Product Sheet

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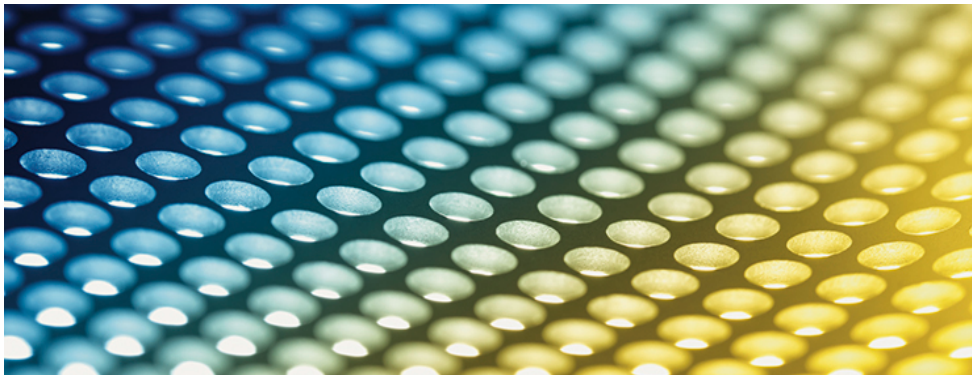
ANODAL® WT-1 LIQUID



WASTE WATER TREATMENT OF SPENT DYEBATHS CONTAINING SANODYE®, SANODURE® AND SANODAL® DYES IN COMBINATION WITH AN INORGANIC PRECIPITANT

The decolorizing processes described here are based on chemical precipitation of the dye with iron III or aluminium salts and a cationic organic polymer (Anodal WT-1® Liquid) followed by separation by sedimentation and/or filtration.

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1. PROPERTIES

Appearance:	colorless, clear liquid
Chemical character:	polyguanidine
Density at 20°C:	1155 ± 15 kg/m3
Viscosity at 20°C:	ca. 40 mPa.s determined with Brookfield Viscometer RVT, 100 rpm, spindle 1
pH:	3.5 ± 1
Dilutability:	dilutable with water in any proportion
Storage time :	5 years in closed original containers at 5°C to 30°C
Ecotoxicological data:	see Safety Data Sheet.
Specifications:	see Technical Delivery Specification

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2. APPLICATION

Anodal® WT-1 Liquid is applied at concentrations of 0.4-5.0 ml/g dye.

If necessary an inoroganic precipitant (e.g. FeCl3) is added to the spent dyebath. The bath is then neutralized to pH 8.0-8.5 before adding Anodal® WT-1 Liquid.

3. PRINCIPLE OF THE PRECIPITATION PROCESS

The dye in the spent dyebaths can be precipitated by three methods:

A. IRON III CHLORIDE/CALCIUM HYDROXIDE*

The dye is precipitated by adding iron III chloride, neutralizing with calcium hydroxide and then adding Anodal® WT-1 Liquid

B. IRON III CHLORIDE/SPENT ETCHING LYE *

For neutralization spent etching lye is used instead of calcium hydroxide.

C. SPENT ETCHING LYE/SPENT ANODIZING ACID

The dye is precipitated by adding spent etching lye, neutralizing with spent anodizing acid and then adding Anodal® WT-1 Liquid.

In all three methods separation is achieved by filtering (sedimentation is also possible but requires leaving the bath to stand overnight).

* To precipitate Sanodal® Gold 4N calcium chloride is used instead of iron III chloride.

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4. CHEMICAL DECOLORIZING PROCEDURE

A. IRON III CHLORIDE/CALCIUM HYDROXIDE

- add iron III chloride and stir until homogeneously distributed
- neutralize while stirring vigorously with calcium hydroxide to pH 8-8.5, bearing in mind that calcium hydroxide requires a certain amount of time for reaction
- add Anodal® WT-1 Liquid while stirring vigorously

B. IRON III CHLORIDE/SPENT ETCHING LYE

- add iron III chloride and stir until homogeneously distributed
- neutralize while stirring vigorously with spent etching lye to pH 8-8.5
- add Anodal® WT-1 Liquid while stirring vigorously.

C. SPENT ETCHING LYE/SPENT ANODIZING ACID

- add spent etching lye and stir until homogeneously distributed
- neutralize while stirring vigorously with spent anodizing acid to pH 8-8.5
- add Anodal® WT-1 Liquid while stirring vigorously.

All three methods require about 1 h before separation by filtration (sedimentation is also possible but requires leaving the bath to stand overnight).

REMARK

Sanodal®Gold 4N is precipitated by adding calcium chloride and neutralizing by method A or B.

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5. CHEMICALS

5.1 IRON III CHLORIDE

Iron III chloride, (ferric chloride) anhydrous
$FeCl_3$, MW: 162, Fe content: 34.6%

Iron III chloride, crystallized
$FeCl_3 \cdot 6H_2O$, MW: 270, $FeCl_3$ content: 60%

Iron III chloride, aqueous solution
$FeCl_3$ content: 40%, Fe content: 13.86%

It is advantageous to use ferric chloride as a concentrated aqueous solution with a $FeCl_3$ content of ca. 40%. Since this strongly acid solution attacks metal machine parts, the dissolving vessels must be made of acid-resistant materials. Safety glasses and rubber gloves must be worn when handling the concentrates.

Dissolve by adding the ferric chloride to water, paying attention to heat development with the anhydrous grade.

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5.2 CALCIUM CHLORIDE

Calcium chloride
$CaCl_2$, MW: 111, $CaCl_2$ content: 92-98%

Calcium chloride dihydrate
$CaCl_2 \cdot 2H_2O$, MW: 147, $CaCl_2$ content: ca. 75%

5.3 CALCIUM HYDROXIDE/CALCIUM OXIDE

Calcium hydroxide, (hydrate of lime, slaked lime)
Ca(OH)2, MW: 74

Calcium oxide, (burnt lime, quicklime)
CaO, MW: 56, content related to Ca(OH)2: ca. 132%

Calcium hydroxide/calcium oxide is preferably applied in the form of milk of lime with a Ca(OH)2 content of ca. 25%, prepared by pasting in water, where the strong heat development of calcium oxide must be taken into account. Safety glasses and rubber gloves should be worn when handling this material.

5.4 SPENT ETCHING LYE*

Aluminium content:	ca. 160 g Al/l
Sodium hydroxide content:	ca. 90 g NaOH/l
Density:	ca. 1.44 g/ml

5.5 SPENT ANODIZING ACID*

Aluminium content:	ca. 15 g Al/l
Sulphuric acid content:	ca. 190 g H2SO4/l
Density:	ca. 1.18 g/ml

* The values given correspond to our test conditions and will naturally vary from case to case.

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5.6 ANODAL WT-1 LIQUID

Anodal® WT-1 Liquid serves as an organic coagulant. Anodal® WT-1 Liquid is a highly efficient cationic polymer which permits virtually complete decolorizing of dyebaths. It also achieves a very substantial reduction of the ferric chloride addition (over 50%) so that the amount of sludge to be disposed of is correspondingly reduced.

6. PRECIPITATION

The precipitant is added while constantly stirring either by hand, by injecting compressed air or using a stirrer. Treatment can take place directly in the dyeing tank or in some other acid resistant vessel.

7. NEUTRALIZATION

Neutralization serves to precipitate the metals completely in the form of hydroxides, whereby the dyes are also precipitated as sparingly soluble salts or adsorbed by the hydroxide sludge. The optimum pH for precipitation is 8-8.5; pH values below 6 or above 9 increase residual solubility appreciably.

The neutralizing agent is added with constant vigorous stirring either by hand, by injecting compressed air or with a stirrer.

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8. COAGULATION

After neutralization the still dissolved dye is coagulated with Anodal® WT-1 Liquid and precipitated.

Anodal® WT-1 Liquid is added with constant vigorous stirring either by hand, by injecting compressed air or with a stirrer.

9. SEPARATION OF THE SEDIMENT

Before the neutralization mixture is released into the receiving water or public sewage system, undissolved substances must be separated in accordance with the official wastewater regulations. This is done either by direct filtration or by sedimentation after mixing with other effluents in sedimentation basins in the processor's own wastewater treatment plant.

9.1 FILTRATION

For dewatering the sediment sludge, filter presses are the most suitable. Machine wire presses or centrifuges result in poorer dewatering values. With direct filtration the neutralization mixture is pumped into the filter press in undiluted form.

9.2 SEDIMENTATION

Sedimentation of a neutralization mixture is complete after ca. 16 h (overnight). After it has settled, the sludge can be pumped out. Since nowadays thin sludges can no longer be disposed of by dumping, they must be converted to thick sludge by dewatering.

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10. DISPOSAL OF WASTE MATERIAL

Filtrate from the filter press is best released via the wastewater treatment plant. The filter residue in the form of thick sludge is disposed of in a landfill approved for metal hydroxide sludges.

11. APPLICABLE AMOUNTS

It is advisable to determine the optimum amount of precipitant in a pretrial with a dyebath sample. This is especially the case if the dye concentration is not known.

Guidelines are given in the *Tables in Section 12*. Excessive amounts of precipitant should be avoided due to secondary pollution of the wastewater and for economic reasons.

To determine the optimum amount, take a dyebath sample of e.g. 500 ml and add the amount of ferric chloride given *in Section 12* (Processes A and B) or spent etching lye (Process C), neutralize to pH 8-8.5, noting the amount, add to the sample the amount of Anodal® WT-1 Liquid given *in Section 12* and allow the sample to stand for about 1 h.

Determine the residual dye in the filtrate by comparison with a standard solution either visually or spectrometrically. If the residual dye content is too high, increase the amount by 10% and repeat the test.

For Sanodal® Gold 4N the required amount of calcium chloride to precipitate the oxalic acid must also be determined:

Add to the dyebath sample the amount of calcium chloride given *in Section 12*, neutralize with milk of lime 25% or etching lye to pH 8-8.5 and filter. Then dissolve 3 g calcium chloride in ca. 100 ml filtrate and adjust to pH 4 with acetic acid.

If turbidity occurs within 15 min the oxalic acid content in the filtrate is over 40 mg/l and the amount of calcium chloride must be increased.

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12. RESIDUAL CONCENTRATION OF THE DYEBATHS

The dye solutions should be decolorized so that they cause no discoloration on being released into the receiving water or public sewage system.

The filtrates released into the public sewage system exhibit a pH of 7± 1.

The residual concentration of dyes and heavy metals in each case are given in the following tables, which also give the amounts of chemicals necessary for precipitation.

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TABLE 1

PRECIPITATION PROCESS A (IRON III CHLORIDE/CALCIUM HYDROXIDE)

	CONC. DYEBATH	ML $FeCl_3$ 40% / G DYE	ML ANODAL WT-1 / G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodal	g/l			mg/l	mg/l	
Gold 4N	30	*	-	<0.1	Fe <0.2	>99.99
Orange 3LW	3	5.0	0.8	~2	Cr <0.05	>99.9
Red B3LW	5	4.0	0.4	<1	Cu <0.2	>99.9
Turquoise PLW	5	-	0.6	<1	Cu <0.2	>99.9
Green 3LW	2	1.7	0.8	~1	Cr <0.05	>99.9
Black GL	30	1.0	0.4	~3	Co <0.2	>99.99
Black 2LW	10	1.8	0.8	<1	Cr <0.05	>99.99
Deep Black HBL	10	1.0	0.7	<1	Cr <0.05	>99.99
Deep Black H3LW	12	1.2	0.3	~3	Cr <0.05	>99.9
Deep Black MLW	10	1.8	0.8	<1	Cr <0.05	>99.99

The iron content of the filtrates is less than 0.2 mg/l

* Sanodal Gold 4N is precipitated with calcium chloride. The required amount depends on the oxalate content and is at least ca. 0.8 g CaCl2/g dye for Sanodal Gold 4N.

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The required amount of calcium hydroxide depends on the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial:

2 ml FeCl3 (40%) correspond to ca. 1.9 ml Ca(OH)2 (25%)

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TABLE 2

PRECIPITATION PROCESS A (IRON III CHLORIDE/CALCIUM HYDROXIDE)

	CONC. DYEBATH	ML $FeCl^3$ 40% / G DYE	ML ANODAL WT-1 / G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodye	g/l			mg/l	mg/l	
Golden Orange RLW	3	5.0	0.6	~8	-	>99.7
Red GLW	4	2.0	0.8	<0.2	-	>99.99
Red RLW	2	2.0	0.5	<0.2	-	>99.9
Brown R	3	3.0	0.9	<1	-	>99.9
Yellow 3GL	3	5.0	2.0	~18	-	~99.4
Blue G	3	2.5	0.3	<1	-	>99.9
Blue 2LW	3	2.5	0.6	<1	-	>99.9
Black OA	10	2.0	0.7	~1	-	>99.99

The iron content of the filtrates is less than 0.2 mg/l

The required amount of calcium hydroxide depends on the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial:

2 ml FeCl3 40% correspond to ca. 1.9 ml Ca(OH)2 25%

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TABLE 3

PRECIPITATION PROCESS A (IRON III CHLORIDE/CALCIUM HYDROXIDE)

	CONC. DYEBATH	ML $FeCl_3$ 40%/ G DYE	ML ANODAL WT-1/ G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodure	g/l			mg/l	mg/l	
Fast Gold L	3	5.0	0.8	~12	Cu ~0,.3	~99.6
Orange G	3	5.0	0.7	~2	Cr ~0.07	>99.9
Orange RL	3	2.0	0.9	<1	-	>99.9
Fire Red ML	5	2.0	0.7	~1	Cr <0.05	>99.9
Bordeaux RL	5	2.0	0.6	<1	Cr <0.05	>99.9
Violet CLW	3	2.0	0.9	<1	Cu <0.05	>99.9
Green LWN	1	2.0	0.9	<1	Cr <0.05	>99.9
Bronze G	1	2.0	0.6	<0.5	Fe ~0.2	>99.9
Bronze 2LW	1	2.0	1.0	<0.5	Cr <0.05	>99.9
Fast Bronze L	0.6	5.0	0.3	~3	Cu ~0.05	~99.5
Brown GSL	2	2.0	0.2	<1	Ni <0.05	>99.9
Yellow-Brown 2G	1	3.0	1.0	<1	Cr <0.05	>99.9
Olive Brown 2R	1	3.0	0.7	<1	Ni <0.05	>99.9
Grey HLN Liquid	2	3,0	0,4	< 0,1	Cr <0,05	>99,9
Grey NL Liquid	2	2.0	0.2	<1	Cr <0.05	>99.9
Black CRO	10	2.0	0.8	<1	-	>99.99

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The iron content of the filtrates is less than 0.2 mg/l

The required amount of calcium hydroxide depends on the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial:

2 ml $FeCl_3$ 40% correspond to ca. 1.9 ml $Ca(OH)_2$ 25%

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TABLE 4

PRECIPITATION PROCESS B (IRON III CHLORIDE/SPENT ETCHING LYE)

	CONC. DYEBATH	ML FECL3 40% / G DYE	ML ANODAL WT-1 / G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodal	g/l			mg/l	mg/l	
Gold 4N	30	*	-	<0.1	Fe <0.5	>99.99
Orange 3LW	3	5.0	0.8	~2	Cr <0.05	>99.9
Red B3LW	5	4.0	0.4	~1.5	Cu <0.2	>99.9
Turquoise PLW	5	-	0.6	<1	Cu <0.2	>99.9
Green 3LW	2	1.7	0.8	~2	Cr <0.05	>99.9
Black GL Paste	30	1.0	0.4	~60	Co <1.0	~99.8
Black 2LW	10	1.8	0.8	<1	Cr <0.05	>99.99
Deep Black HBL	10	1.0	0.7	<1	Cr <0.05	>99.99
Deep Black H3LW	12	1.2	0.3	~110	Cr ~1.2	~99
Deep Black MLW	10	1.8	0.8	<1	Cr <0.05	>99.99

*Sanodal Gold 4N is precipitated with calcium chloride. The required amount depends on the oxalate content and is at least ca. 0.8 g $CaCl_2$/g dye for Sanodal Gold 4N.

The iron content of the filtrates is less than 0.5 mg/l

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The aluminium content of the filtrates is less than 3 mg/l (exception: Sanodal® Gold 4N 20 mg/l).

The required amount of etching lye depends on its NaOH/aluminium content, the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial: 2 ml FeCl3 40% correspond to ca. 1.6-1.8 ml spent etching lye.

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TABLE 5

PRECIPITATION PROCESS B (IRON III CHLORIDE/SPENT ETCHING LYE)

	CONC. DYEBATH	ML FECL3 40%/ G DYE	ML ANODAL WT-1/ G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodye	g/l			mg/l	mg/l	
Golden Orange RLW	3	5.0	0.6	~5	-	~99.8
Red GLW	4	2.0	0.8	<0.2	-	>99.99
Red RLW	2	2.0	0.3	<0.1	-	>99.99
Brown R	3	3.0	0.9	~2	-	>99.9
Yellow 3GL	3	5.0	2.0	~25	-	~99.1
Blue G	3	2.5	0.3	<1	-	>99.9
Blue 2LW	3	2.5	0.6	<1	-	>99.9
Black OA	10	2.0	0.7	~400	-	~96

The iron content of the filtrates is less than 0.5 mg/l

The aluminium content of the filtrates is less than 3 mg/l (exception: Sanodal Gold 4N 20 mg/l).

The required amount of etching lye depends on its NaOH/aluminium content, the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial: 2 ml FeCl3 40% correspond to ca. 1.6-1.8 ml spent etching lye.

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TABLE 6

PRECIPITATION PROCESS B (IRON III CHLORIDE/SPENT ETCHING LYE)

	CONC. DYEBATH	ML FECL3 40% / G DYE	ML ANODAL WT-1 / G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodure	g/l			mg/l	mg/l	
Fast Gold L	3	5.0	0.8	~7	Cu ~0.2	~99.8
Orange G	3	3.0	0.7	<0.5	Cr ~0.05	>99.9
Orange RL	3	2.0	0.9	~7	-	~99.8
Fiery Red ML	5	2.0	0.7	~1	Cr <0.05	>99.9
Bordeaux RL	5	2.0	0.6	<0.5	Cr <0.05	>99.99
Violet CLW	3	2.0	0.9	<1	Cu <0.05	>99.9
Green LWN	1	2.0	0.9	<1	Cr <0.05	>99.9
Bronze G	1	2.0	0.6	<0.5	Fe <0.05	>99.9
Bronze 2LW	1	2.0	1.0	~1	Cr <0.05	>99.9
Fast Bronze L	0.6	5.0	0.3	~4	Cu ~0.06	~99.3
Brown GSL	2	3.0	0.3	<1	Ni <0.05	>99.9
Yellow-Brown 2G	1	3.0	1.0	<0.5	Cr <0.05	>99.9
Olive Brown 2R	1	3.0	0.7	<0.5	Ni <0.1	>99.9
Grey HLN Liquid	2	3,0	0,5	< 0,1	Cr<0,05	>99,99
Grey NL Liquid	2	2.0	0.2	~12	Cr ~0.1	~99.4
Black CRO	10	2.0	0.8	<1	-	>99.99

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The iron content of the filtrates is less than 0.5 mg/l

The aluminium content of the filtrates is less than 3 mg/l (exception: Sanodal Gold 4N 20 mg/l).

The required amount of etching lye depends on its NaOH/aluminium content, the amount of iron III chloride applied and the buffer content of the dye solution. It must be determined in a pretrial: 2 ml FeCl3 40% correspond to ca. 1.6-1.8 ml spent etching lye.

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TABLE 7

PRECIPITATION PROCESS C (SPENT ETCHING LYE/SPENT ANODIZING ACID)

	CONC. DYEBATH	ML ETCHING LYE / G DYE*	ML ANODAL WT-1 / G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodal	g/l			mg/l	mg/l	
Gold 4N	30	-	-	-	-	-
Orange 3LW	3	6.0	0.8	~20	Cr ~0.20	~99.3
Red B3LW	5	4.0	0.8	~80	Cu ~5.5	~98
Turquoise PLW	5	-	-	-	-	-
Green 3LW	2	3.0	0.8	~3	Cr <0.05	~99.9
Black GL	30	1.0	0.5	~30	Co <1.0	~99.9
Black 2LW	10	1.8	0.8	<1	Cr <0.05	>99.9
Deep Black HBL	10	1.2	0.7	<1	Cr <0.05	>99.99
Deep Black H3LW	12	1.2	0.3	~70	Cr 1.0	~99
Deep Black MLW	10	1.8	0.8	~1.5	Cr <0.05	>99.9

* The amounts of etching lye are related to a content of ca. 160 g/l aluminium and must adjusted according to the Al content (see also *Section 5.4*).

The aluminium content of the filtrates is less than 3 mg/l.

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The required amount of anodizing acid depends on the amount of etching lye and its NaOH/aluminium content, the H2SO4/aluminium content of the anodizing acid and the buffer content of the dye solution. It must be determined in a pretrial: 1 ml etching lye corresponds to ca. 1.3-1.6 ml anodizing acid.

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TABLE 8

PRECIPITATION PROCESS C (SPENT ETCHING LYE/SPENT ANODIZING ACID)

	CONC. DYEBATH	ML ETCHING LYE/ G DYE*	ML ANODAL WT-1/ G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodye	g/l			mg/l	mg/l	
Golden Orange RLW	3	5.0	1.2	~5	-	~99.8
Red GLW	4	2.0	1.5	~1.5	-	>99.9
Red RLW	2	2.0	0.5	<1	-	>99.9
Brown R	3	3.0	1.6	~2	-	~99.9
Yellow 3GL	3	5.0	3.0	~25	-	~99
Blue G	3	2.5	0.5	~2	-	~99.9
Blue 2LW	3	2.5	1.0	~4.5	-	~99.8
Black OA	10	2.0	0.8	~3400	-	~66

*The amounts of etching lye are related to a content of ca. 160 g/l aluminium and must adjusted according to the Al content (see also *Section 5.4*).

The aluminium content of the filtrates is less than 3 mg/l.

The required amount of anodizing acid depends on the amount of etching lye and its NaOH/aluminium content, the H2SO4/aluminium content of the anodizing acid and the buffer content of the dye solution. It must be determined in a pretrial: 1 ml etching lye corresponds to ca. 1.3-1.6 ml anodizing acid.

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TABLE 9

PRECIPITATION PROCESS C (SPENT ETCHING LYE/SPENT ANODIZING ACID)

	CONC. DYEBATH	ML ETCHING LYE/ G DYE*	ML ANODAL WT-1/ G DYE	RESIDUAL DYE IN THE FILTRATE	RESIDUAL HEAVY METAL CONTENT IN THE FILTRATE	DYE REDUCTION IN % RELATED TO CONC. DYEBATH
Sanodure	g/l			mg/l	mg/l	
Fast Gold L	3	5.0	1.5	~10	Cu ~0.2	~99.7
Orange G	3	5.0	0.7	~2	Cr ~0.05	>99.9
Orange RL	3	2.0	1.5	~9	-	~99.7
Fire Red ML	5	2.0	1.2	~4	Cr ~0.05	>99.9
Bordeaux RL	5	2.0	0.9	~2	Cr <0.05	>99.9
Violet CLW	3	3.0	1.6	~3	Cu <0.05	~99.9
Green LWN	1	2.0	1.6	<1	Cr <0.05	>99.9
Bronze G	1	2.0	0.6	<0.5	Fe <0.05	>99.9
Bronze 2LW	1	2.0	1.5	<0.5	Cr <0.05	>99.9
Fast Bronze L	0,6	5.0	0.6	~5	Cu ~0.1	>99.2
Brown GSL	2	4.0	0.3	<1	Ni <0.05	>99.95
Yellow-Brown 2G	1	3.0	1.4	<1	Cr <0.05	>99.9
Olive Brown 2R	1	3.0	1.4	<0.2	Ni <0.1	>99.9
Grey HLN liquid	2	3,0	0,6	<0,1	Cr <0,05	>9,99
Grey NL Liquid	2	2.0	0.3	~320	Cr ~2.6	~84
Black CRO	10	2.0	0.9	<1	-	>99.99

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*The amounts of etching lye are related to a content of ca. 160 g/l aluminium and must adjusted according to the Al content (see also *Section 5.4*).

The aluminium content of the filtrates is less than 3 mg/l.

The required amount of anodizing acid depends on the amount of etching lye and its NaOH/aluminium content, the H2SO4/aluminium content of the anodizing acid and the buffer content of the dye solution. It must be determined in a pretrial: 1 ml etching lye corresponds to ca. 1.3-1.6 ml anodizing acid.

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TABLE 10

COMPARISON OF THE PRECIPITATION PROCESSES

	RESIDUAL DYE IN THE FILTRATE [MG/L PROCESS]				RESIDUAL CONTENT OF HEAVY METAL IN THE FILTRATE [MG/L PROCESS]		
Sanodal	A	B	C		A	B	C
Gold 4N	<0,1	<0,1	-	Fe	<0,2	<0,5	-
Orange 3LW	~2	~2	~20	Cr	<0,05	<0,05	~0,2
Red B3LW	<1	~1,5	~80	Cu	<0,2	<0,2	5,5
Turquoise PLW	<1	<1	-	Cu	<0,2	<0,2	-
Green 3LW	~1	~2	~3	Cr	<0,05	<0,05	<0,05
Black GL	~3	<60	~30	Co	<0,2	<1,0	<1,0
Black 2LW	<1	<1	<1	Cr	<0,05	<0,05	<0,05
Deep Black HBL	<1	<1	<1	Cr	<0,05	<0,05	<0,05
Deep Black H3LW	~3	~110	~70	Cr	<0,05	~1,2	~1,0
Deep Black MLW	<1	<1	~1,5	Cr	<0,05	<0,05	<0,05

Chloride content (Cl-):

process A.: max. 1% (Sanodal® Gold 4N: 2%)

process B.: max. 1% (Sanodal® Gold 4N: 2%)

process C.: max. 0,2%

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TABLE 11

COMPARISON OF THE PRECIPITATION PROCESSES

	RESIDUAL DYE IN THE FILTRATE [MG/L PROCESS]			RESIDUAL CONTENT OF HEAVY METAL IN THE FILTRATE [MG/L PROCESS]			
Sanodye	A	B	C		A	B	C
Golden Orange RLW	~ 8	~ 5	~ 5	-	-	-	-
Red GLW	< 0,2	< 0,2	~ 1,5	-	-	-	-
Red RLW	< 0,2	< 0,1	< 1	-	-	-	-
Brown R	< 1	~ 2	~ 2	-	-	-	-
Yellow 3GL	~18	~25	~25	-	-	-	-
Blue G	<1	<1	~2	-	-	-	-
Blue 2LW	<1	<1	~4,5	-	-	-	-
Black OA	<1	~400	~3400	-	-	-	-

Chloride content (Cl-):

process A.: max. 1%

process B.: max. 1%

process C.: max. 0.2%

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TABLE 12

COMPARISON OF THE PRECIPITATION PROCESSES

	RESIDUAL DYE IN THE FILTRATE MG/L PROCESS				RESIDUAL CONTENT OF HEAVY METAL IN THE FILTRATE MG/L PROCESS		
Sanodure	A	B	C		A	B	C
Fast Gold L	~ 12	~ 7	~ 10	Cu	~ 0,3		~ 0,2
Orange G	~2	< 0,5	~ 2	Cr	~ 0,07	< 0,05	~ 0,05
Orange RL	< 1	~ 7	~ 9	-	-	-	-
Fiery Red ML	~ 1	~ 1	~ 4	Cr	< 0,05	< 0,05	~ 0,05
Bordeaux RL	< 1	< 0,5	~ 2	Cr	< 0,05	< 0,05	< 0,05
Violet CLW	< 1	<1	~ 3	Cu	< 0,05	< 0,05	< 0,05
Green LWN	< 1	< 1	< 1	Cr	< 0,05	< 0,05	< 0,05
Bronze G	< 0,5	< 0,5	< 0,5	Fe	~ 0,2	< 0,05	< 0,05
Bronze 2LW	< 0,5	~ 1	< 0,5	Cr	< 0,05	< 0,05	< 0,05
Fast Bronze L	~ 3	~ 4	~ 5	Cu			
Brown GSL	< 1	< 1	< 1	Ni	< 0,05	< 0,05	< 0,05
Yellow-Brown 2G	< 1	< 0,5	< 1	Cr	< 0,05	< 0,05	< 0,05
Olive Brown 2R	< 1	< 0,5	< 0,2	Ni	< 0,1	< 0,1	< 0,1
Grey HLN Liquid	<0,1	<0,1	<0,1	Cr	< 0,05	< 0,05	< 0,05
Grey NL Liquid	< 1	~ 12	~ 320	Cr	< 0,05	~ 0,1	~ 2,6
Black CRO	< 1	< 1	< 1	-	-	-	-

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Chloride content (Cl-):

process A.: max. 1%

process B.: max. 1%

process C.: max. 0.2%

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13. EXAMPLE OF DECOLORIZING (PROCESS)

1000 ml	spent dyebath (Sanodal® Deep Black MLW: 13.6 g/l)
25 ml	iron III chloride solution 40% stir vigorously for 5 min, then add ca.
30 ml	milk of calcium hydroxide 25% (to pH 8-8.5) and stir until pH remains constant; if necessary add more milk of calcium hydroxide. Add while stirring
11 ml	Anodal® WT-1 Liquid and stir for another ca. 5 min.

After about 1 h separate the sediment by vacuum or gravity filtration.

The filtrate exhibits the following values:

residual dye:	<1	mg/l
total iron:	<0.2	mg/l
total aluminium:	<1	mg/l
total chrome:	<0.05	mg/l
chloride (Cl-)	<1	%
sulphate:	<0.1	%
pH:	7.0 ± 1	

Dye reduction related to the dyebath concentration: >99.9%.

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