PLATING PRODUCTS IND PVT LTD

Plot No.G 527, Phase 2, UPSIDC, M.G. Road, Industrial Area, Tehsil Dhaulana, Dist. Hapur, Uttarpradesh 201015.
CIN No.: U24303MH2021PTC371241
Gala No. 116, Saraf Udyog Bhavan, Chincholi Phatak, Malad (West), Mumbai – 400 064.
Phone: 9821340134/ 8104437477 Email: lab@platingproducts.in or info@platingproducts.in

Technical Data Sheet

PRODUCT INFORMATION

P BRIGHT PROCESS

High efficiency bright silver bath without strike solution for silver plating **Bright silver bath**

(Rack and Barrel plating)

The bright silver bath **P BRIGHT** is a cyanide high efficiency electrolyte for silver plating decorative and technical surfaces .The silvery-white colour of the deposit is very tarnish resistant. The deposited layer shows a hardness of 100 HV without being brittle. Highly bright silver deposits can be achieved, according to base material, without strike solution for silver plating. The deep throwing power of the electrolyte is extraordinary. The possibilities for use lie in rack as well as in cylinder electro-plating.

The maintenance of the electrolyte is not complicated.

Technical details

New make-up for 100 ltr bath solution:

Potassium cyanide (free of sodium)	13.000 kg
Potassium silver cyanide	7.430 kg
Potassium carbonate	4.000 kg
Brightener additive P BRIGHT MU C	app. 2.5 ltr
Brightener additive P BRIGHT MT C	app. 2.5 ltr
Consumption of brightener additive P BRIGHT MU C (according to bath load)	500 - 750 ml / 1000 Ah resp. 125 - 180 ml per kg deposited silver
Consumption of brightener additive P BRIGHT MT C (according to carry-over)	500 ml per kg deposited silver

Current efficiency	app. 99 - 100 % cathodic app. 103 % anodic
Hardness of deposits	app. 110 HV (Vickers)
Density of bath	18 - 20 Be / 20°C
Deposit	1 micron in app. 1,2 min. at 2 A/dm²

The following working conditions have to be observed:

	Value limits	optimum
Silver concentration	35 - 45 g/l	40 g/l
Free calcium cyanide concentration	120 - 140 g/l	130 g/l
Bath temperature	20 - 30°C	25°C
Current density	0,1 - 5 A/dm²	
Current efficiency	97 % corresponds to 65 mg/A/min (rack ware)	
Parts agitation	app. 10 - 12 Hub/min a 7 - 10 cm	

Using instruction

Composition of silver bath:

Potassium cyanide (free of sodium)	130 g/l
Potassium silver cyanide 54 %	74.3 g/l
Potassium carbonate (potash)	35 - 45 g/l

Attention: The bath must not contain any sodium cyanide. Only potassium cyanide can be used. Cyanide double salt must not be used.

Per 100 ltr ready bath add:

Brightener additive **P BRIGHT MU C**	2.5 litres
Brightener additive **P BRIGHT MT C**	2.5 litres

Silver baths containing sodium cyanide or cyanide double salt cannot be reversed. We suggest to precipitate the silver in the bath in the known way and to rework the potassium silver cyanide and to make up a new silver bath on the basis of potassium cyanide.

The ready silver bath should contain analytically:

Silver as metal	40 g/l
Free KCN	130 g/l
Potassium carbonate	34 - 45 g/l

(When the highest value of 110 g/l has been achieved, a new silver bath must be made up!)

Preparation of the bath:

A container made of polypropylene, hard rubber, stone ware etc. is filled with distilled water, that means an amount corresponding to half of the silver bath volume. The required amount of potassium cyanide is dissolved under strong stirring. When this has happened, potassium silver cyanide is added in small amounts. When everything has been well dissolved, potassium carbonate (potash) is added. When a clear solution has been achieved, 2.5 ltr brightener additive P BRIGHT MU C is added per 100 litres silver bath under strong stirring. A wooden frame is placed over the silver bath and a filtering cloth is clamped into this, which is made of a boiled-out and well rinsed cotton. If a filter unit with pump is available, the solution can be pumped into the silver bath container over the filter. Now the silver bath is half filled with bath concentrate, then distilled or fully desalted water is added up to working height, under constant stirring. Per 100 l ready bath 2.5 ltr brightener additive P BRIGHT MT C is added under stirring.

A test run can be made now, however, it should stand for one day for aging.

Bath container:

Made of polypropylene , hard rubber , stoneware. No tanks lined with lead.

Working temperature:

20 - 40°C (not under 20°C)

At higher temperature and agitation of the rod, a higher current density can be used.

Warming up of the bath:

Electric bath warmers made of enamel are fixed between the anodes and the long side of the bath container and be completely screened off from the anodes, therefore, if possible, not over the ground of the container!

Current density:

At 20°C bath temperature app. 1 A/dm²

At a higher temperature and agitation of the rod a higher current density can be used up to max. 5 A/dm²at about 40°C bath temperature.

Filtration:

It is naturally desirable that the bath must be kept completely clean. Frequent filtering is absolutely recommended. For working with high current densities, continuous filtering is necessary.

Anodes: 1

Made of fine silver, in bags made of boiled-out and well rinsed, non-bleached cotton material or bags of nylon.

Voltage:

1 - 3 volt according to current density.

Brightener additives:

The brightener **P BRIGHT MU C** is the main additive for maintaining a high bright silver sedimentation. This brightener additive is normally not soluble in water but easily soluble in caustic potash solution or silver bath. It is sold in the form of a stock solution and should be added to the bath after the end of the working period under strong stirring.

Use according to bath load 500 - 750 ml / 1000 Ah, resp. 125 - 180 ml per kg deposited silver.

The P BRIGHT MT C brightener is an additive which complements the effect of MU C brightener. MT C brightener is relative stable and the consumption depends largely on the "loss of bath fluid" and also on the amount of silver bath fluid which is carried out of the bath with the parts.

A too high addition of MT C gives a white silver colour in the lower current density range and a more yellowish colour in a higher current density range.

Be careful! Do not add too much MT B brightener.

Control of the bath:

The content of potassium cyanide, silver and potassium carbonate (potash) in the bath is set according to the known methods common for silver bathes. The control of the brightener is made with the aid of a hull cell. First of all, the normal composition of the bath of potassium cyanide, silver and potassium carbonate is corrected, and then the corrected bath sample is filled into the hull cell where with small additions of MU C and MT C brightener, the brightener range of the bath is corrected. If too large additions of Part MUC or MTC have been done, these can be annihilated by filtering the bath with active carbon. It should be mentioned that a too high addition of MU C brightener cannot make any damages.

Cleaning with active carbon:

Should the silver bath have become impure, so that an unobjectionable bright precipitation is no longer possible, the bath must be treated with active carbon. For this purpose you require:

1. A separate container made of polypropylene or a bath lined with hard rubber, which has the capacity of the total bath fluid to be cleaned.

2. A filtering unit, i.e. filter aggregate suitable for silver bathes with a pump made of stainless material plastic), a wooden frame with filtering cloth made of well washed, non-bleached cotton material or nylon.

3. Electric immersion heater or another heating possibility, so that the container with the bath fluid can be held constantly at 40 - 50°C.

4. Active carbon of best quality, finely ground, per litre bath fluid 5 gm.

Transfer the to be cleaned silver bath into a separate container, heat to 40 - 50°C, add 5 g active carbon per litre bath fluid and stir strongly for at least one hour. Maintain temperature constant at 40 - 50°C and let the carbon work on the bath fluid for 48 hours, stir strongly now and again.

After 48 hours let the fluid rest, so that the sludge can settle down on the ground. The fluid now standing over the sludge is now filtered carefully over into a well cleaned container - without unnecessarily stirring up the sludge. No sludge or carbon particles are to be transported over with the fluid. When the complete clear fluid has been transported, the missing bath amount is replaced by pure distilled or desalinated water, the silver potassium cyanide and potassium carbonate content of the bath corrected according to analysis – transfer 250 cm^3 of the corrected bath fluid into the hull cell and now add MU C and MT C brightener, until the proof sheet run in the hull cell shows a satisfactory brightening effect.

The correspondingly calculated quantity of brightener additive MU C and MT C are then added to the bath.

This cleaning with active carbon is therefore a general cleaning; all brightener additives and decomposition products in the bath are destroyed herewith.

Through this treatment one achieve an unobjectionable silver bath over and over again.

Analysis instructions:

Required chemicals:

1. Potassium iodide solution 10 %

2. Silver nitrate solution 0.1 N

Conduction:

1. Pipette 1 ml bath solution in 300 ml Erlenmeyer flask.
2. Add 100 ml water.
3. Add 1 ml of a 10 % potassium iodide solution and titrate with silver nitrate solution up to a certain cloudy colouring

Use up of silver nitrate solution x 13 = g/l KCN

Set value: 130 g/l KCN

Silver determination of Bath

Necessary chemicals:

1. Lead acetate

2. Sulphuric acid conc.

3. Iron alum (Ammonium iron (III)-sulphate 150 g/l)

4. Nitric acid conc.

5. Ammonium thiozyanat solution 0,1 n

Conduction:

1. Pipette 1 ml bath solution in 300 ml Erlenmeyer flask.

2. Add 100 ml water and about 1 g lead acetate.

3. Add 2 ml of sulphuric acid.

4. Add 3 ml iron alum solution.

5. Add 10 ml nitric acid and with ammonium thiozyanat solution titrate to change of colour to light brownish.

Use of ammonium thiozyanat solution x 10,78 = g/l Ag

Set value: 40 g/l Ag

Analysis:

1. Hull cell test of the incoming bath in order to get a picture of the quality of the bath.

2. Free potassium cyanide:

1 ml bath sample in an Erlenmeyer flask plus 100 ml distilled water, add a few drops of potassiumiodide indicator (10 %), titrate under shaking with n/10 silver nitrate solution, just until a weak opalescence arises which cannot be removed, even through strong shaking.

Reading: used ml N/10 silver nitrate x 13 = gram free potassium cyanide per litre bath

3. Silver:

10 ml bath sample in an Erlenmeyer flask plus 75 ml distilled water plus 25 ml of a 25 % sodium sulphide solution. Leave to rest for 15 minutes, whereby the silver is deposited as black silver sulphide.

Filter through filter paper into a clean Erlenmeyer flask. Wash the filtrate several times with warm distilled water. Transfer filter with content into a clean Erlenmeyer flask (silver sulphide).

Add under discharge: 10 ml conc. nitric acid chem. pure

20 ml distilled water

Let to boil until all silver sulphide is dissolved and no more brown steam arises. Let to cool off, add 50 ml distilled water plus app. 1 ml of a 25 % ferric ammonium solution. Titrate with n/10 potassium rhodanide solution until the sample only just becomes a weak blood red colour which cannot be removed, despite of strong shaking.

Reading: used ml n/10 rhodanide solution x 1.08 = gram silver per litre bath.

4. Potassium carbonate:

10 ml bath sample in a 250 ml measuring beaker, then fill up to measuring mark with distilled water, shake well. Take 25 ml from this with a pipette and transfer into an Erlenmeyer flask. Add 25 ml of a 5 % mercury sublimate solution, a few drops methyl orange indicator and titrate under shaking with n/10 hydrochloric acid, until change from yellow to clearly red.

Reading: used ml n/10 hydrochloric acid x 6.9 = gram potassium carbonate per litre bath.

5. Correction of bath to correct values:

KCN = 130 g/l bath

Ag = 40 g/l bath

K_2CO_3 = 35 - 45 g/l bath

Potassium carbonate is very important for a good conductivity of the bath. A too high content, however, is detrimental. The bath does not work unobjectionably smooth.

The best method of improvement: dilute bath and adjust to correct values with potassium cyanide and silver cyanide. The same with a too high cyanide content: dilute and correct. The silver content should not drop under 36 g/l, better is 40 g/l.

Brightener additive MUC and MTC is determind through hull cell test and simultanously also the other conditions of the silver bath: see control plan.

Addition of Brightener additive MUC is not critical, this is used up during the working of the bath.

Too much brightener additive MTC however can produce milky deposits.MTC is only used up through carry-over, therefore use MUC very reserved (milky deposits in lower current density areas).

Cleaning of bath: Filtration and treatment with active carbon.

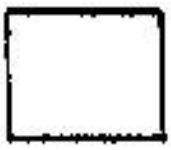
Heat to 50°C and maintain this temperature for 48 hours. Under strong stirring add 5 g active carbon per litre silver bath. Stir frequently. Filter carefully after 48 hours.
As filtering help: asbestos powder.

Working conditions for hull cell test for testing the brightener additives P BRIGHT MU C and MT C

250 ml bath sample

Room temperature:	25 °C
Current:	1 A
Voltage:	app. 1.6 – 2.0 V
Time:	10 minutes
	no bath agitation
Anode:	silver
Cathode:	nickel sheet or polished brass sheet, well degreased

Key:



bright

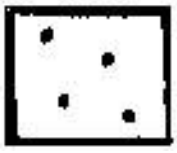
stripped

dull

burnt

rough

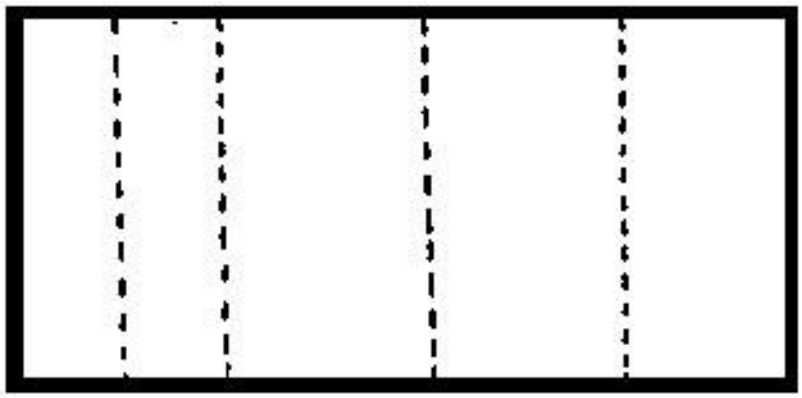
porous



semi-bright powdry

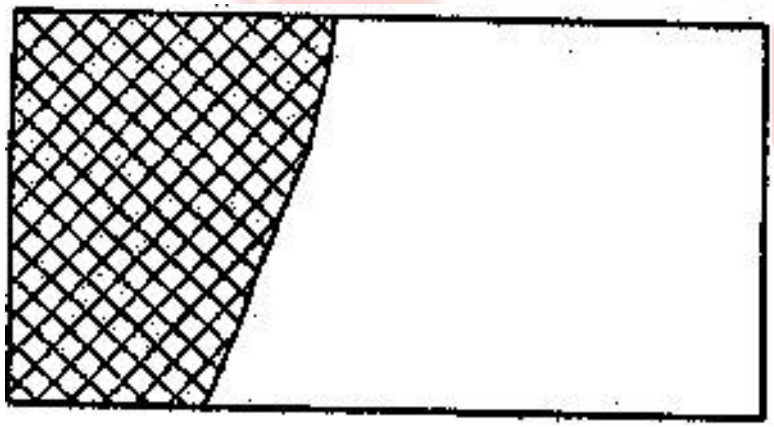
Hull cell sheet

1 A total current

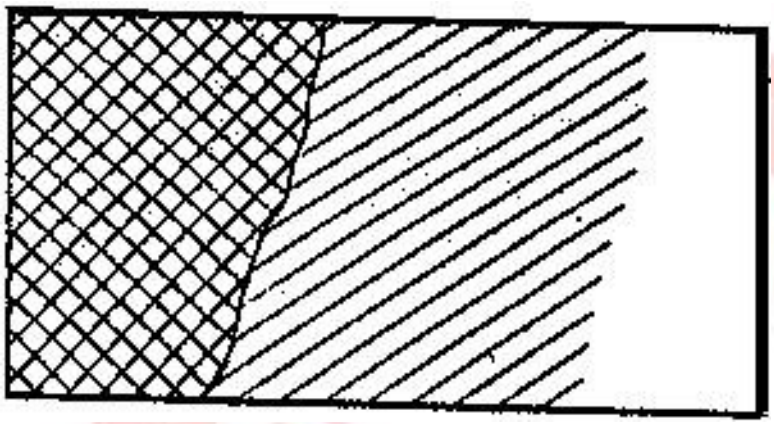


4,6 2,9 1,1 0,4 0,2 A/dm²

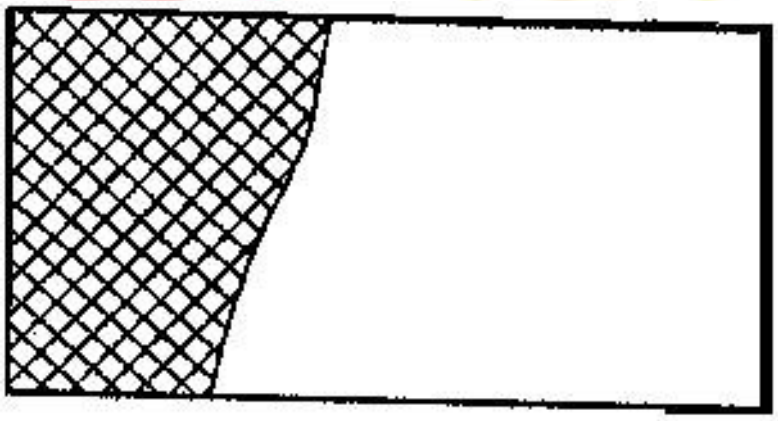
<u>Results of brightener bath</u> with balanced content of silver, free cyanide and carbonate



Normal precipitation with normal MUC and MTC brightener additive

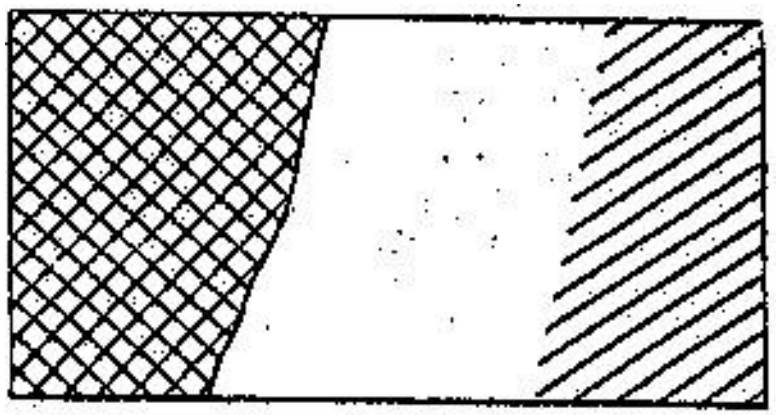


too little MUC, MTC normal <u>ANTIDOTE:</u>
addition of MUC

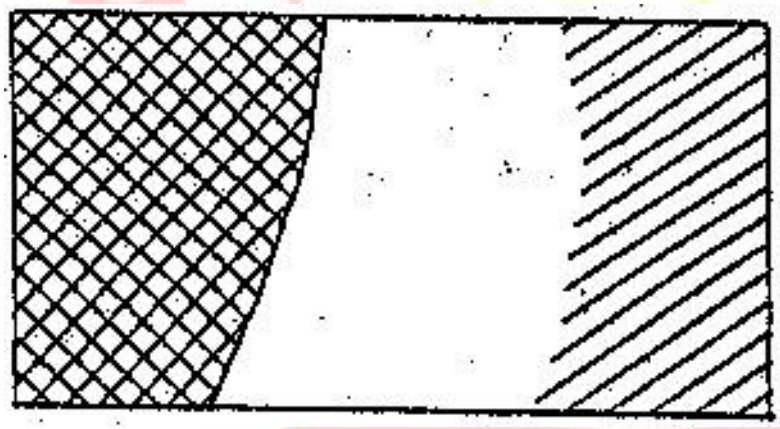


high content of MUC, MTC normal

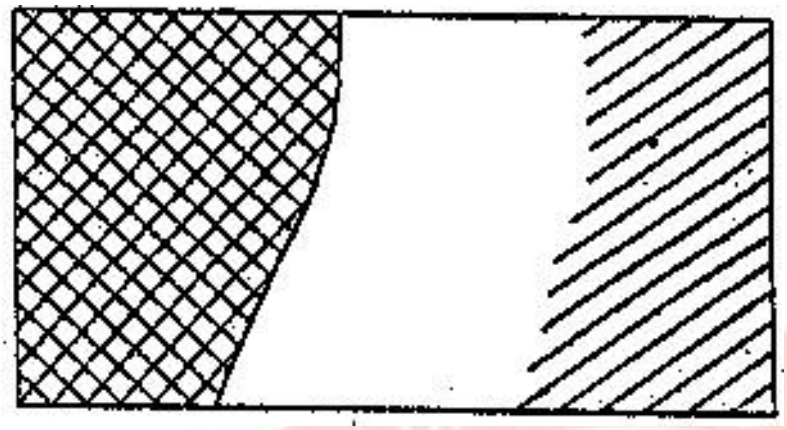
<u>Results of brightener bath</u> with balanced content of silver, free cyanide and carbonate



MUC normal, MTC low
ANTIDOTE: addition of MTC

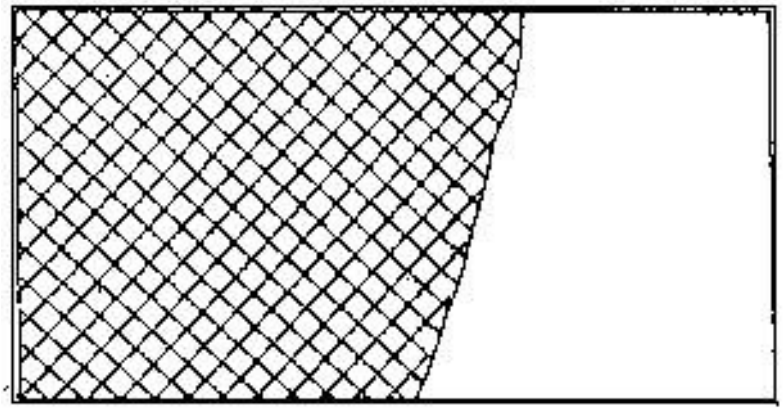


MUC normal, high content of MTC
ANTIDOTE: stronger agitation for treatment with active carbon



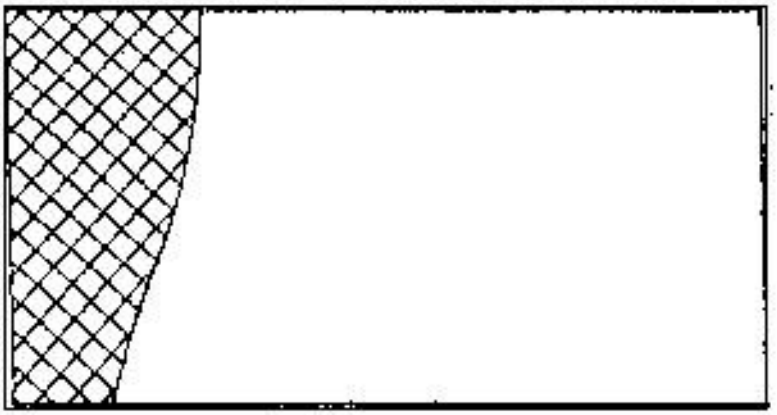
high pH-content, MUC and MTC normal

ANTIDOTE: addition of potassium bicarbonate in order to reduce the pH-content **Results of brightener bath** with unbalanced silver content, cyanide and carbonate correct

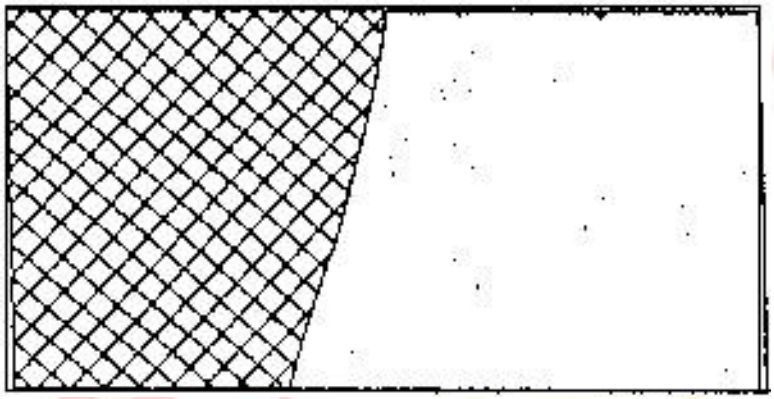


low silver content, MUC and MTC normal

ANTIDOTE: addition of potassium silver cyanide



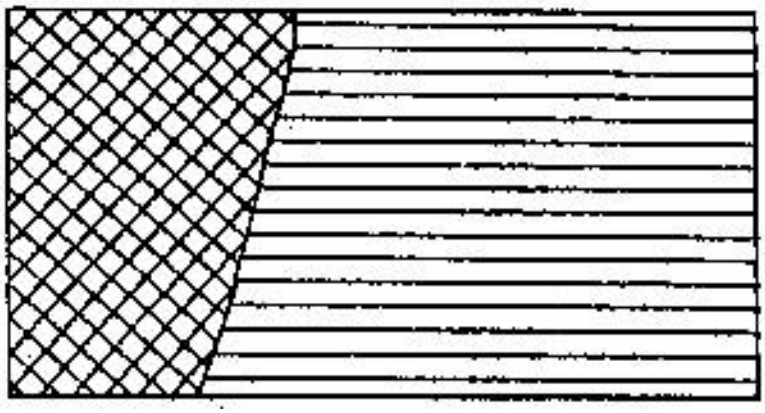
higher silver content - MUC and MTC normal



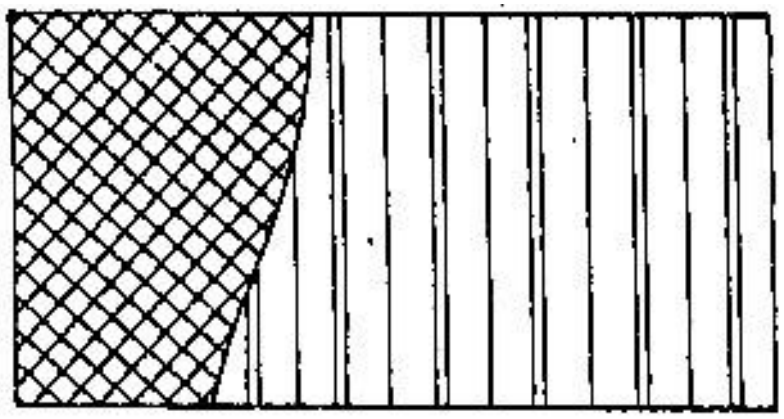
low free potassium cyanide content

ANTIDOTE: addition of KCN

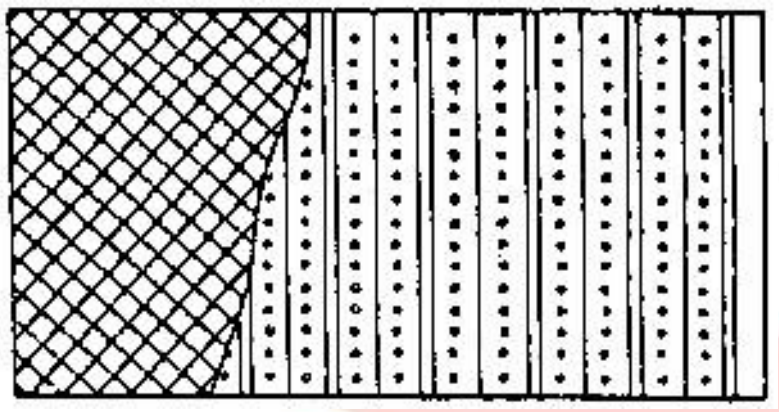
Results of brightener bath:- Effect of foreign substances



inorganic foreign substances
MUC and MTC normal
ANTIDOTE: electrolysis with low current density

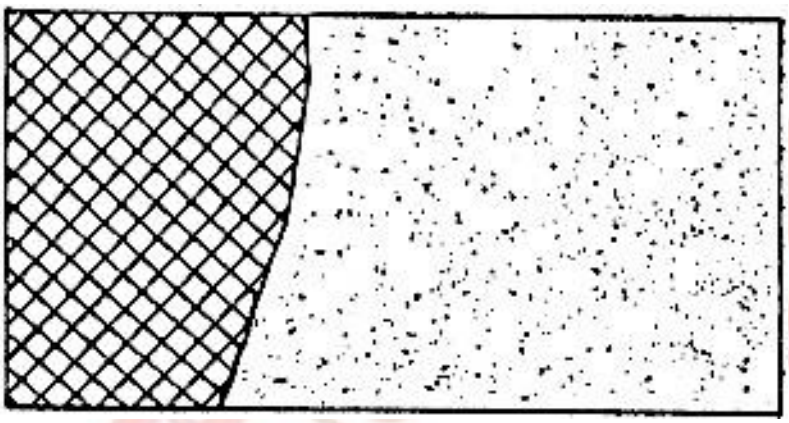


lightly floating particles
MUC and MTC normal
ANTIDOTE: filtering (asbestos filter)

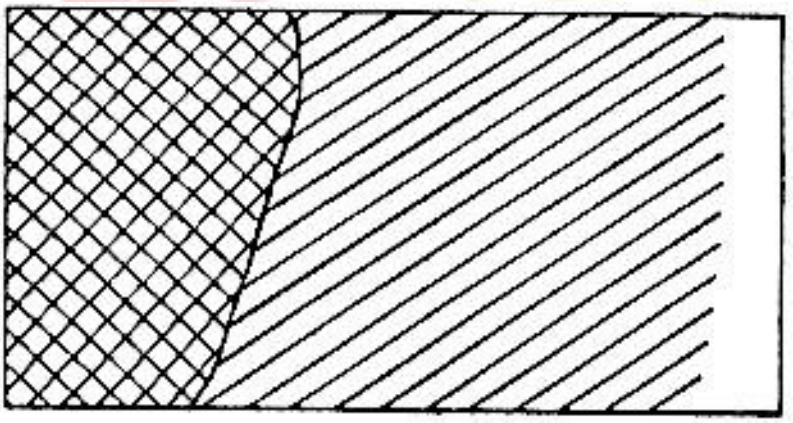


heavy, massive particles
MUC and MTC normal
ANTIDOTE: simple filtering

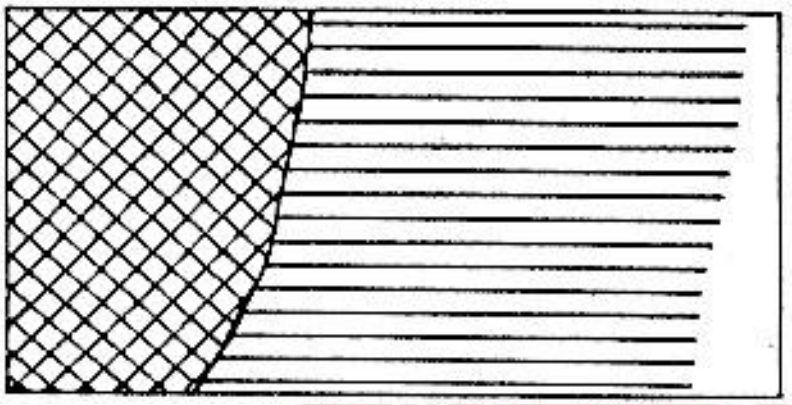
Results of brightener bath:- Effect of foreign substances



salt and pepper effect
MUC and MTC normal
ANTIDOTE: filtering and electrolysis

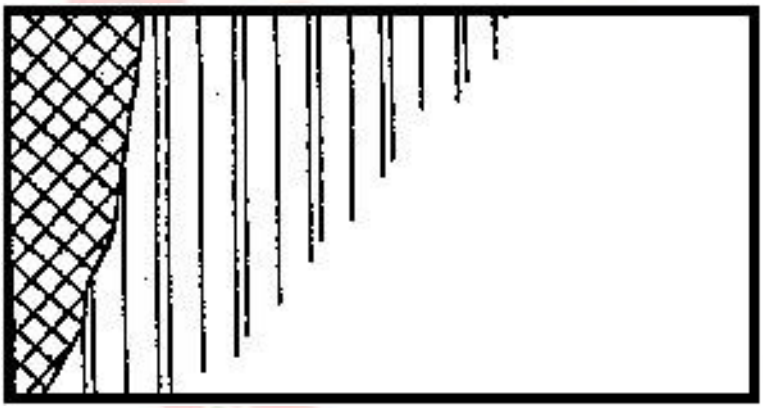


high concentration of sodium ion
MUC and MTC normal
ANTIDOTE: addition of 60 - 120 g/l potassium nitrate

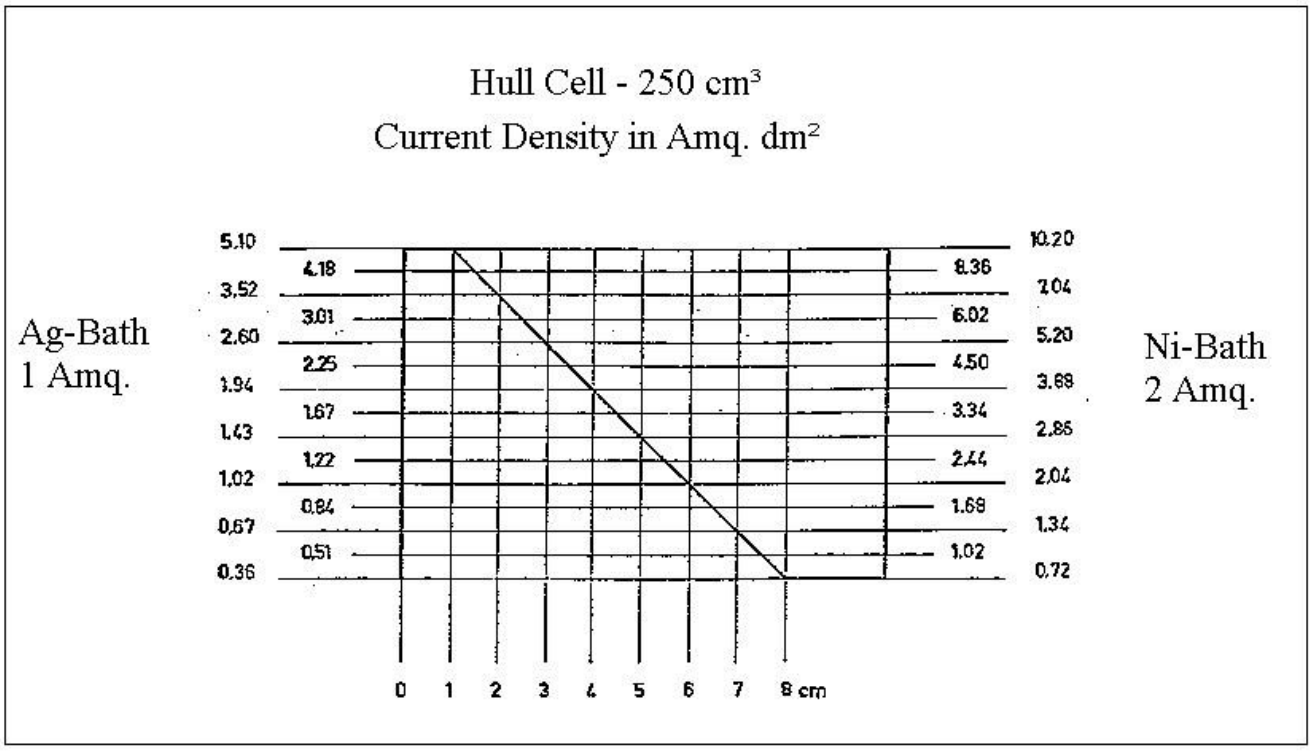


high concentration of sodium carbonate
MUC and MTC normal
ANTIDOTE: treatment with calcium nitrate and active carbon

Results of brightener bath:- Effect of foreign substances



Effect of potassium nitrate in mixed sodium/potassium bath
MUC and MTC normal normally does not arise
ANTIDOTE: simple filtering



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