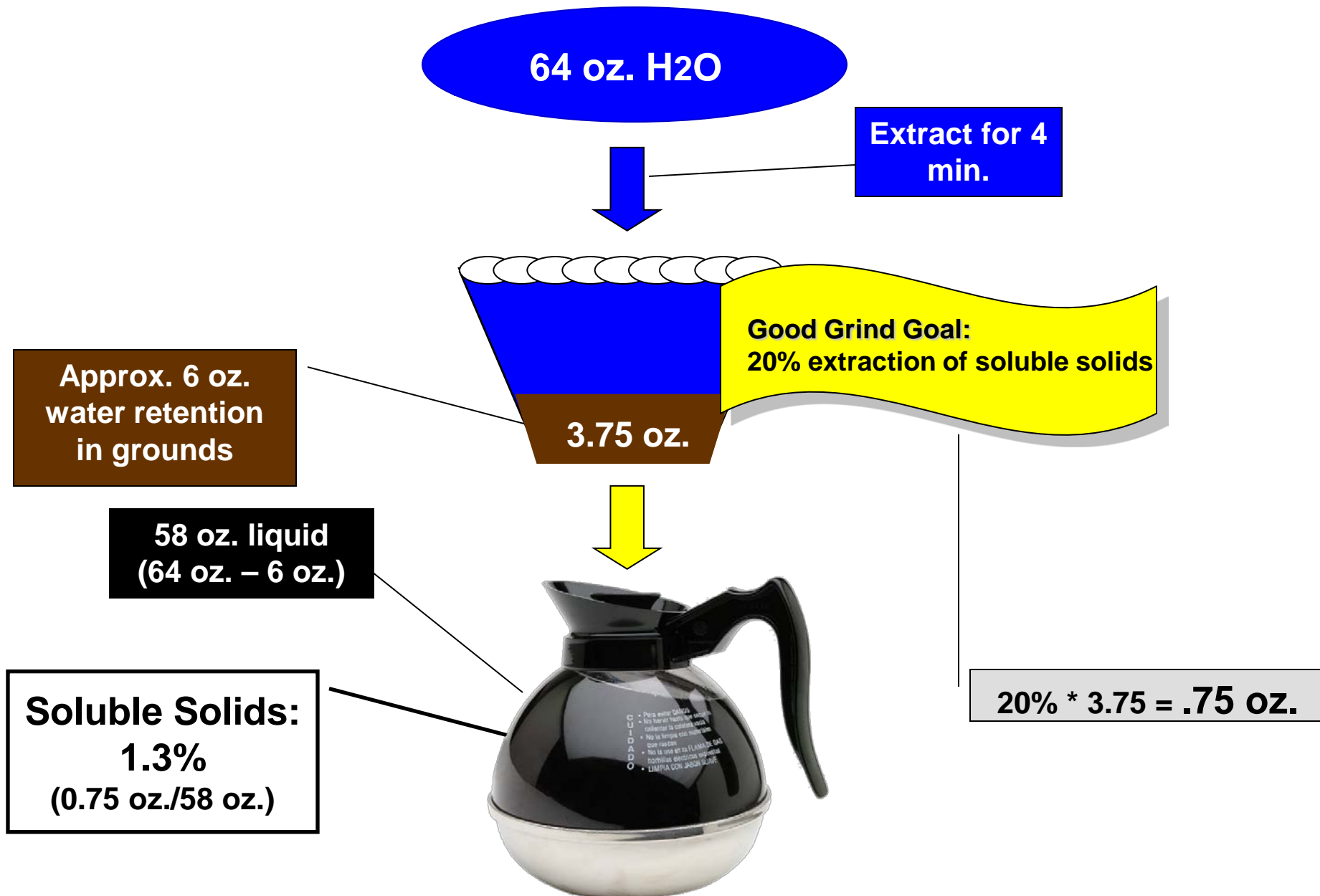


**Ideal Extraction of the  
coffee particle's soluble  
solids is 18-22%**

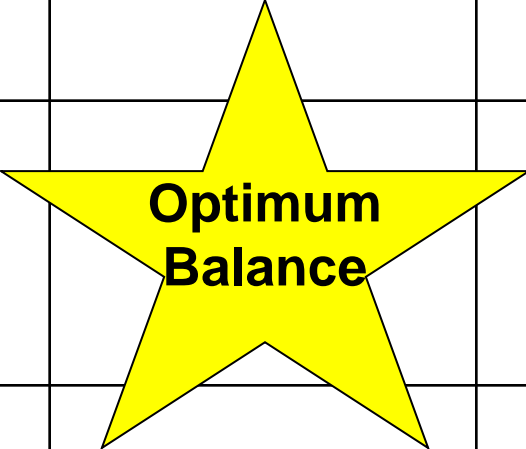


**Ideal Brew Strength  
is 1.15-1.35%  
brewed solids**

# Macro Grind Challenge



# Ideal Matrix of Grind vs. Time

		Grind		
		Coarse	Optimal	Fine
Brew Times	Excessive	Strong Under-Developed	Strong	Strong Bitter
	Optimal	Under-Developed	 Optimum Balance	Bitter
	Too Short	Weak Under-Developed	Weak	Weak Bitter

**Brewed Coffee Taste Profiles**

# Macro Analysis of Extraction

## Filter Basket Brewer

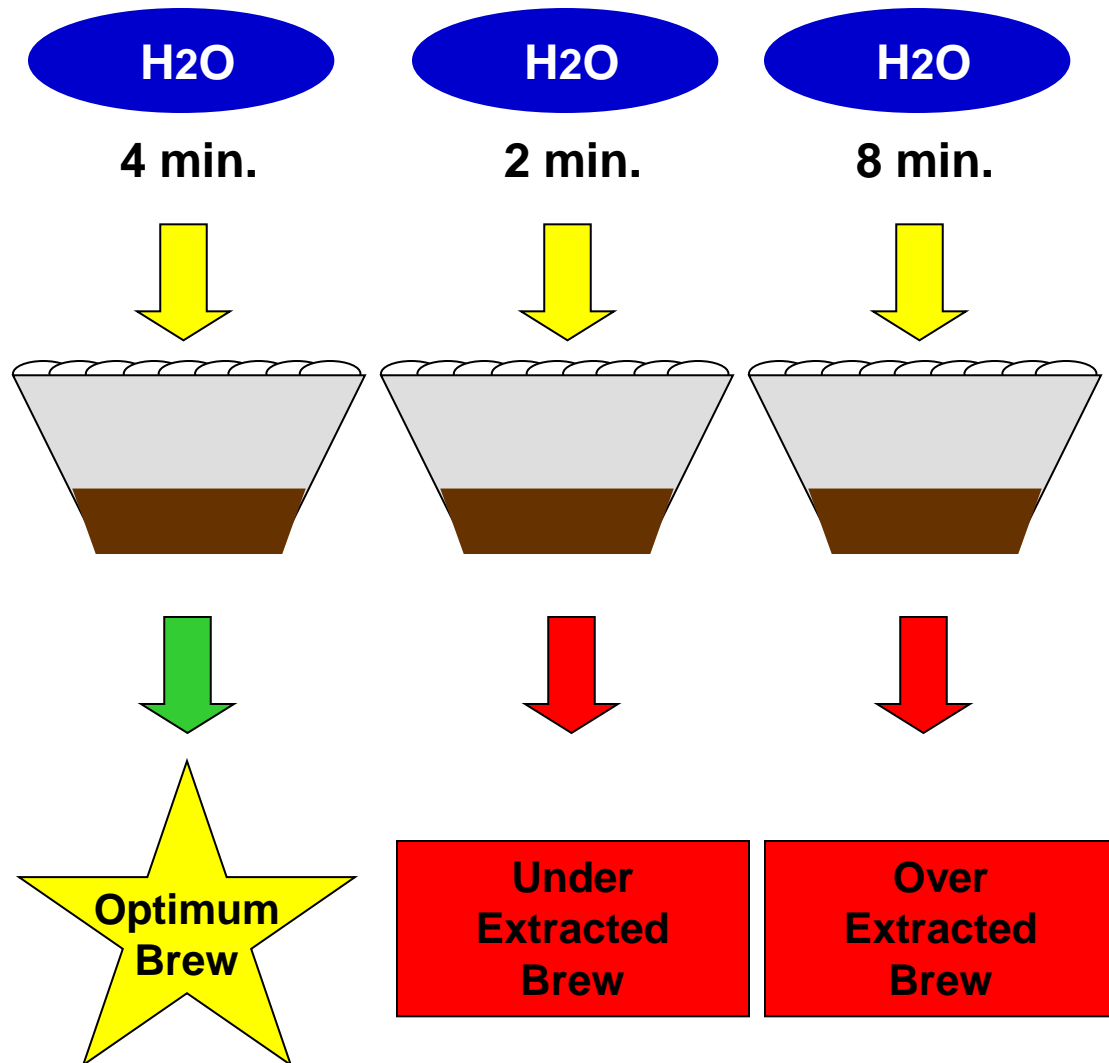
*850 um grind*

By the “Gold Cup”  
Brewing Standard:

**-64 oz. of water**  
**(8 cups), requires**

**-3.25–4.25 oz. of coffee**  
**(92-120 grams)**

This translates to around  
**2 heaping spoons** of  
coffee per cup of water.



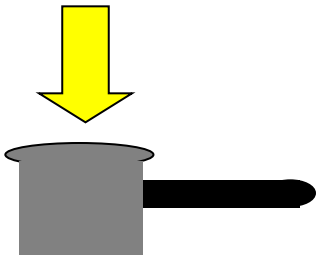
# Macro Analysis of Extraction

## Espresso Brewer

*225 um grind*

H<sub>2</sub>O

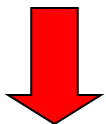
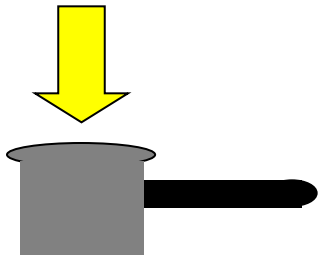
20 sec.



Optimum  
Brew

H<sub>2</sub>O

1 min.



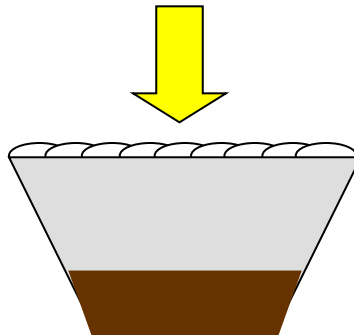
Over  
Extracted  
Brew

## Filter Basket Brewer

*850 um grind*

H<sub>2</sub>O

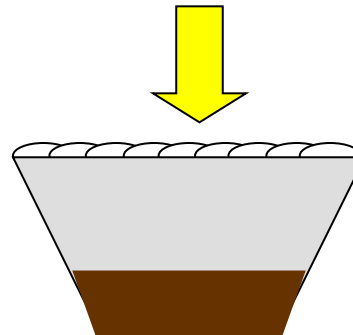
4 min.



Optimum  
Brew

H<sub>2</sub>O

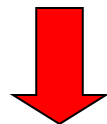
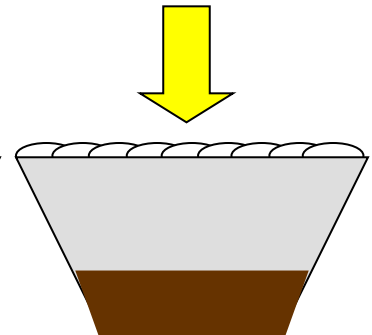
2 min.



Under  
Extracted  
Brew

H<sub>2</sub>O

8 min.



Over  
Extracted  
Brew

# Grinder Analysis Comparison



**Mr. Coffee  
Blade Grinder**



**Capresso  
Cone  
Grinder**



**MPE  
Roller  
Grinder**

# The Ro-Tap Method

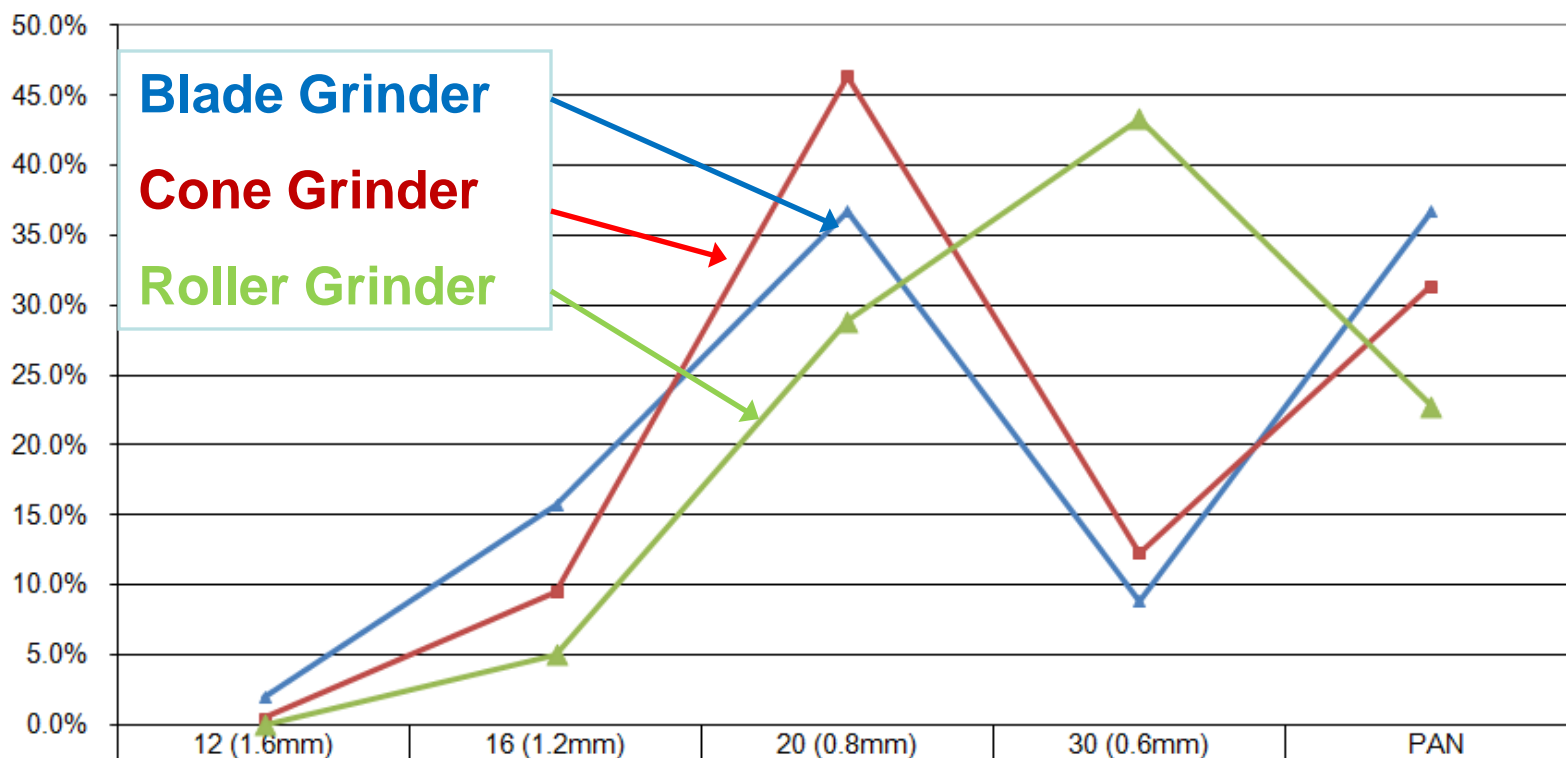


# Ro-Tap Particle Size Comparison

**Modern Process Equipment**  
Ground Coffee Particle Size Testing  
Whole Bean Arabica, Medium-Dark Roast  
Target: Filter Grind Size

Chart Area

% Retained (Non-Cumulative)



Blade Grinder	2.0%	15.7%	36.7%	8.9%	36.7%
Cone Grinder	0.5%	9.5%	46.4%	12.3%	31.4%
Roller Grinder	0.0%	5.0%	28.9%	43.4%	22.8%

RoTap Screen Size (US Series)

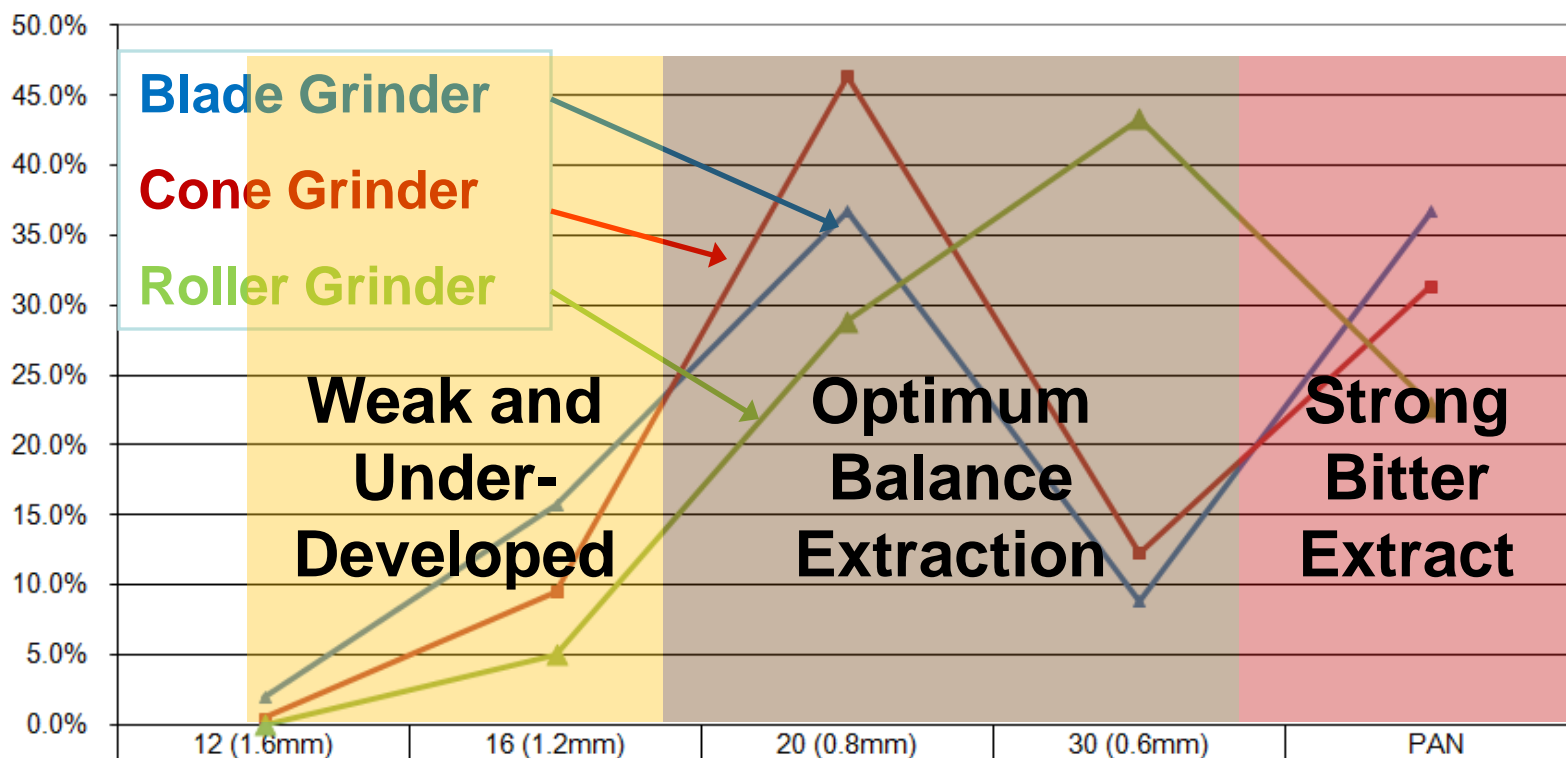


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RoTap Screen Size (US Series)

# Takeaway Points

## 1. Achieve a Uniform Grind Size

- Roller Grind (Store Purchased Ground Coffee),
- Cone or Burr Grind if ground at home,
- Avoid Blade Grinders

## 2. Configure the Grind Size for the Brew Method

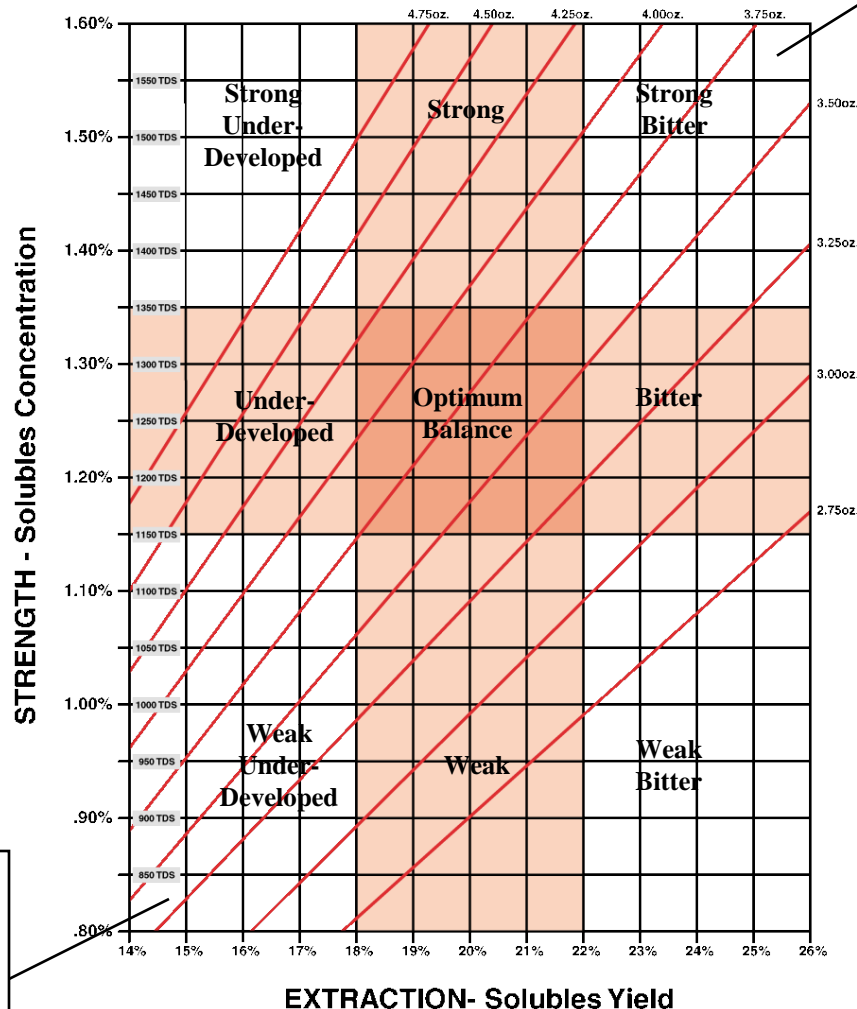
- Espresso (0.2 – 0.3 mm average, sand size)
- Filter (0.6 - 0.9 mm average)
- French Press (~1.0-1.2 mm average)

## 3. Use the appropriate amount of coffee to control the brew strength

# The “Gold Cup” Standard Calculation

## COFFEE BREWING CONTROL CHART

Brewing Ratio: Ounces per Half-Gallon



Too Fine so  
Extraction  
Rate  
Too High

## How do we calculate brewed solids?

1. Use 64 oz. of water for brewing
2. Subtract water absorbed in coffee grounds (6 fl/oz.)
3. Use 3.75 oz. of ground coffee to extract 20% solids
4. Brew to “Gold Cup” Standard that will extract 20% of solids:  
 $20\% \times 3.75 \text{ oz.} = 0.75 \text{ oz.}$
5. Calculate brewed solids as percentage of liquid:  
 $0.75 \text{ oz.} / 58 \text{ oz.} = 1.3\%$

Too Coarse  
so  
Extraction  
Rate  
Too Low

# Evaluation of the same grind (average particle size) but different uniformities

Particle Size/Particle Uniformity:

645  $\mu\text{m}$ /1.35  $\sigma$  (Good Quality Grind)

650  $\mu\text{m}$ / 3.0  $\sigma$  (Poor Quality Grind)

## COFFEE BREWING CONTROL CHART

Brewing Ratio: Ounces per Half-Gallon

