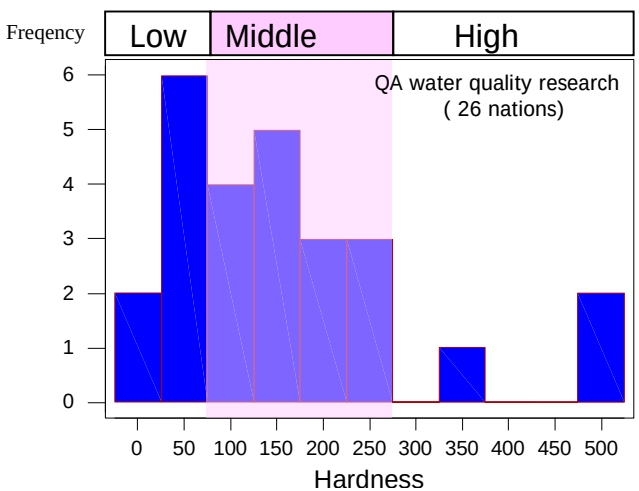

TEZERO

USP / I-Sensor

Conventional

Algorithm	• Hardness : 100~250 • Detergent : 1g/ℓ • Water temp : 15~35°C
Actual Washing Conditions	• Different hardness by areas • Different detergent amount • W/temp changes by seasons
Problems	•Poor performances - ↑ H/ness, ↓ Detergent, ↓ temp •Energy overuse - ↓ H/ness, ↑ Detergent, ↑ temp

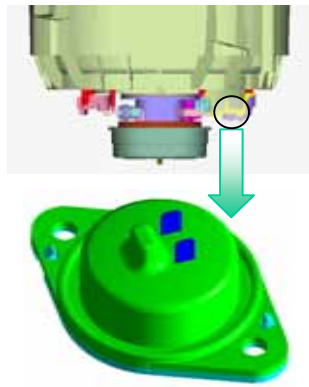
Hardness table for countries



Concept

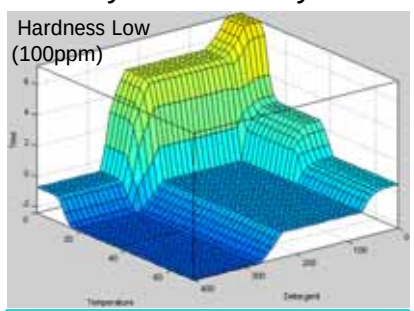
Is it impossible to make Algorithm optimized for actual washing environment in order to have performance enhanced and energy saved?

I-Sensor



Hardness, Detergent, Water Temp. Sensing

Fuzzy Inferance System



Algorithm Optimizer

USP / I-Sensor

I-Sensor

- Hardness Sensor
- Detergent Sensor
- Temperature Sensor
- Laundry Load Sensor
- Water Level Sensor
- Unbalance Sensor
- Door Opening Sensor

Output

Best Washing Performance
- ❑ Low Temperature
- ❑ High Hardness
- ❑ Little Detergent

Rinsing Performance Up (Skin care)
- ❑ Much Detergent

Energy Saving
- ❑ Much Detergent
- ❑ High Temperature
- ❑ Low Hardness

Safety

Change Factors

- Wash Time
- Wash Pattern
- Water Level

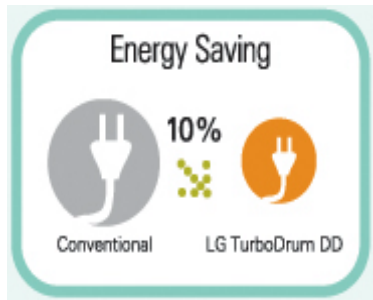
- Water Level
- Spin Time
- Rinse Times

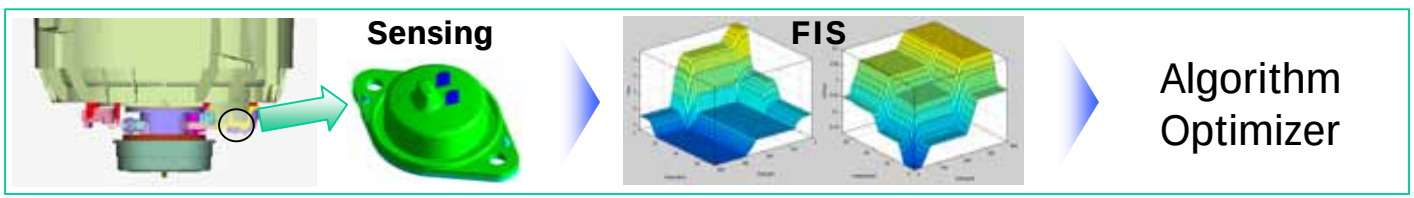
- Wash Time
- Wash Pattern

- Motor On/Off

Program Control

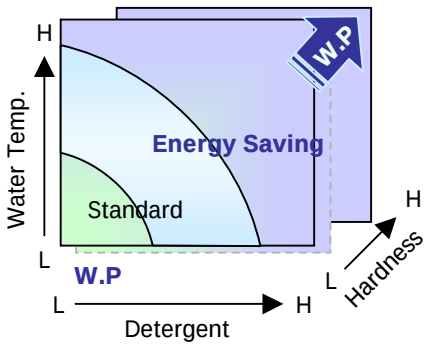
Results



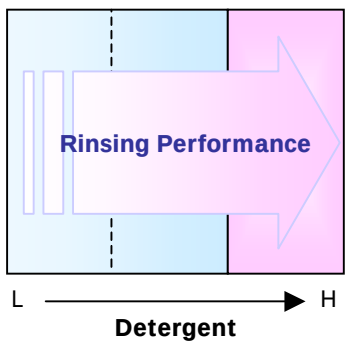


Alg. Concept

Wash

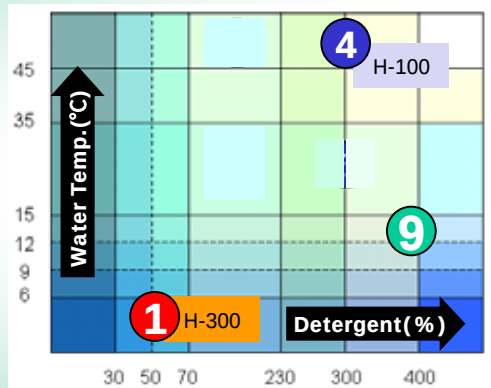


Rinse



Benefit

	Performance	Conditions
Washing Performance	• 15% higher at ①	
Energy Saving	• 10% Lower at ④	
Rinsing Performance (Skin Care)	• 12% Higher at ⑨ • No Suds	



< Conventional >

< New >

USP / i-Sensor

Water Hardness, Detergent, and Water TemperatureAnd	LED Display	Remarks
Unfavorable wash conditions to cause more wash time & wash power	**Orange**	Less detergent, lower temperature, or/and higher Hardness
Standard conditions	**Green**	Standard conditions
Favorable wash conditions to cause less wash time & wash power	**Red**	More detergent, higher temperature, or/and lower hardness

USP / Smart Control & Wide Display

[Current]

1 Mluti-stage Water Level Control(4 →7)

2 Wide Digital Display (88 → 88:88)

3 Total Care™ Programs (4 → 8)

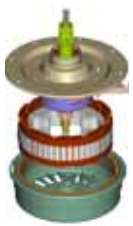
[New]

4 Stain Level Options

5 Digital Display of i-Sensor™

6 Wash, Rinse, Spin Selector

USP / Look Variety

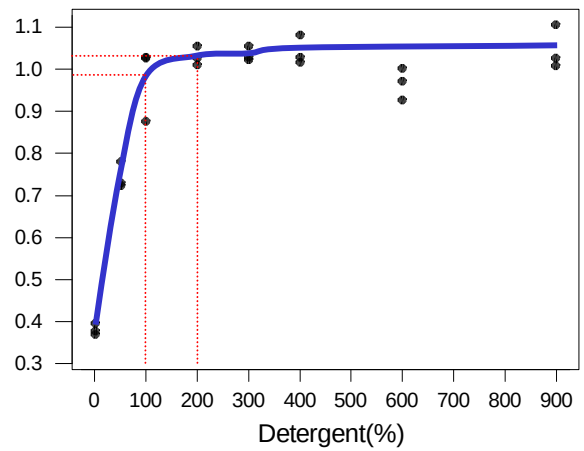
	Driving	Controller	Window	Result
	O/Rotor Induction DD	Smart Control & Wide Display	Design Look	• 7,9,10kg Family Look (Transparent & Opaque) • DD Full Range Line-Up
7 kg			 Transparent Design	
9 kg				
10 kg			 Opaque Design	


TurboDrum DD™
TurboDrum Direct Drive System
LG
3WAY WASH
TURBODRUM wash
DRUM ROTATING wash
CENTRIFUGAL wash
INTELLIGENT WASH sensor
HARDNESS sensing
DETERGENT sensing
TEMPERATURE sensing

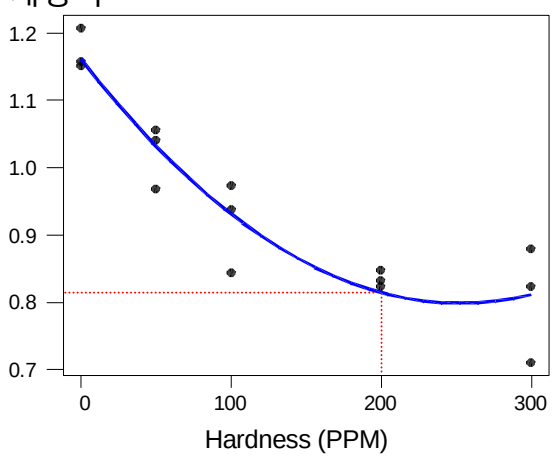

TurboDrum Direct Drive System
TurboDrum DD™
LG
Cleaner !!
3WAY WASH
TURBODRUM wash
DRUM ROTATING wash
CENTRIFUGAL wash
Brighter !!
More Delicate !!


Thank you!

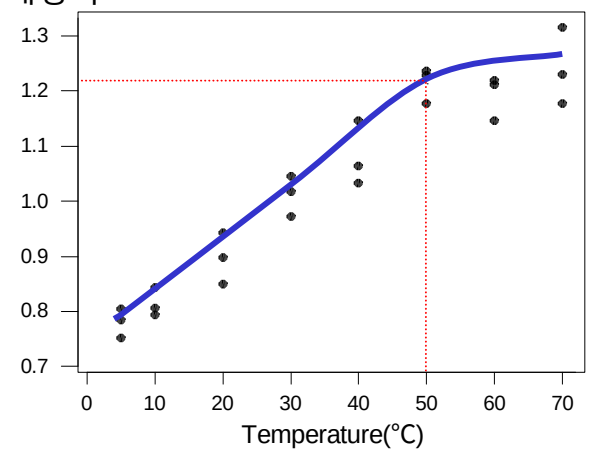
세제의 영향성



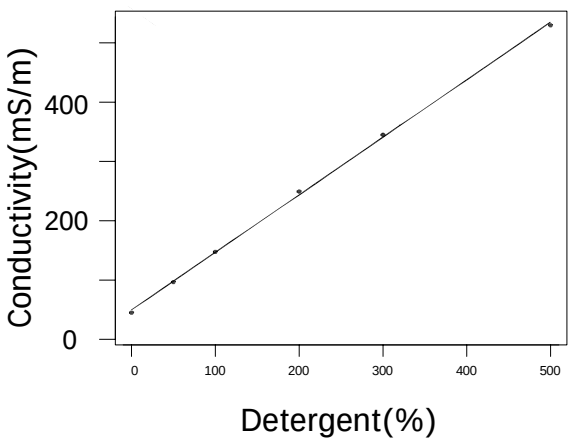
경도의 영향성



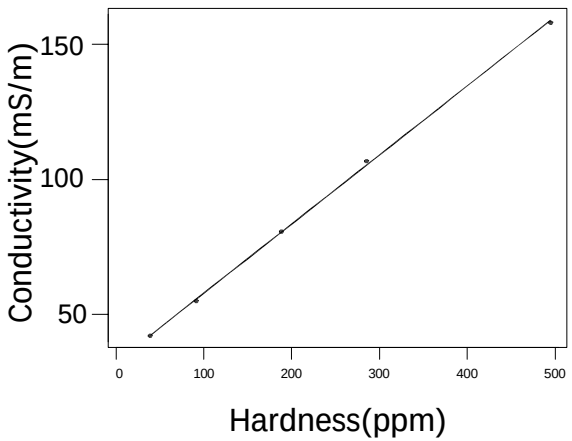
수온의 영향성

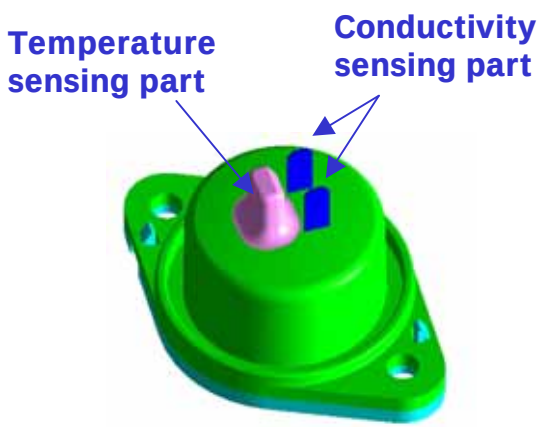


■ Detergent-



■ Hardness-Coductivity





I-Sensor / Algorithm Optimization Process by F.I.S

퍼지추론 방법을 이용하여 적용 알고리즘의 상세 패턴을 구성하고 최종 데이터를 구성함.

감지 인자

- 세제량
- 경도
- 수온

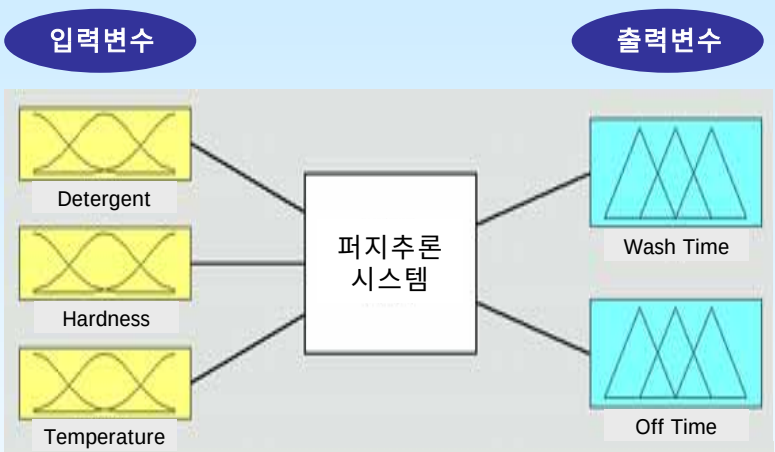
Sensor

Detail Algorithm

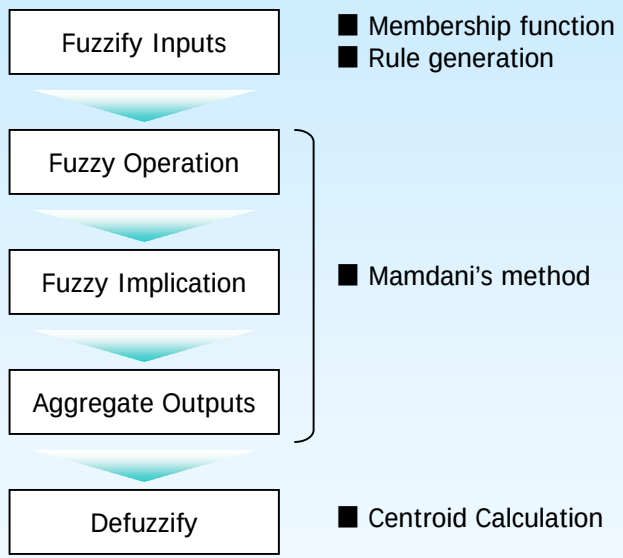
목표 달성

- 세탁성능 향상
- 위생 (Skin Care) 추구
- 에너지절감

FIS(Fuzzy Inference System)



퍼지추론 과정



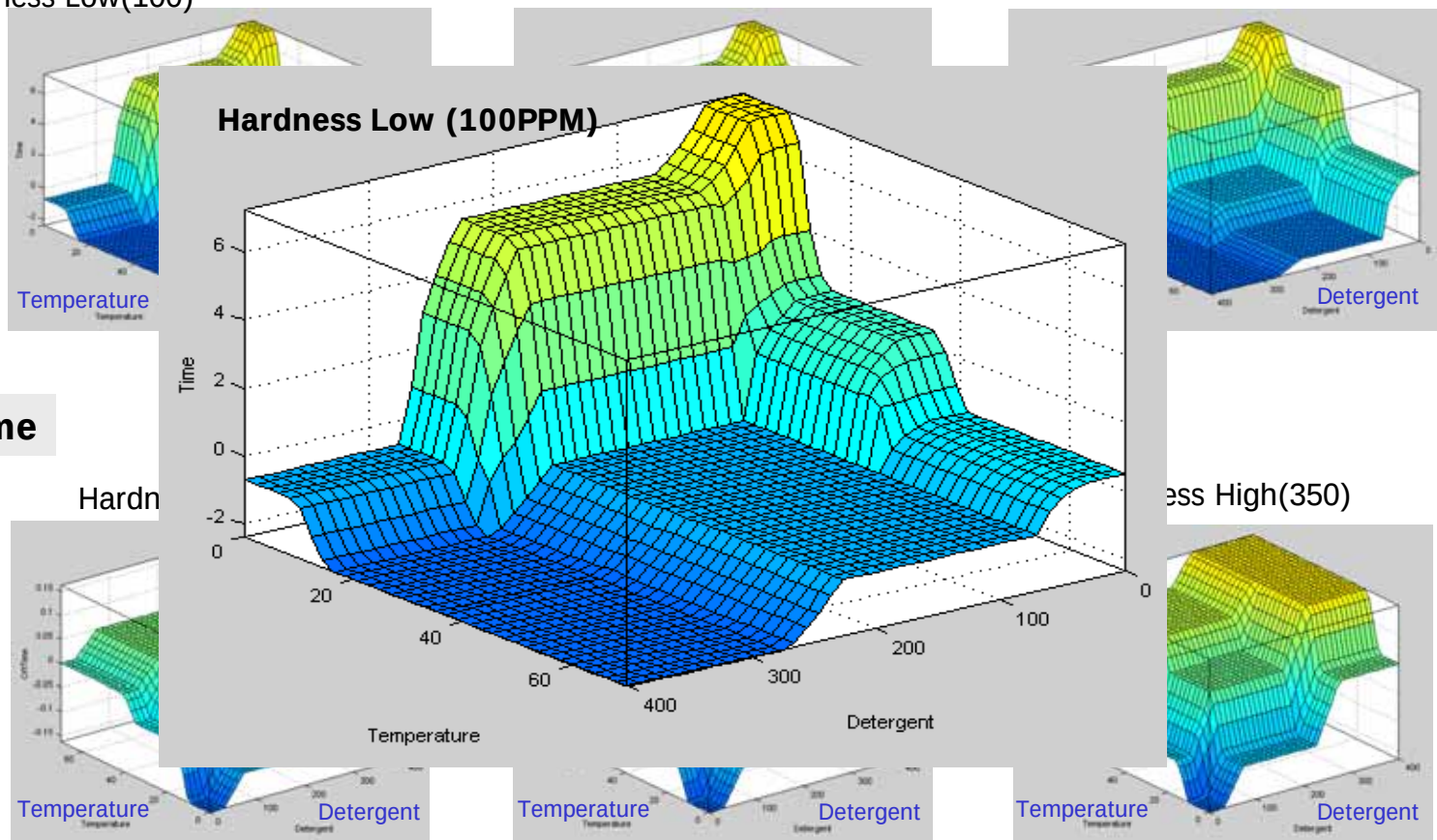
퍼지추론 시스템을 적용하여 각 감지 조건에서의 출력값을 얻을 수 있음.

Wash Time

Hardness Low(100)

Hardness Middle(220)

Hardness High(350)



Off Time

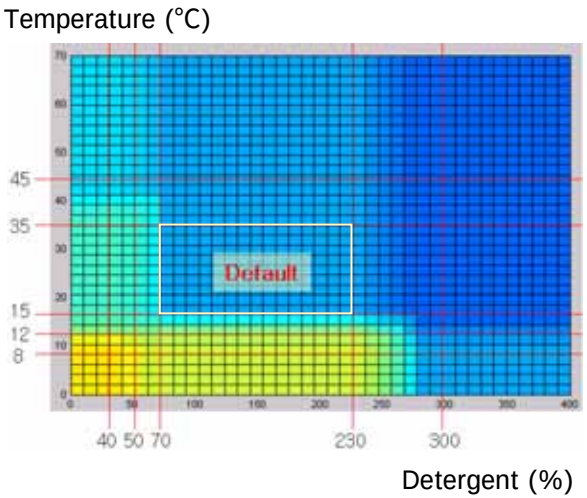
Hardn

ess High(350)

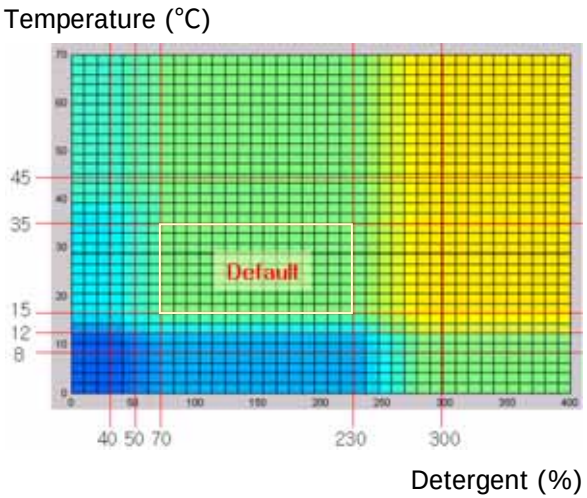
I-Sensor / Optimizer - 최종적용안

실제 마이콤 용량을 고려하여 **216**개의 데이터로 구성된 알고리즘을 확정함.

Wash Time



Off Time



Constraints

- Wide default region
  (Detergent: 70 ~ 230%, Temperature: 15 ~35°C)
- Output variables resolution
  (Wash Time: 1 min., Off Time: 0.1 sec.)
- Positive off time change

최종 적용안

- 경도 구분: 3 영역
- 수온 구분: 6 영역
- 세제 구분: 6 영역

- Wash Time
- Off Time

데이터 수

216

* All graphs are based on hardness 100 ppm

I-Sensor / Algorithm Control Factor

Optimize algorithm is adopted to improve the performance according to the wash condition.

Performace Target	Wash Condition	Main Factor	Change Level
Wash performance	Low Temperature High Hardness Little Detergent	**Wash time**	**Max +8 min.**
Energy saving	High Temperature Low Hardness Much Detergent	**Wash time** **Wash pattern (Off time)**	**Max –2 min.** **Max +0.2 sec.**
Skin care	Much Detergent	**Spin time** **Rinse w. level** **Rinse times**	**Max +2 min.** **Max +0.2kHz** Deep rinse addition

Design Look

Transparent Lid

Opaque Lid

New Concept DD /Comparison of Driving System

Turbodrum DD

Turbodrum

STORM

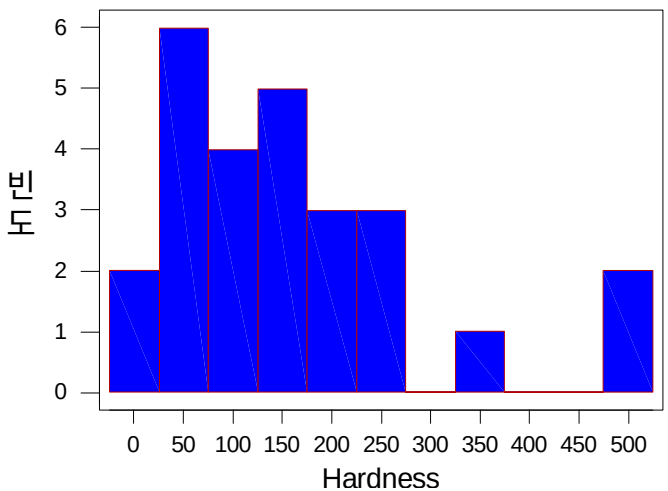
I-Sensor / 국가별 경도

대부분 지역의 경도는 **300**이하이며 칠레와 시리아에서 경도가 **500**수준으로 높게 나타남.

Classfication of Water by Hardness Content

mg/L CaCO3	Degree of Hardness
0 ~ 75	단물 (soft)
76 ~ 150	약한센물 (moderately hard)
150 ~ 300	센물 (hard)
300 이상	대단히 센물 (Very hard)

경도분포*



※출처: QA 수질 분석자료

국가별 평균경도*

국가명	경도(PPM)
남아공	134
대만	27
독일	228
러시아	174
레바논	258
말레지아	22
멕시코	114
미국	111
스페인	268
시리아	514
영국	198
이란	106
이집트	61
이태리	175
인도	184
일본	54
중국	139
칠레	515
콜롬비아	15
태국	68
터어키	150
튀니지	366
파나마	44
프랑스	156
한국	95
호주	50