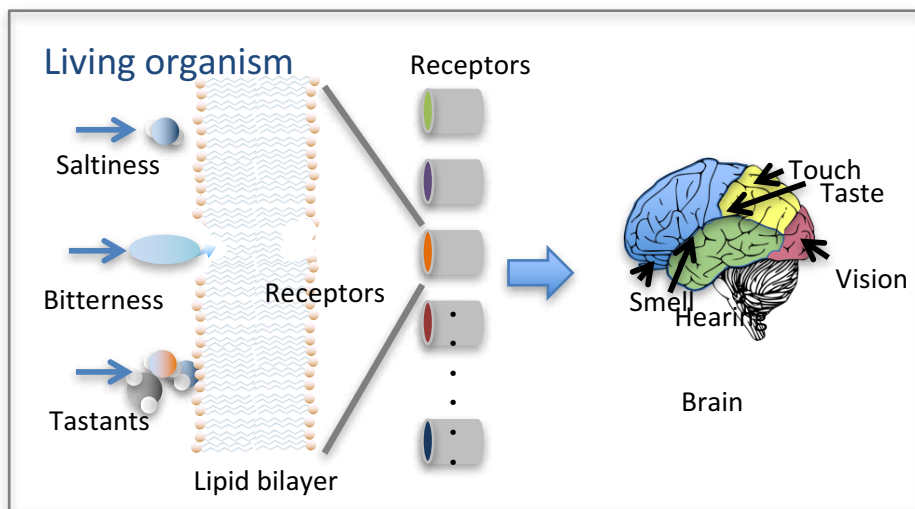


Taste Sensing System and Coffee Application

insent
Taste Sensing System
TS-5000Z

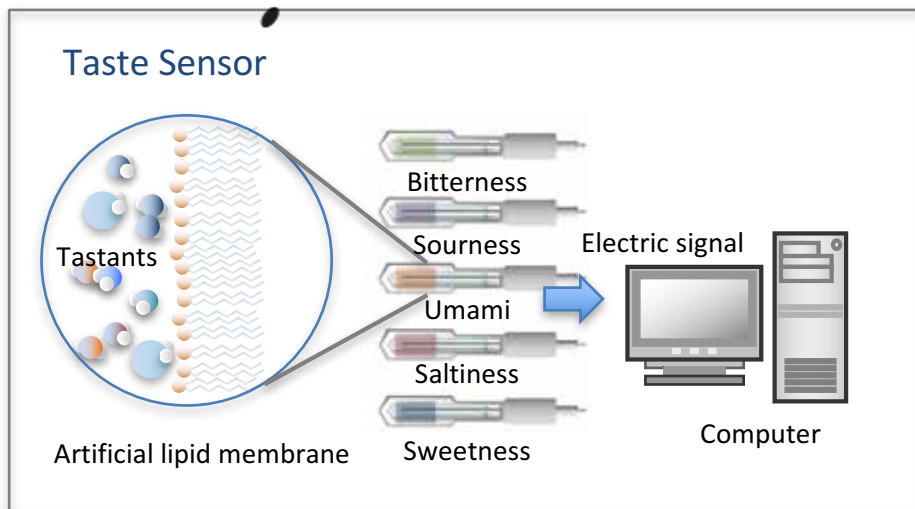


Concept of Taste Sensing System



Human

Taste substances are received at taste receptors and change a membrane potential. The electric signal transfers to brain and recognizes as a taste.



Taste sensor

Artificial taste receptors composed of lipids and polymers receive taste substances and change its membrane potential. Each sensor was designed to have high selectivity for each basic taste, and the electric signal is analyzed by computer.

Taste Sensing System

Multichannel sensors detect various taste



Autosampler
Arm with taste sensors automatically moves to a sample.



Pin jack terminal

Sensor probe

Artificial lipid membrane

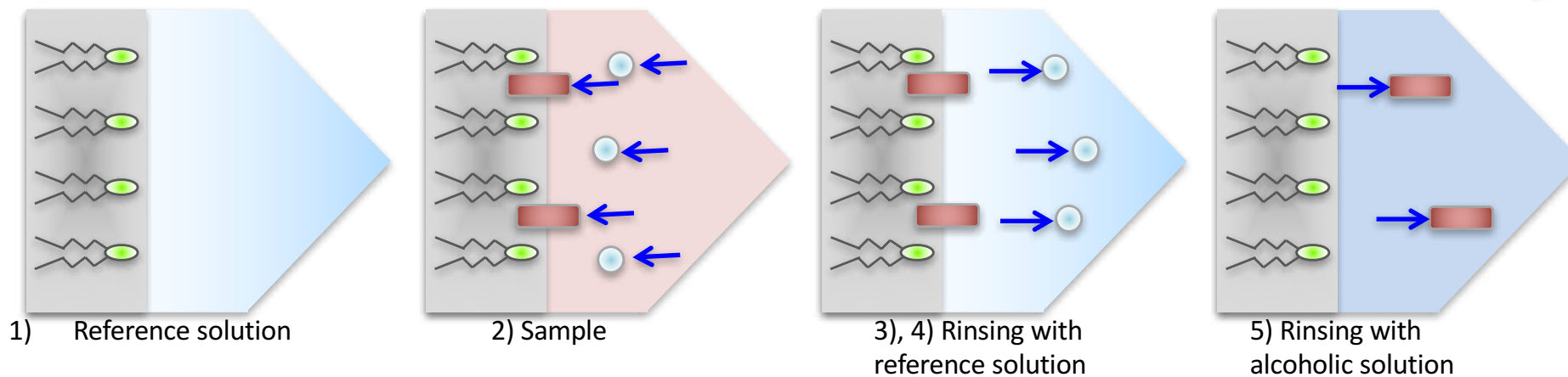
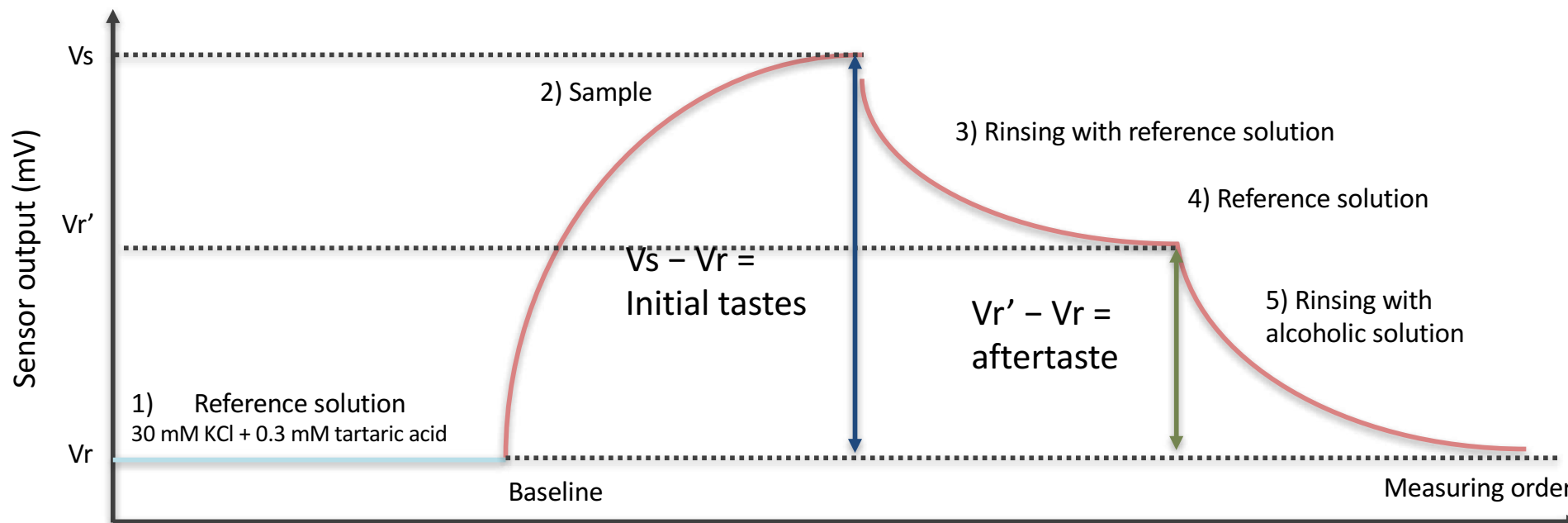
Ag/AgCl electrode


Inner solution


Taste Sensing System:

- the same sensitivity as human threshold
- high selectivity for each basic taste
- interaction among taste substances
- digitization of taste information
- koku, sharpness and aftertaste

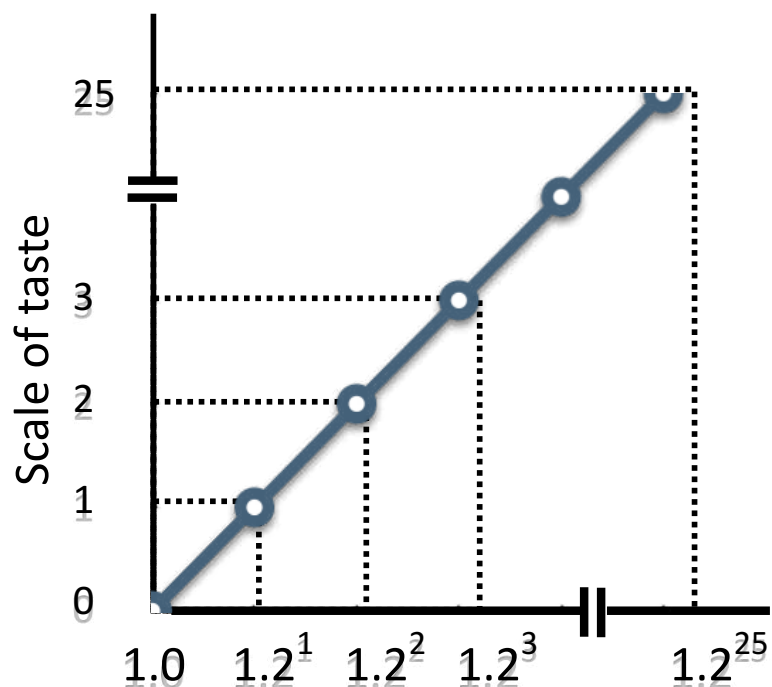
Measurement Timeline



 Hydrophobic molecules such as bitter and astringent compounds

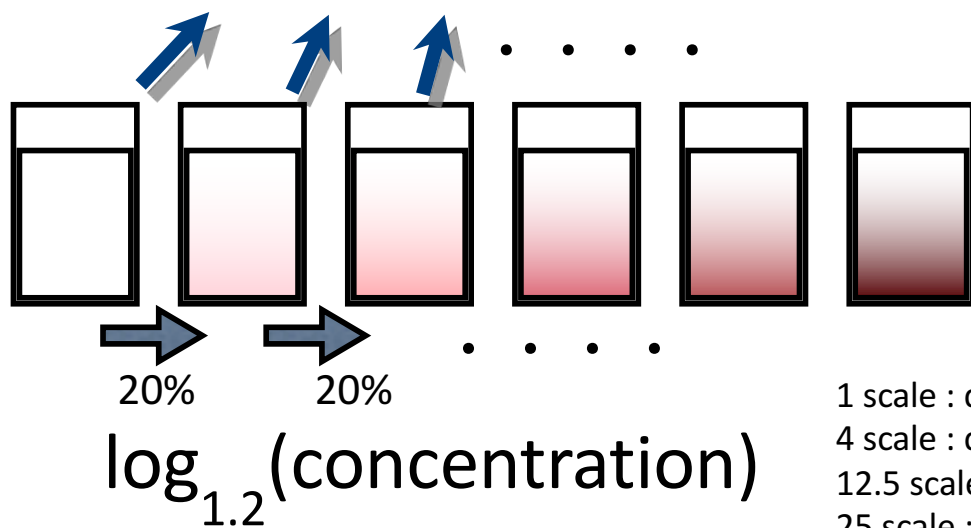
 Hydrophilic molecules such as salty and sour substances

Digitalization of Taste



Weber-Fechner's law describes the human perception of various stimuli.

Responses in the gustatory receptors of many animals increase linearly with the logarithmic concentration of the solution.



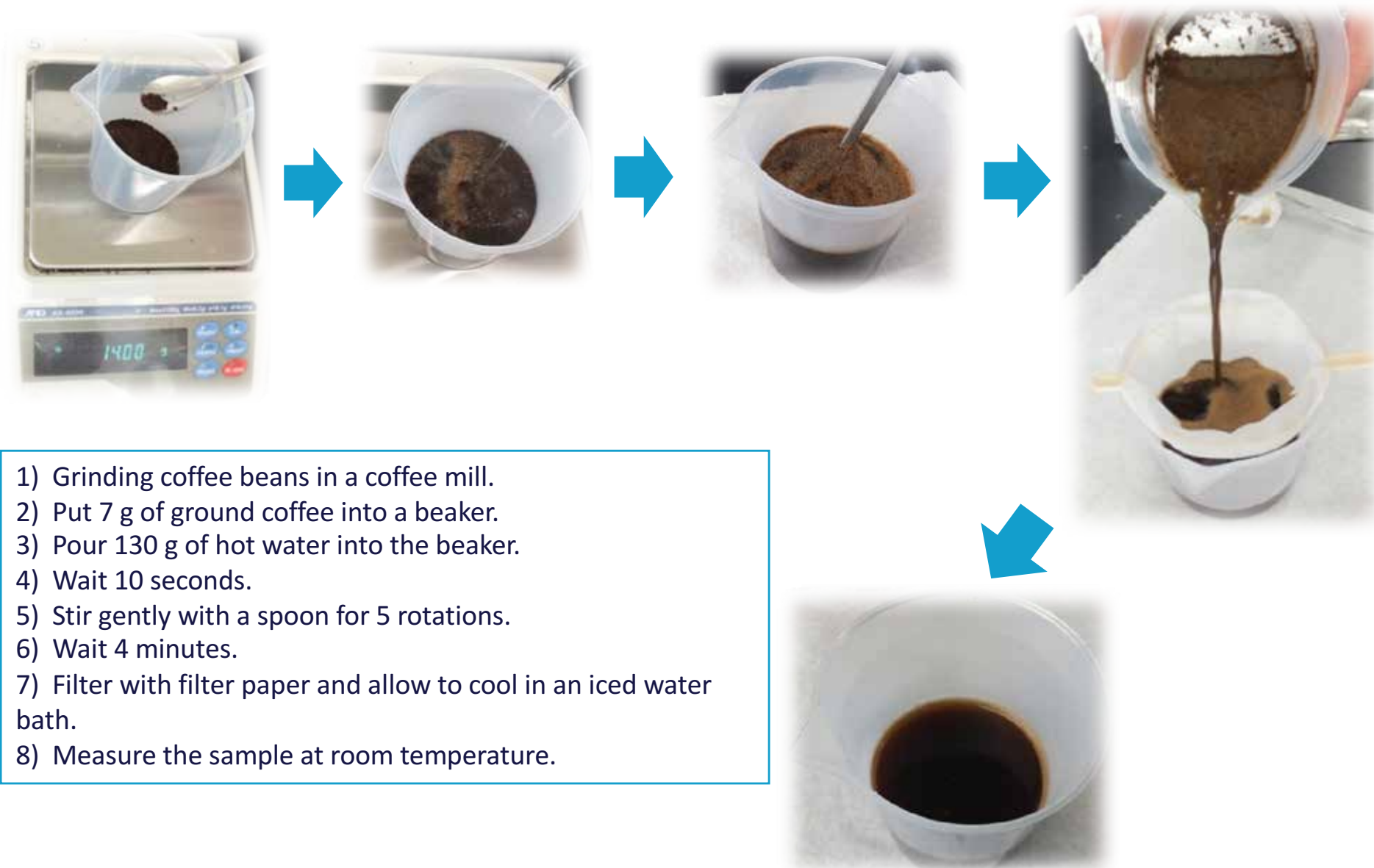
- 1 scale : difference in concentration by a factor of 1.2 ($=1.2^1$)
- 4 scale : difference of concentration by a factor of 2 ($=1.2^4$)
- 12.5 scale : difference of concentration by about a factor of 10
- 25 scale : difference of concentration by about a factor of 100

Taste Qualities Available From The Taste Sensor : Coffee Sample

Sensor	Coffee taste	
	Initial taste	Aftertaste
Umami (AAE)	Umami not so often used in coffee assessment	Aftertaste of umami
Saltiness (CT0)	Body	NA
Sourness (CA0)	Acidity good index for coffee	NA
Bitterness (C00)	Initial taste good index for coffee	Aftertaste lasting taste, richness
Astringency (AE1)	Initial taste	Aftertaste

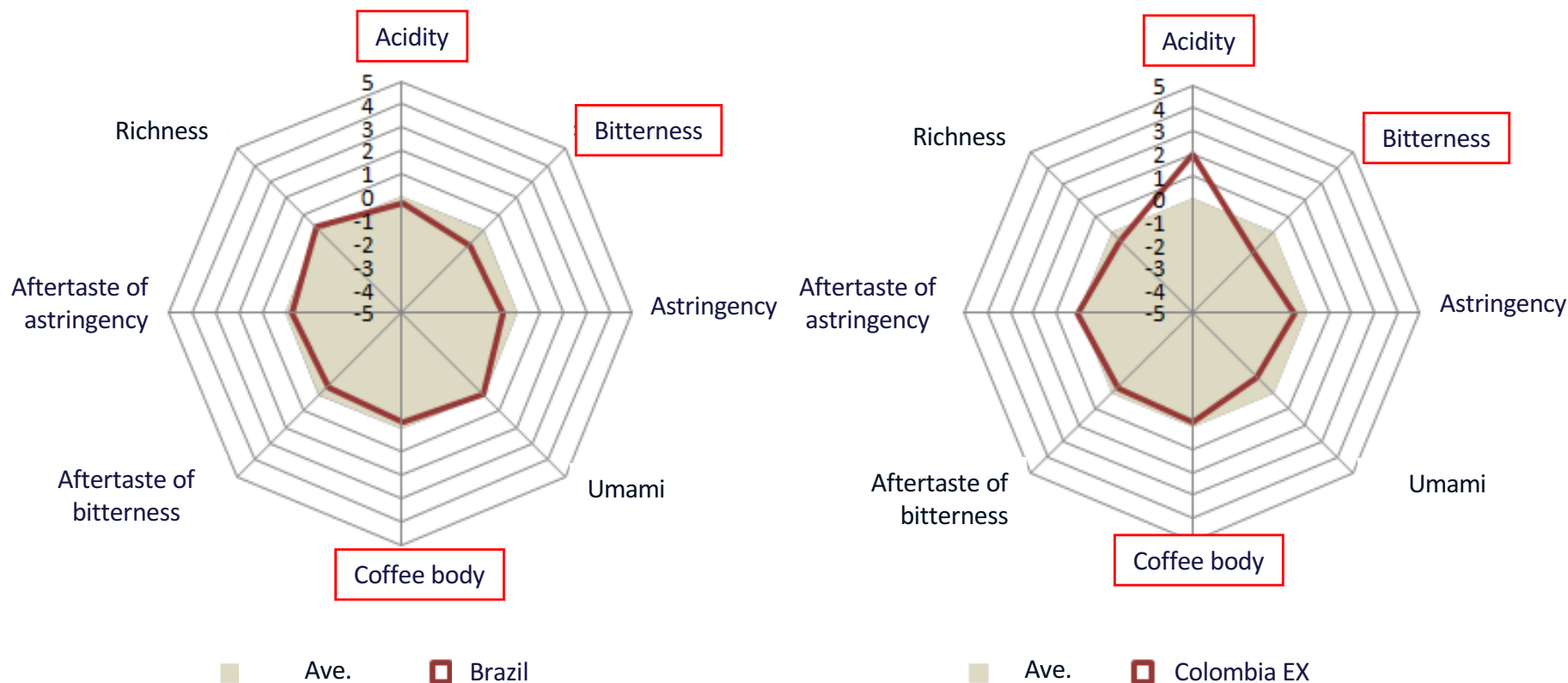
Green : blended membrane, Red: positively charged membrane

Sample Preparation of Ground Coffee

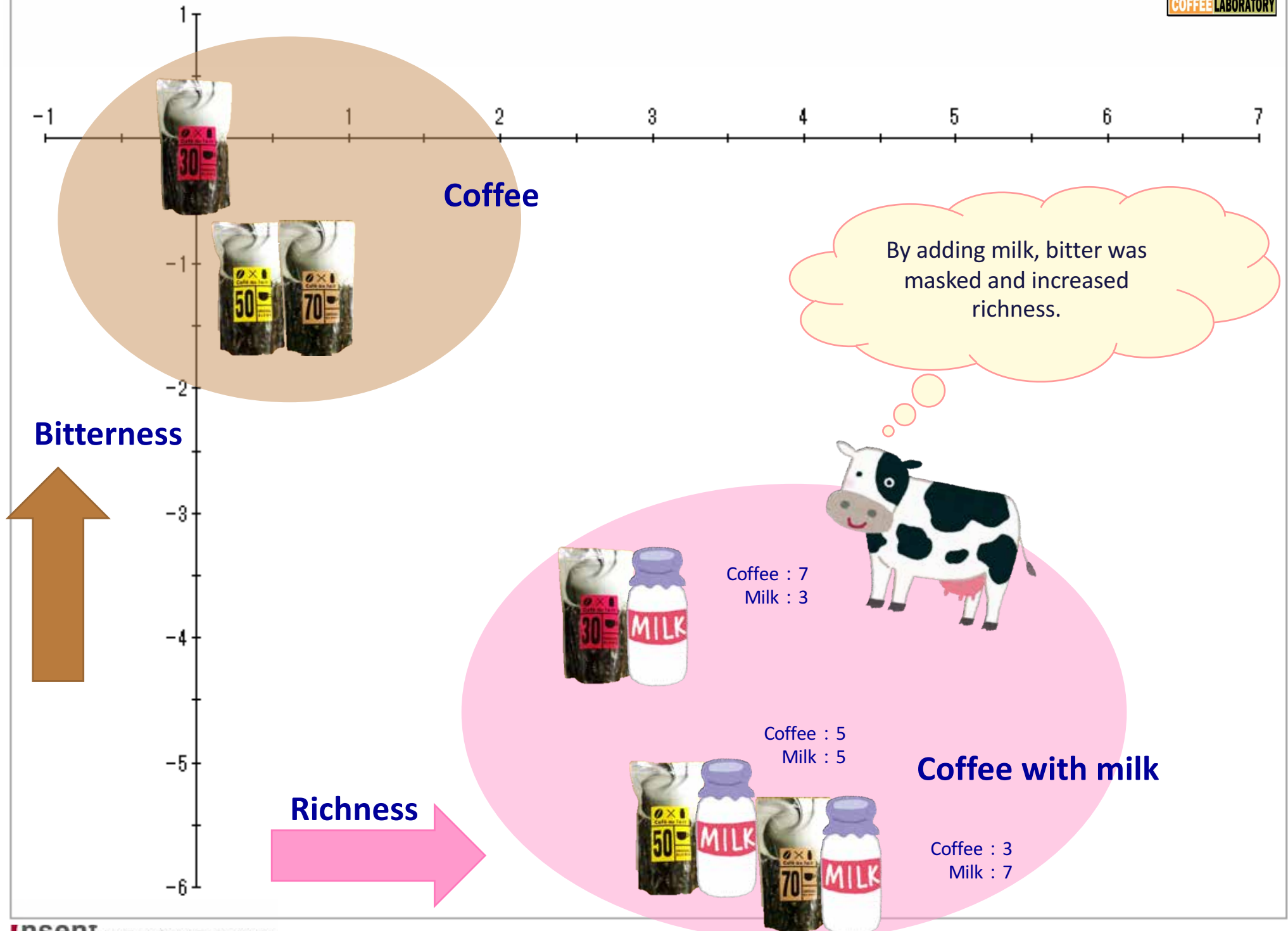


- 1) Grinding coffee beans in a coffee mill.
- 2) Put 7 g of ground coffee into a beaker.
- 3) Pour 130 g of hot water into the beaker.
- 4) Wait 10 seconds.
- 5) Stir gently with a spoon for 5 rotations.
- 6) Wait 4 minutes.
- 7) Filter with filter paper and allow to cool in an iced water bath.
- 8) Measure the sample at room temperature.

How to interpret the result



- ◆ Bitterness → coffee bitterness
- ◆ Astringency → coffee astringency
- ◆ Saltiness → coffee body



Optimization of coffee taste and price

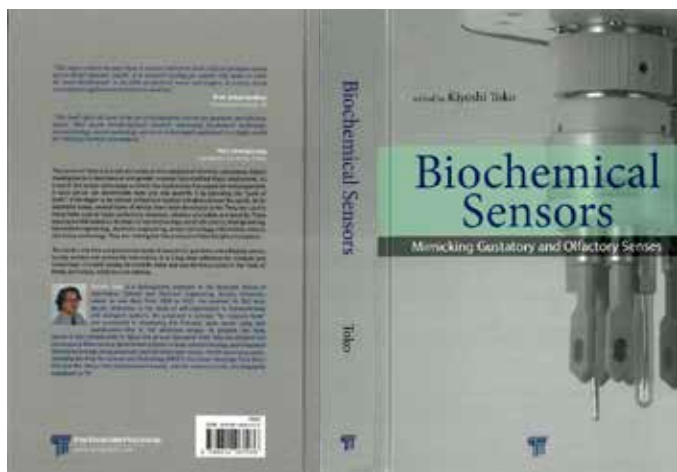
Development efficiency and cost reduction

Taste database with taste sensing system

- (1) Coffee beans price and taste data
- (2) Target product and taste
- (3) Calculation of minimal cost

→ 10% cost reduction on average

→ Reduction of the number of beans



Biochemical Sensors edited by K. Toko,
Pan Stanford Publishing (2013)

Science and Technology to
Produce Deliciousness of
Foods/Medicines and Ensure
the Safety (2012) CMC
Publishing



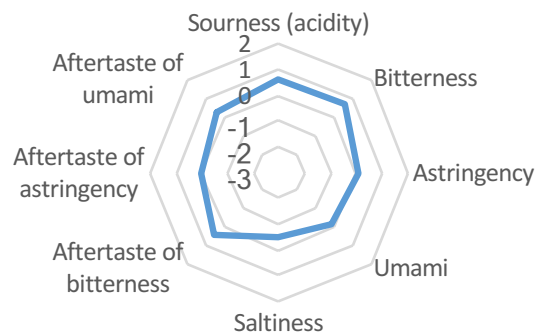
Blending Coffee with Optimization Software

Targeting Blue Mountain coffee

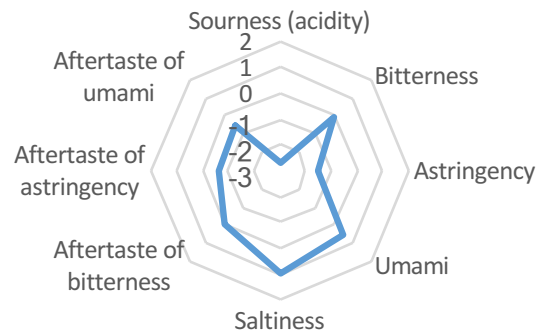
	Acidity	Bitterness	Astringency	Umami	Saltiness	Aftertaste of bitterness	Aftertaste of astringency	Aftertaste of umami
Blue Mountain No.1 (L:20)	0	0	0	0	0	0	0	0
Colombia (EXC) (L:18.5)	0.61	0.68	0.08	-0.11	-0.49	0.49	0.02	0.35
Brazil No.2 (L:18.5)	-2.65	-0.07	-1.57	0.47	0.99	-0.04	-0.63	-0.55
Brazil No.2 (L:20)	-0.61	-0.7	-0.63	0.1	-0.14	-0.53	-0.29	0.11
Brazil No.2 (L:21)	1.3	-1.19	0.16	-0.19	-0.92	-0.48	0.17	0.62
Blended	0.18	0.13	-0.09	-0.06	-0.74	-0.11	-0.14	0.12

	L value	Bleded ratio (%)
Colombia	18.5	49.9
Brazil	18.5	20.3
Brazil	20	7.4
Brazil	21	22.5

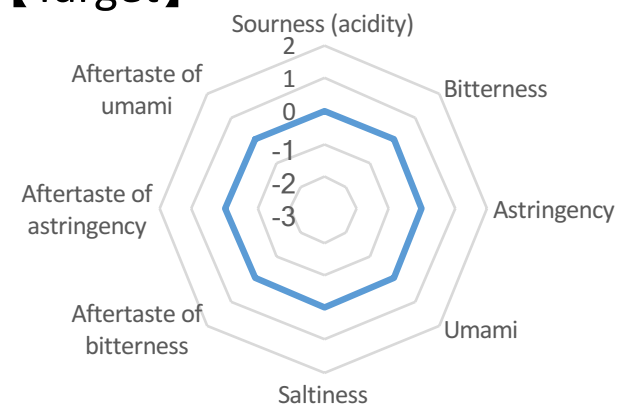
Colombia (EXC) (L:18.5)



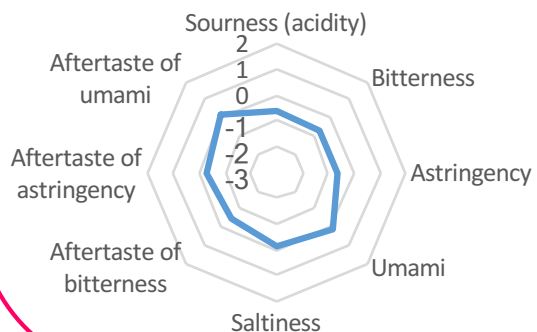
Brazil No.2 (L:18.5)



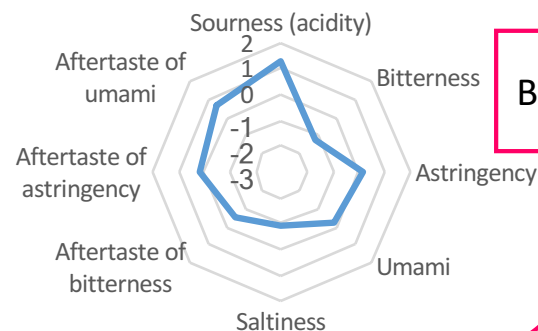
【Target】



Brazil No.2 (L:20)

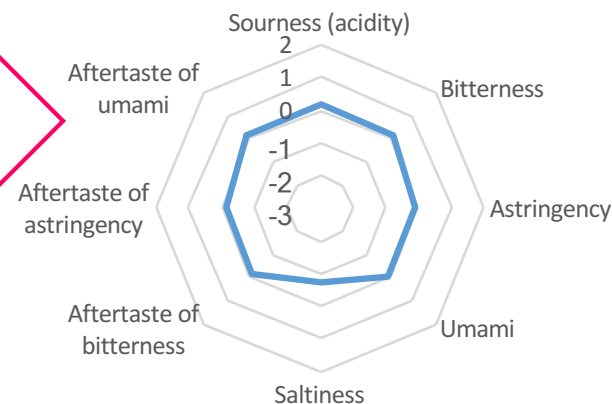


Brazil No.2 (L:21)

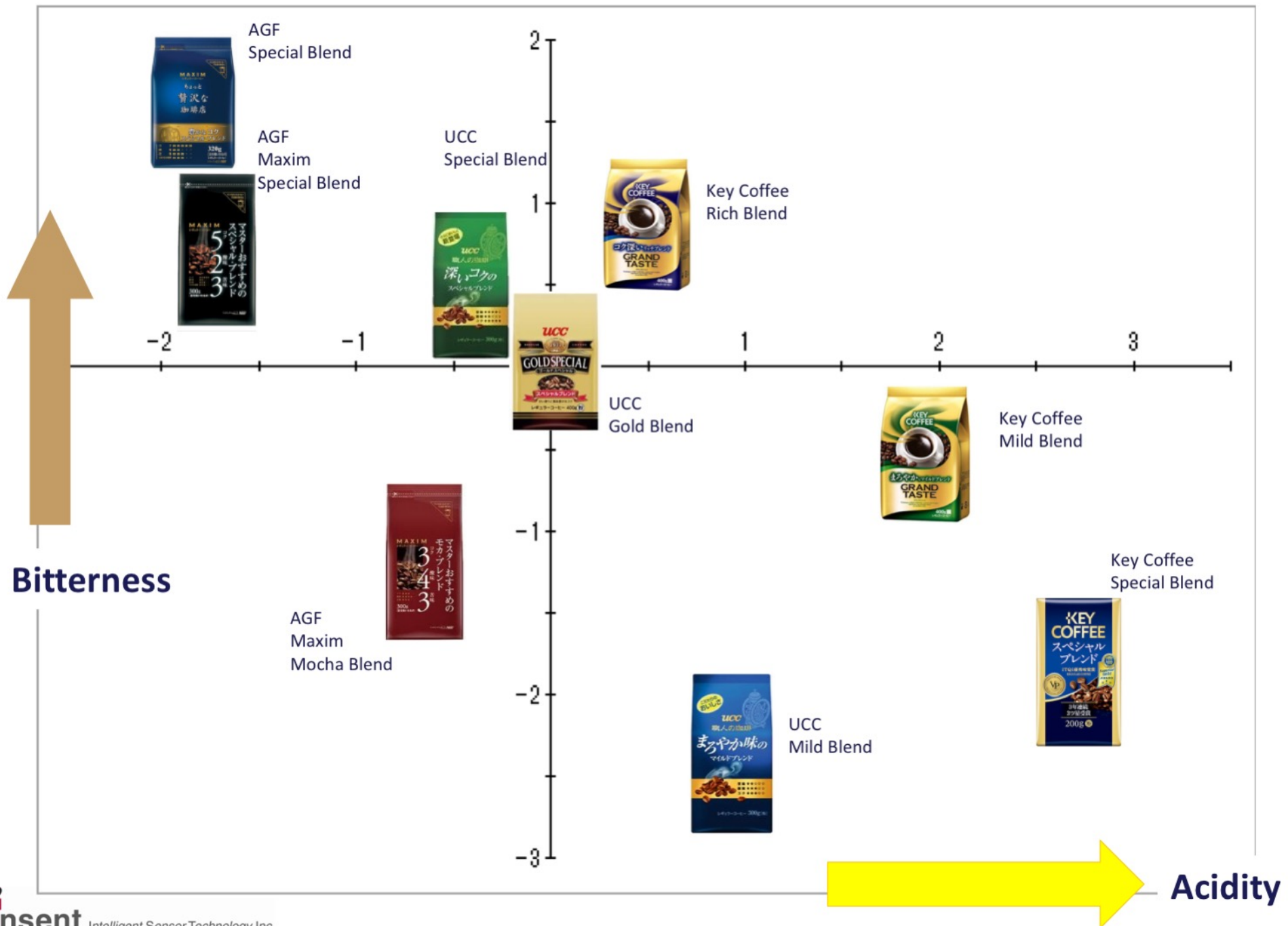


Blended

【Final result】



Ground Coffee Taste Map

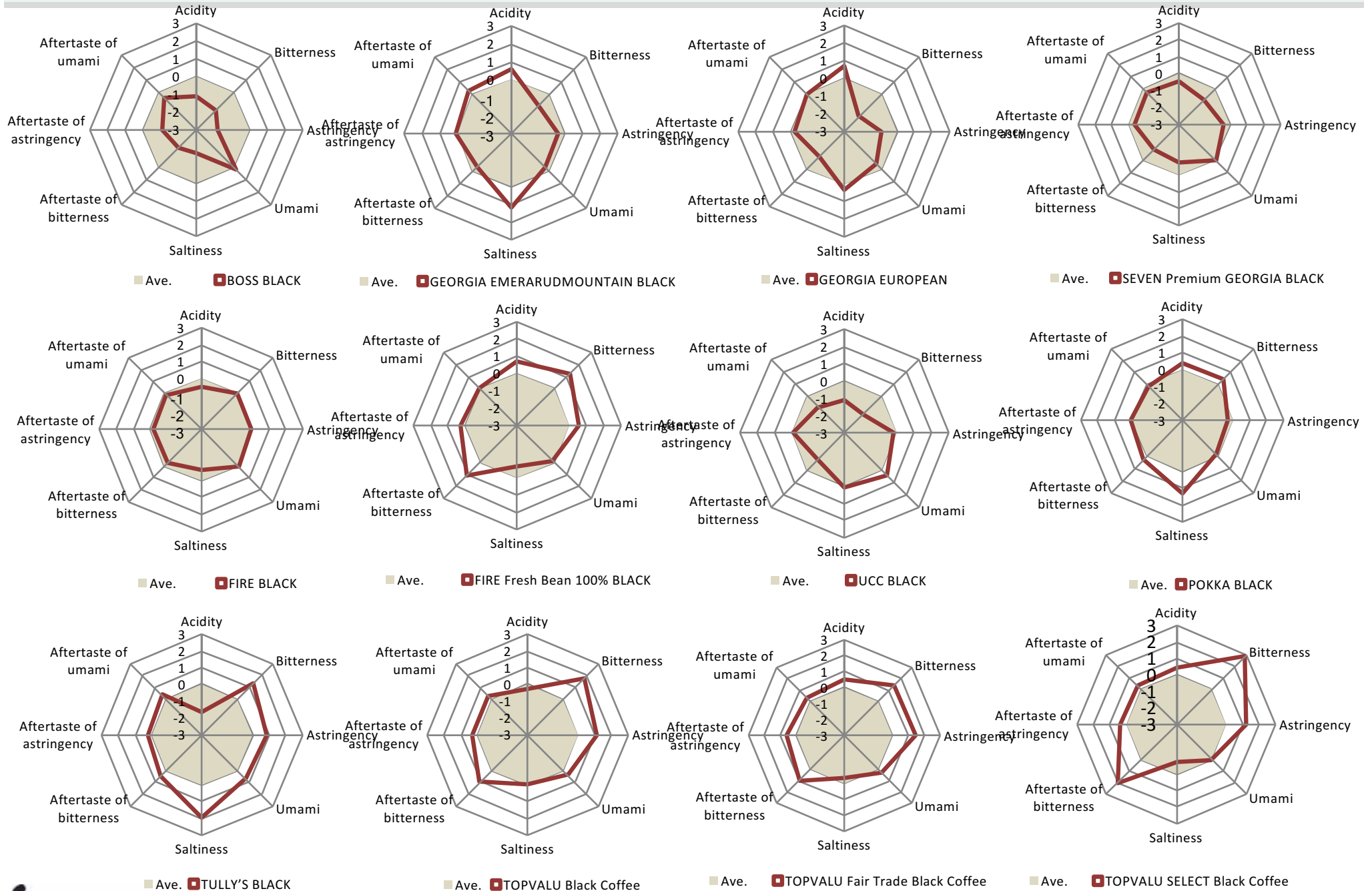


Bitterness



Feb. 2016

Canned Coffee Taste Profile

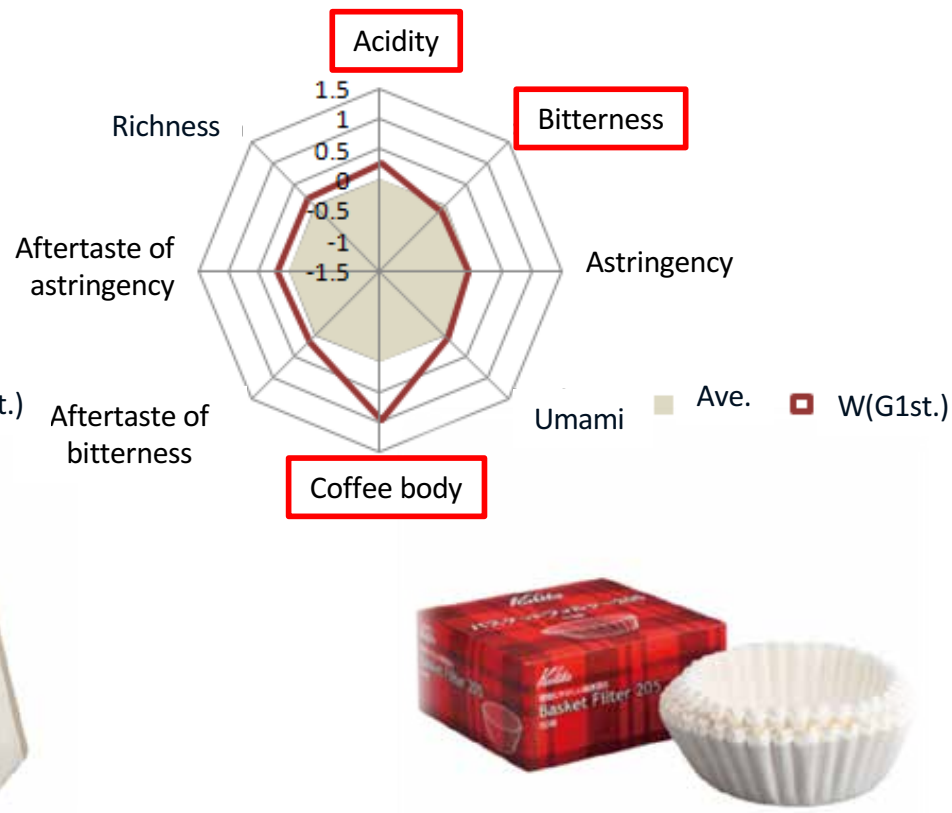


Difference in Paper Filter

< Standard filter >



< Waved filter >

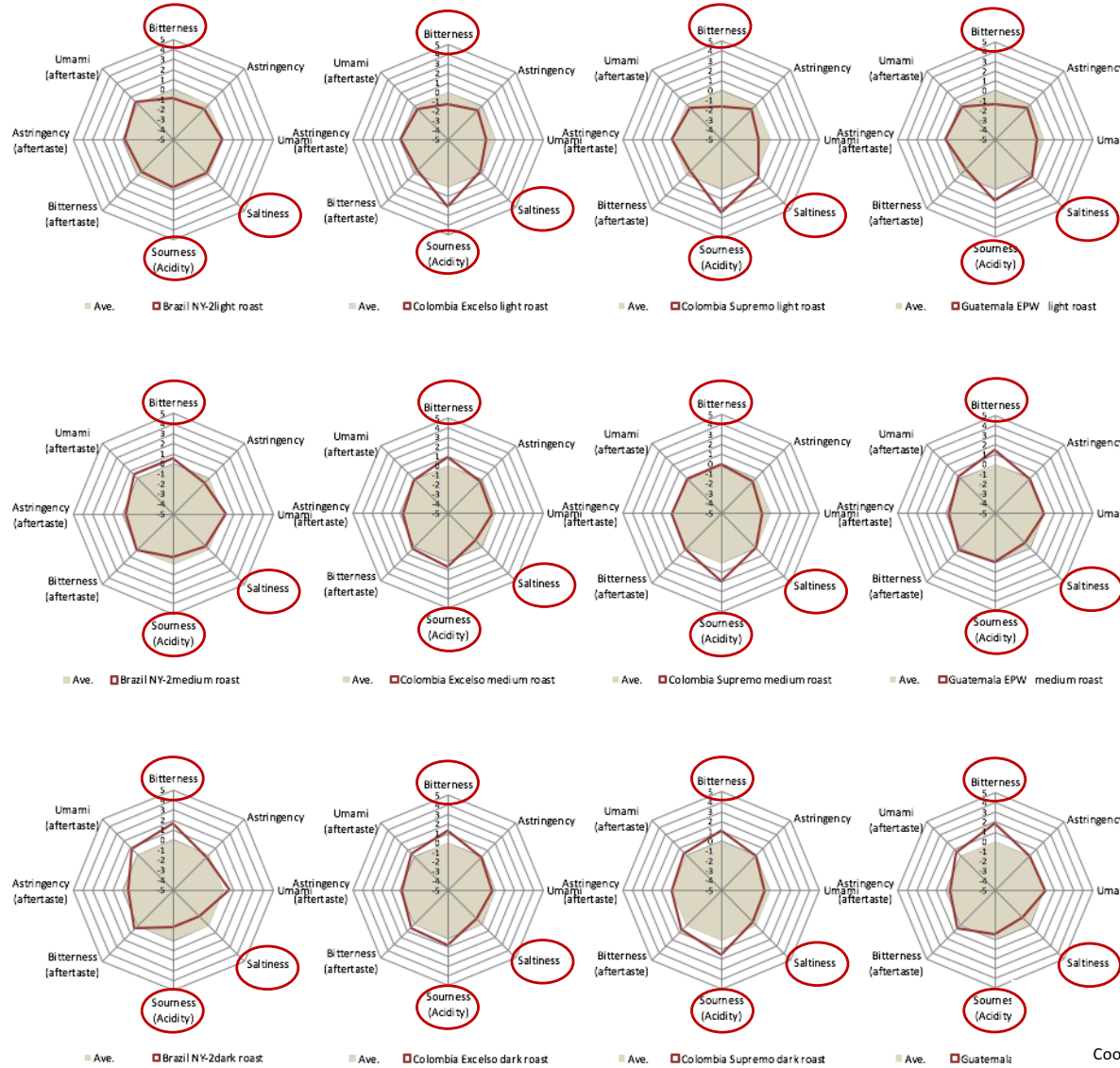


Same coffee
Same paper material
Brewed with KW102

Paper filters were provided by Kalita Co., Ltd.

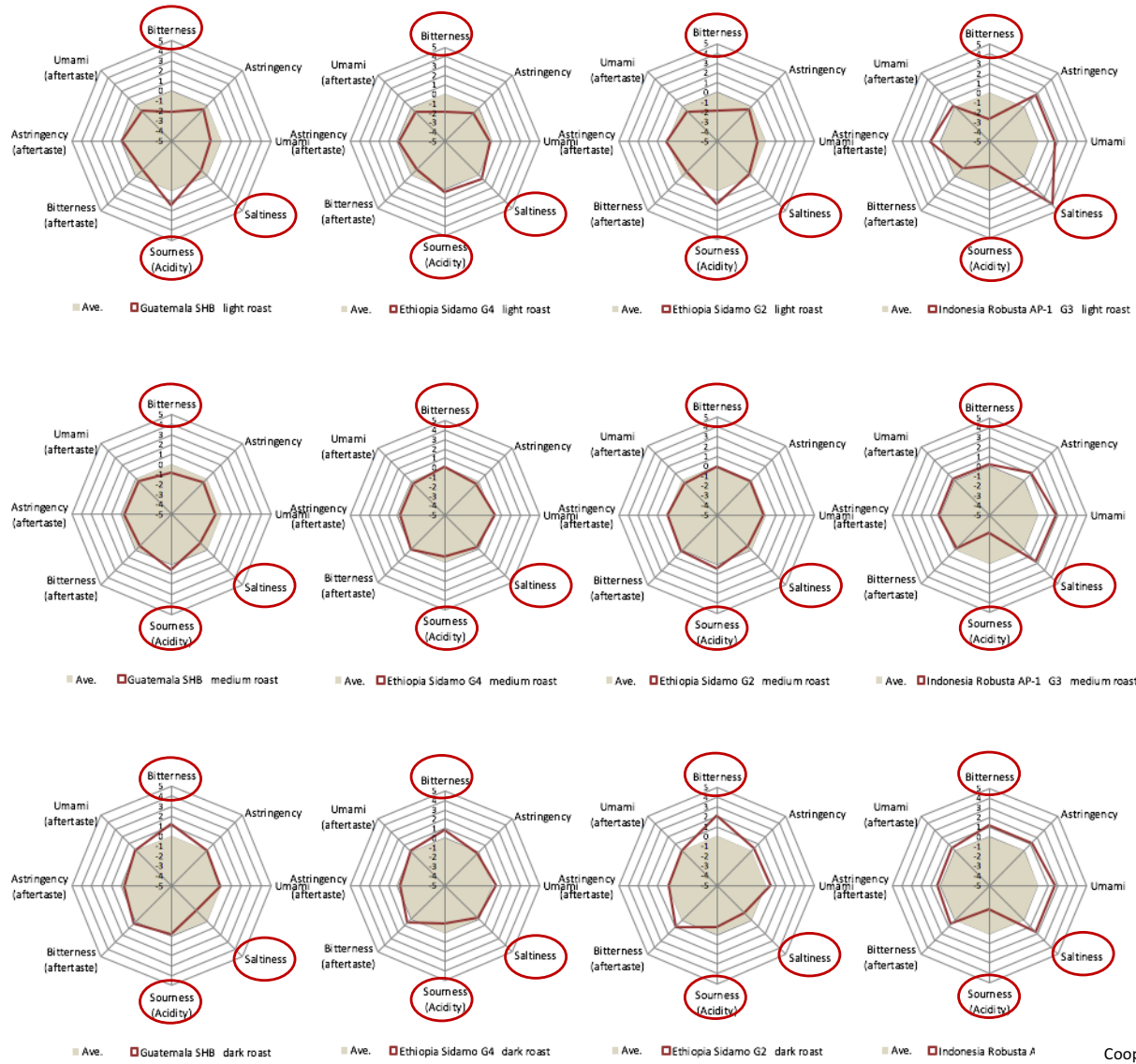
Coffee Beans and Roasting Degree

Lighter
 ↓
 Roasting Degree
 ↓
 Darker



Coffee Beans and Roasting Degree

Lighter
 ↓
 Roasting Degree
 ↓
 Darker



Cooperated with UNIMAT PRECIOUS Co.,Ltd.

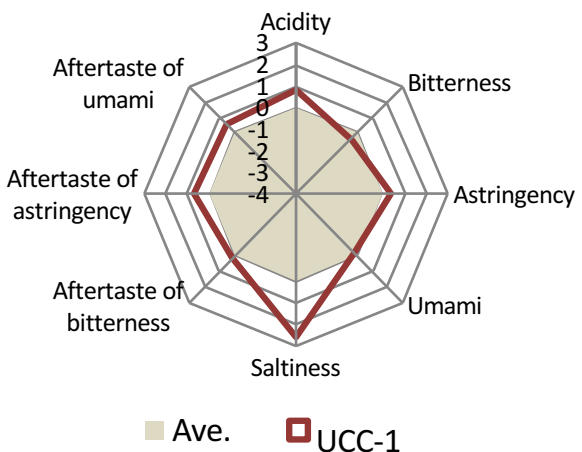
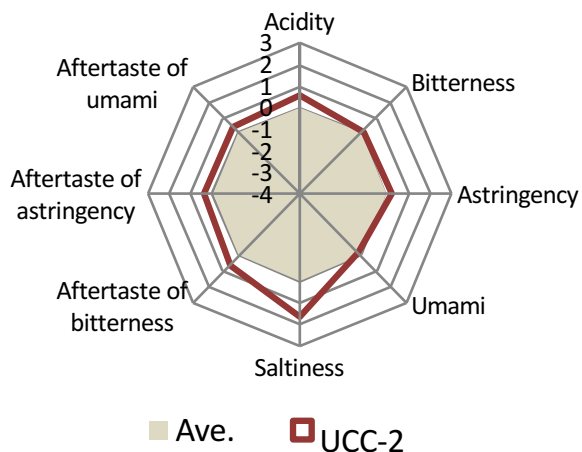
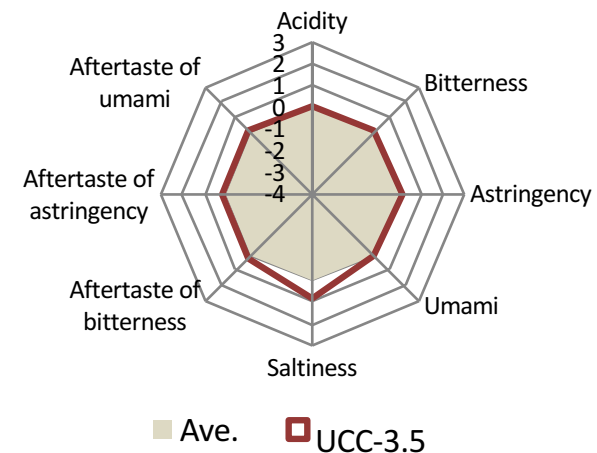
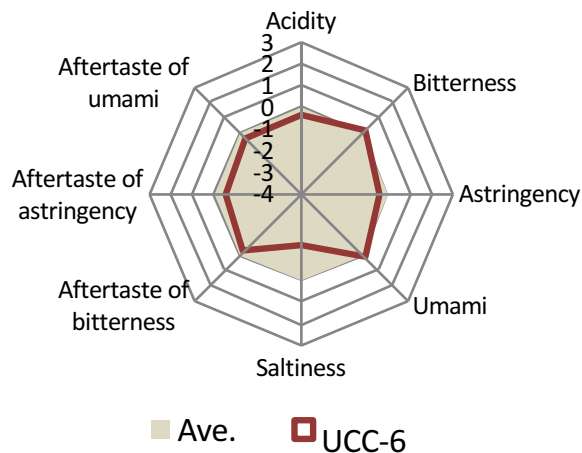
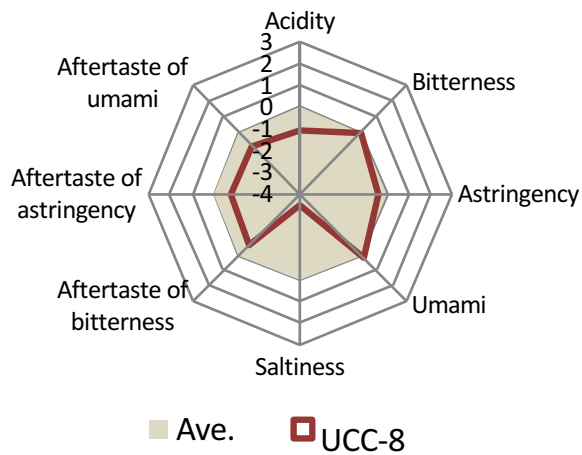
Coffee Beans : Grain Size and Taste

- Beans : UCC Gold Special Special Blend
- Mill : Kalita Nice Cut Mill
- Grain size : 1, 2, 3.5, 6, 8
- Brewing : Recommended method by Insent



Blended with various coffee beans





Comparison from the average of all results