AQUAREX

caustic & acid solutions recycling

MAINTEK
Engineering Company

Wasser Abwasser Gase

Outlet
clean castic

Aquarex

Inlet
dirty caustic

What is Aquarex?

- Aquarex is a multi-stage filtration system to clean soiled caustic & acid solutions
- Comprising of:
  - optional label retention filter
  - pre-filter &
  - multi-bed reactor
- Applications
  - bottle-washing
  - Certain CIP & crate-washing
  - Textile processing

BRASCO
Pointe Noire – Congo


Pre-filter
Multi-bed reactor
Flocculation
Ibadadan, Nigerian Breweries

Source of impurities in bottle washers

Bottles in Africa & partly in Asia have a long return time back to the brewery / bottler.
- 4 - 9 months outward stay depending on the location & means of transport.
- Usually remain outdoors & exposed to dust, dirt & contamination.
- Bottles are used for other purposes, e.g. storage of petrol, oil, etc.
- Labels are partly destroyed by weather or mechanicel action.

In general, they are much more contaminated; have much more impurities than the return bottles in Europe

Organic impurities:
- Paper fibres, pulp from labels and its printing components, colour pigments, etc.
- Denatured beer & soft drink residues or other liquids.
- Glue
- Fats
- Starch
- Humic acids

Source of impurities in bottle washers

Inorganic Impurities
- Ca, Mg, CaO and CaOH, TiO2 from labels,
- Staniole, aluminium, heavy metals
- Dust, sand, SiO2

Microbiological and ofter impurities
- Bacteria, virus, spores, moulds /silica powder from bad quality glass, cigarettes

Effects of Impurities on bottle washing

Reaction with washing chemicals

- Consumption of NaOH + Additives is increased through secondary reactions. This accounts for 15% to 30% of total.
- Building of sodium carbonates. carbonates coming from turbulence with CO_2 from air stay unchanged.
- Foaming effect, preventing the diffusion of cleanser, cleaning and disinfection.

Transport of impurities throughout the washer zones up to the water rinsing zones.

- Hygienic conditions are problematic. Impurities allow shelter, fixation base and supply nutrients for microbiological activities.
- Progressive blockage of caustic and water rinse spray bulks throughout the washer.
- Increased mechanical abrasion in the washer, carrier chains, pumps, label extractors (paper fibres, sand, staniol, silica from glass).

Coating of heat exchangers, bad heat transfer though paper (paper is a good isolator) .

- Energy usage is increased

Effects of Impurities on bottle washing

Frequent Maintenance schedules for cleaning and overhauling the washer
- Time loss, about 6 to 12 hours for any caustic transfer.
- Therefore production loss, time loss, reduced washer efficiency.
- Wastewater load increases. Up to 10-20% caustic loss through transfer and setting.

Wastewater Pollution
- Periodical sedimentation losses of caustic baths with pH 13-14 can destabilize the WWTP.
- Periodical discharge of caustic baths with pH 13-14 will destroy the microbiological activity.
- Neutralization costs for neutralizing acids high. 1Kg NaOH will need 2,98Kg 30% HCL
- Destruction of biological process if wastewater is not properly neutralized.
- Chemical supply charges and storage costs. Chemical handling and personal schooling is high.
- Salt concentration in neutralized wastewater is increased.

Staniole Labels, Aluminates in the caustic baths

Orgins: bottle neck foils, crown corks, label prints with metallic pigments

Reaction in the caustic baths:
- AL + 3 H2O + NaOH → NaAl(OH)4 + 1l/2H2
- Max. Al concentration allowed = 0,34 x NaOH concentration
- Should Al conc >0,34 NaOH conc.→ risk of precipitation of Al (OH)3. Fine, white-grey precipitate all over the washer

NaOH consumption is increased:
- Usage of NaOH to bind aluminium.
- 1,48 Kg NaOH is needed to dissolve 1 kg of aluminium in aluminate
- Additives are additionally dosed to bind aluminium as a dissolved metallic-organic-complex to prevent the precipitation in Al(OH)3

Grey bottles:
- Deposit of an aluminium silica thin layer on bottles (hard grey deposit) due to the variations of temperature, concentration, alkalinity (pH).

Staniole Labels, Aluminates in the caustic baths

Precipitation Rinse Zones:
- Neutralization area of caustic carried over. Precipitation of Al(OH)3 in the water. Carry over throughout to bottle outlet.
- Risk of deposits on cleaned bottles

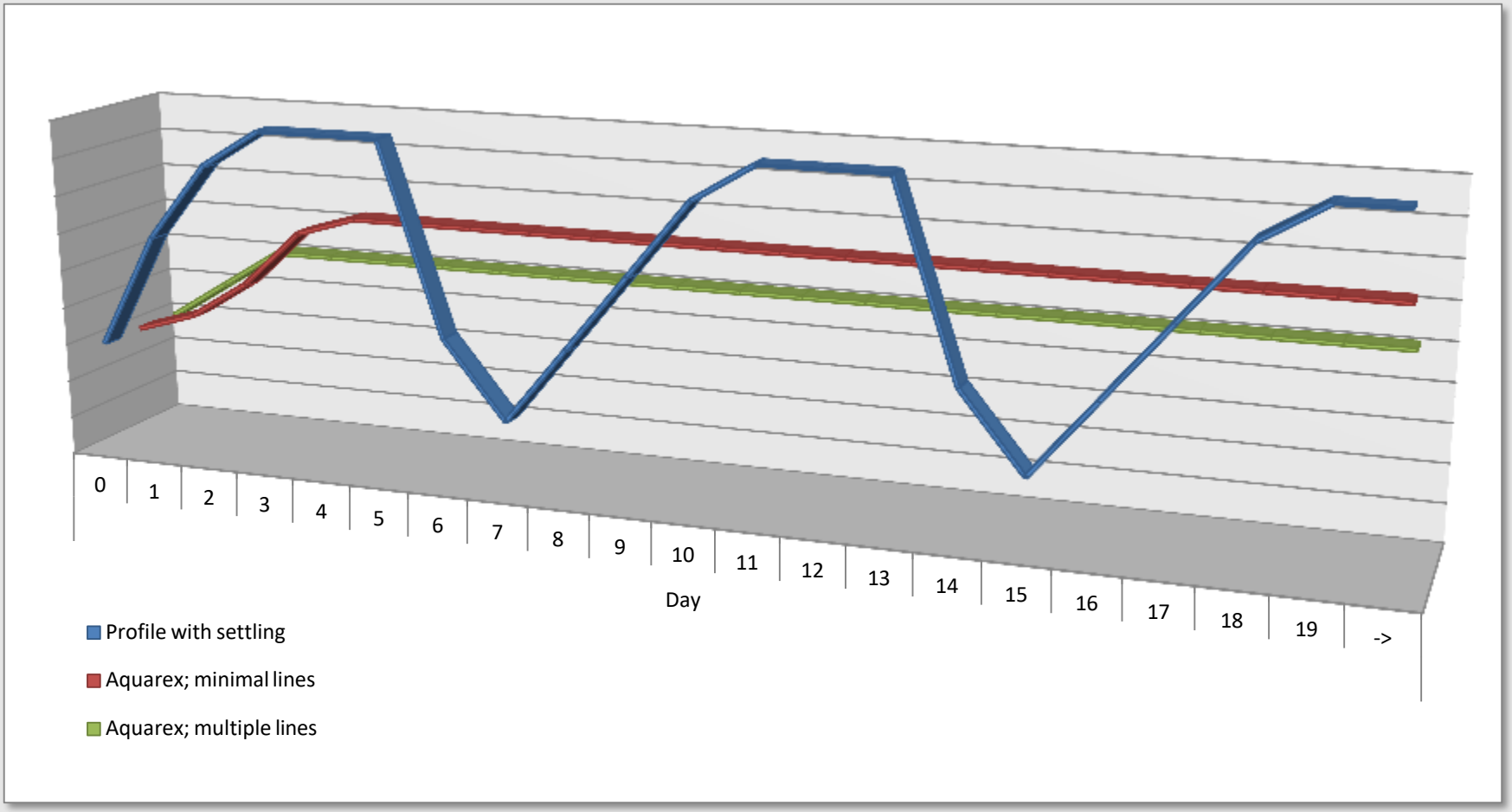
Other deposits:
-Aluminates can also build insoluble salts or compounds with other chemical elements in the caustic baths, e.g. aluminium silicate
- Building of deposits on all surfaces.
- Heat exchangers efficiecy disturbed

Amount of neutralisation agent needed to neutralise an unbuffered Sodium Hydroxide Solution to a pH value of 8,5.

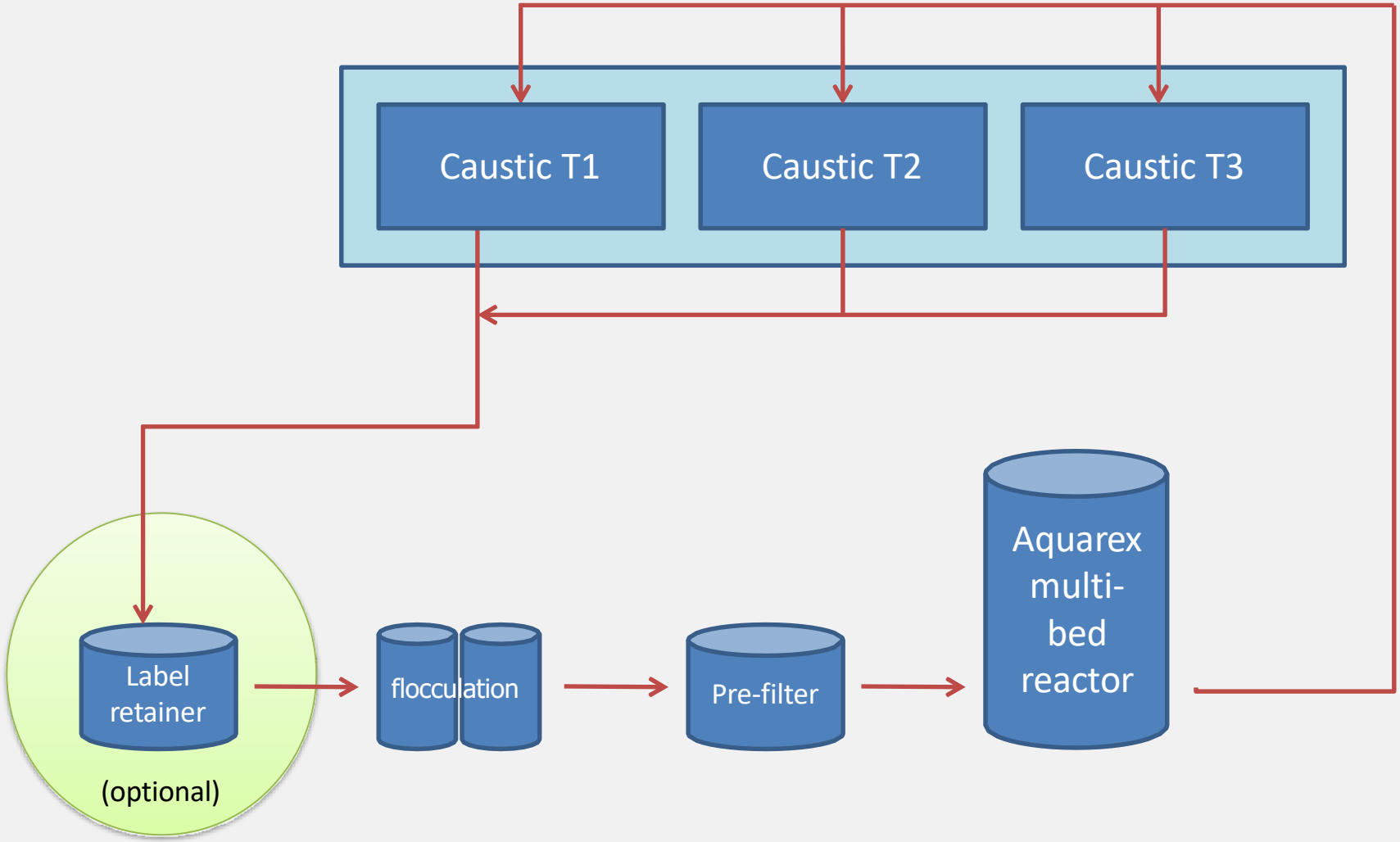
pH	NaOH [kg/m^3]	CO_2 [kg/m^3]	HCl 30% [kg/m^3]	H_2SO_4 96% [kg/m^3]	HNO_3 65% [kg/m^3]
10,0	0,004	0,004	0,012	0,005	0,01
10,5	0,013	0,014	0,038	0,016	0,031
11,0	0,04	0,044	0,12	0,05	0,1
11,5	0,13	0,14	0,38	0,16	0,31
12,0	0,4	0,44	1,22	0,51	0,97
12,5	1,3	1,39	3,84	1,6	3,1
13,0	4,0	4,4	12,2	5,1	9,7
13,5	12,6	13,9	38,4	16,1	30,7
14,0	40	44	122	51	97

Sludge visuals

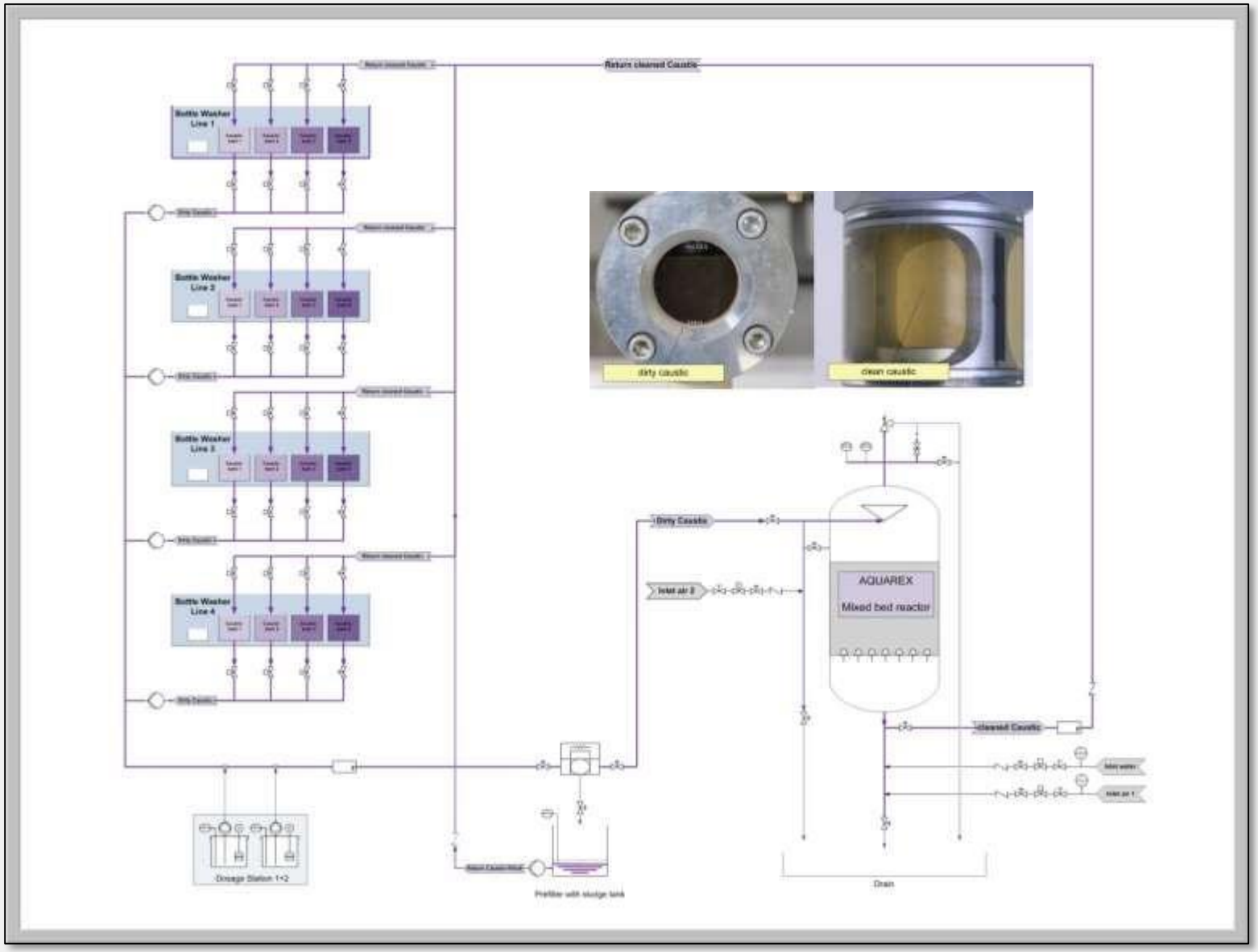
Impurities profile: Settling vs Aquarex



Path of caustic soln.

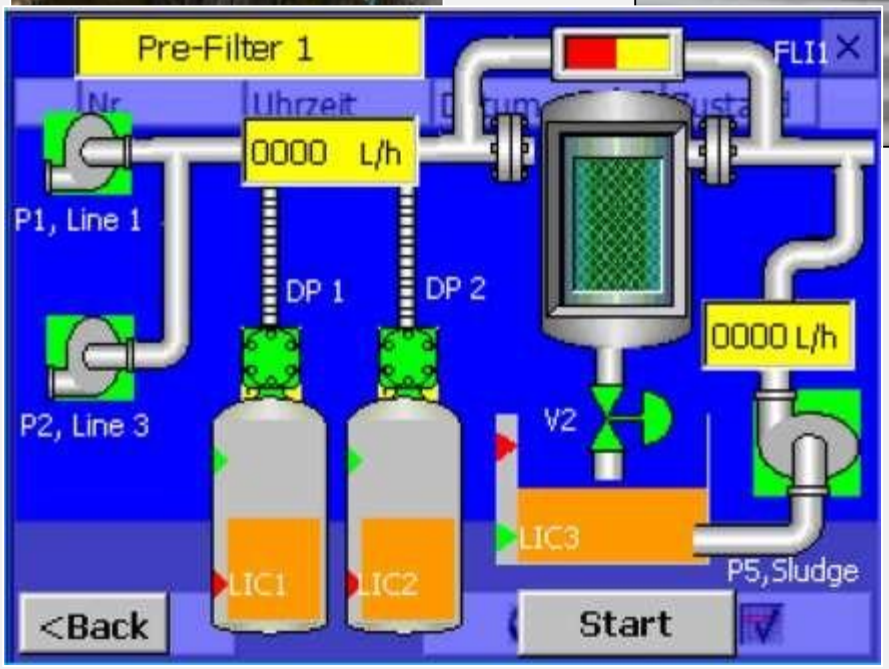


Aquarex flow diagram



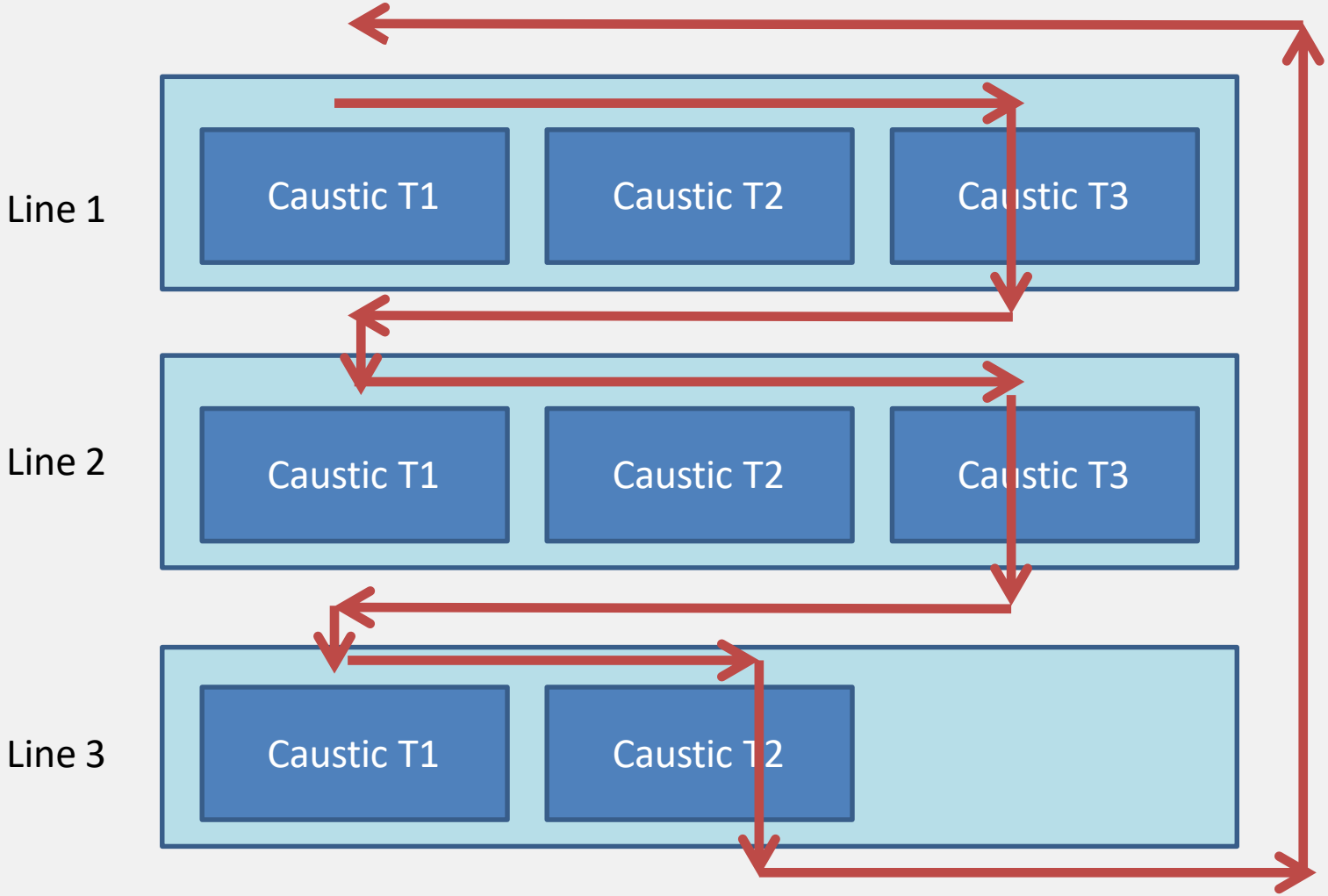
Label retaining filter
(optional)

Pre-filter visuals



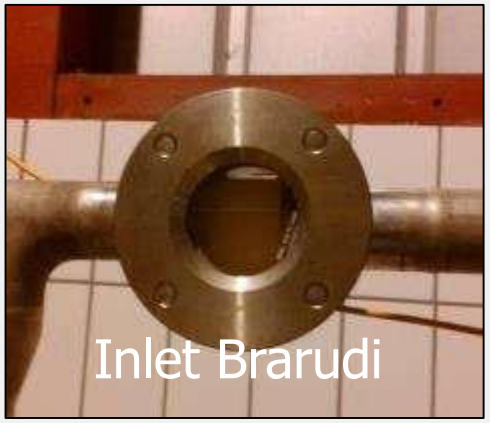
Aquarex visuals

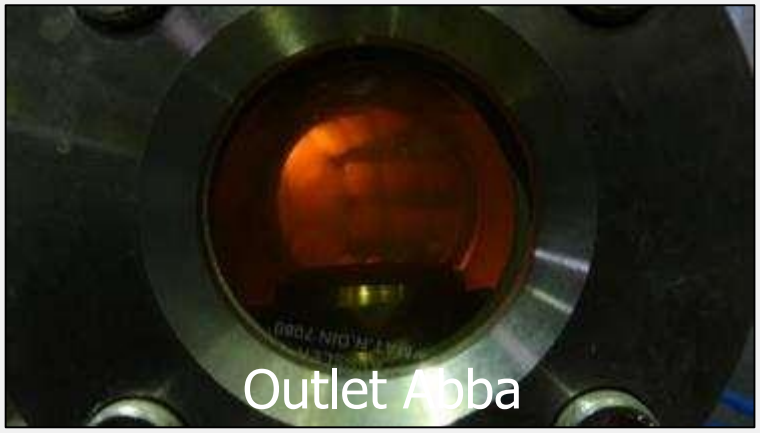
- Aquarex automatically cycles from washer to washer & tank to tank
- unless manually overridden
- Aquarex detects washers in operation & bypasses washers that are inactive



Aquarex system touch panel visuals

Caustic solutions before & after Aquarex visuals





Aquarex after 1-day start-up & 1 day

Objectives of the Aquarex process

The Aquarex process <u>continuously</u> removes the impurities from the caustic baths in the washer.

Better hygienic conditions within the washer.

It provides stable cleaning conditions in the washer despite of any incoming impurities, such as lime, pulp and beverage left-overs.

Reduced maintenace time:
- It has been designed to remove any non-dissolved impurities disturbing the cleaning process.
- The washer will be cleaner overall.
- No transfer of caustic bath in settling tank necessary. (Exception is for removal of broken glass).
- Less maintenance necessary for cleaning baths and spray/rinse bulks.

Objectives of the Aquarex process

Chemical savings.
- No loss of caustic through settling process (about 10 - 20%) or unexpected discharge
- Less secondary reactions of chemicals with impurities.
- Environmental protection.

Production increase:
- It replaces time loss for setting and cleaning bath

Energy saving
- Caustic heat exchangers are cleaner, less heat loss, better heat transfer.

Protection of the wastewater treatment plant (WWTP)
- No more risk of sudden discharge of caustic in the WWTP.
- No loss of caustic in WWTP through settling process

Aquarex Process Benefits

Economical advantages due to:

- Savings in cleaning chemicals and additives (ca. 20% - 40%)
- Reduction of water consumption.
- Reduction of waste water and neutralization costs.
- Elimination of loss through settling (ca.15%)
- Reduction of energy consumption (heat exchangers and less caustic losses)
- Shortening of the machine down-time, more production.
- Reduction of personnel costs and less maintenance.

Ecological advantages due to

- Substantial reduction of the volume of waste water.
- Substantial reduction of the amount of salts, CSB and settleable materials in wastewater.
- Energy saving, chemical saving, water saving

Aquarex Process Benefits

Improvement of the hygiene and cleaning quality due to

- Continuous removal of impurities carried in
- Protection of heat exchangers
- Long-term reduction of surface tension and contamination of the caustic solution

Economical solution
- Other solutions are feasible or technically possible
- Never the less Aquarex system offers the most interesting ROI.
- Cost effective system

KISS – an uncomplication system
- Minimal human intervention
- Simple solutions are important for all continents
- Solutions with easily manageable control
- Solution with little maintenance

AQUAREX PLANT COST BENEFIT ANALYSIS (2012 Vs 2013), NaOH .

Period	2012 Consumpt (Kg/1000 hl)	2012 volume (Hl packed)	2012 Soda Consumpt (kg)	2013 Consumpt (Kg/1000 hl)	2013 volume (Hl packed)	2013 Soda Consumpt (kg)	Difference (kg)	Diff cost (N)
Jan	233,87	157673	36875	184,18	163833	30175,00	6700,00	2342186,0
Feb	232,08	171819	39875	206,82	133329	27575,00	12300,00	4299834,0
Mar	248,61	169943	42250	176,25	173903	30650,00	11600,00	4055128,0
Apr	193,05	152810	29500	180,06	166609	30000,00	-500,00	-174790,0
May	247,02	156867	38750	199,49	195501	39000,00	-250,00	-87395,0
Jun	232,49	131188	30500	165,26	164893	27250,00	3250,00	1136135,0
Jul	166,17	105312	17500	169,52	119455	20250,00	-2750,00	-961345,0
Aug	206,32	141163	29125	197,69	139109	27500,00	1625,00	568067,5
Sep	190,31	198492	37775	129,61	156234	20250,00	17525,00	6126389,5
Start staniole labels		increase NaOH concentration in bath						
Oct	184,29	210673	38825	159,01	201407	32025,00	6800,00	2377144,0
START AQUAREX								
Nov	197,46	212950	42050	144,85	221091	32025,00	10025,00	3504539,5
Dec	169,06	192799	32595	153,11	237570	36375,00	-3780,00	-1321412,4
		2.001.689,00	415.620,00		2.072.934,00	353.075,00	62.545,00	**21.864.481,10**

Ibadan Nigerian Brewery

Euro

savings with Aquarex	104.116,58


Ibadan
Nigerian Breweries


SP Brewery
Papua New Guinea

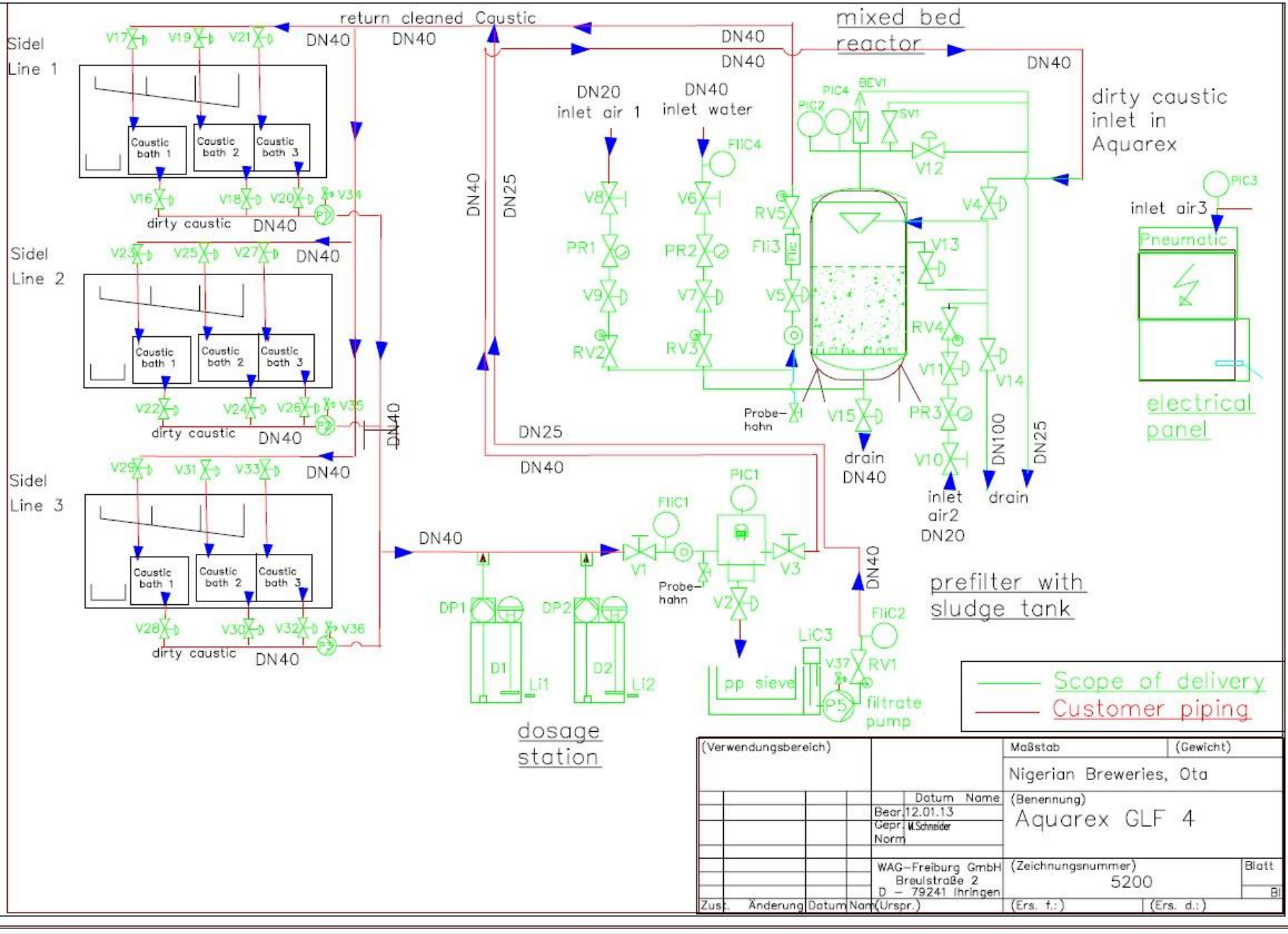

Otta
Nigerian Breweries


BRASCO
Brazzaville Congo


Spomlek Dairy
Poland


Bralirwa
Kigali Rwanda


BRASCO
Pointe Noire - Congo


return cleaned Caustic
mixed bed reactor
Sidel Line 1
Sidel Line 2
Sidel Line 3
Caustic bath 1
Caustic bath 2
Caustic bath 3
dirty caustic
DN40
DN25
DN20
inlet air 1
inlet water
dirty caustic inlet in Aquarex
inlet air3
Pneumatic
electrical panel
Probe-hahn
drain
DN100
inlet air2
prefilter with sludge tank
dosage station
DP1
DP2
D1
D2
Li1
Li2
pp sieve
filtrate pump
Scope of delivery
Customer piping
Nigerian Breweries, Ota
Aquarex GLF 4
WAG-Freiburg GmbH
Breulstraße 2
D - 79241 Ihringen
5200

Aquarex references (@ June 2014)

- Henniez Min. (Nestlé) (CH)
- Heineken, Brand Brewery (NL)
- Schwollener Sprudel (D)
- Rivella Getränke (CH)
- Allgäuer Brauhaus (D)
- Südpfalz Leergut (D)
- Unifontes Eglisau Mineralquelle (CH)
- Bad Brückenau Mineralbrunnen (D)
- Kumpf Fruchtsaft (D)
- Granini Fruchtsaft (CH)
- Spomlek Molkerei (P)
- Heineken, SP Brewery, Papua New Guinea
- Pro UVA Univerre (CH)
- Heineken Nigerian Breweries OTTA Nigeria
- Heineken Brasserie Nationale D´Haiti
- Heineken Nigerian Breweries Kudenda Nigeria
- Heineken Nigerian Breweries Uyo Nigeria
- Heineken Brasserie Bourbon Ile de La Reunion

- Heineken, BRASCO, Brazzaville, Congo
- Heineken, BRASCO, Pointe Noire, Congo
- Heineken, BRALIMA, Kinshasa, DR Congo
- Heineken, Nigerian Breweries, Lagos, Nigeria
- Heineken, Nigerian Breweries, ABA, Nigeria
- Heineken, BRARUDI, Bujumbura, Burundi
- Heineken, Nigerian Breweries, AMA, Nigeria
- Heineken, Nigerian Breweries, Kaduna, Nigeria
- Heineken, Nigerian Breweries, Ibadan, Nigeria
- Diageo, Achimota Ghana
- Heineken, BRALIMA, Bukavu, DR Congo
- Heineken, Kigali, Rwanda Bralirwa
- Heineken BRALIRWA, Rwanda, Gisenyi,
- Heineken Sedibeng Johannesburg Sth Africa
- Heineken Paulaner Brauerei München (D)
- Heineken Sierra Leone Brewery Ltd Freetown SL

Ready for shipping

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