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THE FINAL REPORT
Of
TANNERY SLUDGE DRYING TEST BY FLUIDIZED BED DRYER

Under the UNIDO Assistant Project

(Shanghai Dachang)

Project No. US/CPR/97/022
Contract No. 98/148

Implementation Unit
SHANGHAI RICHINA LEATHER CO., LTD.

June 1998—June 1999

Final Report of Fluidized Bed Drying Test of Tannery Sludge

Shanghai Dachang
UNIDO Assisted Project
Project No. CPR/120/022
Contract No. 98/148
Implementation Unit Shanghai Richina Leather Co., Ltd.

1. Background

1.1 In October 1997, the UNIDO assisted project of tannery sludge disposal was formally confirmed at Beijing meeting, project no. US/CPR/97/022, as the chain and supporting project of the project of tannery effluent treatment (US/CPR/92/120).

1.2 In Feb. 1998 China Leather Industrial Association (CLIA) organized a team for Germany with the aim of investigating the sludge treatment technology. In April a sludge project meeting was hold in Shanghai to discuss and assign the test tasks and work schedule for each assisted site.

1.3 In Mar. 98 UNIDO expert Mr. Frings came to Dachang to discuss with SRL the preliminary plan of co-drying test of tannery/petrochemical sludge and the overall assignment of the cooperation test with the Water Purification Plant of Shanghai Jinshan Petrochemical Refinery (SJPR).

1.4 On April 29, 1998 SRL submitted UNIDO Beijing, Vienna and CLIA the Implementation Plan of Tannery sludge Disposal. In June, SRL president Mr. E. Hagen signed the project contract (No. 98/148) provided by UNIDO Vienna.

1.5 In Jan. 99 SRL submitted UNIDO Beijing and Vienna the Analysis Report of Tannery Sludge Drying Test under UNIDO Project after the completion of the first three tests and analysis and continued carrying on the last two tests and analysis prescribed in the project contract.

2 Objectives

2.1 The objectives are in accordance with Item 1.01 and 2.01 of the contract (No. 98/148) and Item B and C of the Annex B, Terms of Reference.

2.2 Please see Item 2 of the Implementation Plan of Tannery Sludge Disposal Project.

3 Tests and Analysis

3.1 Table 1 shows the progress of the project.

Actual progress of five times co-drying tests of tannery/petrochemical sludge

Table 1

Tests	Mixture ratio of sludge	Water content of sludge	time of drying tests	time of analysis
1	1:1		Oct. 20, 98	Nov. 6, 98
2	1:3		Nov. 24, 98	Dec. 10, 98
3	1:5	80-85%	Dec. 29, 98	Jan. 12, 99
4	1:2		Feb. 9, 99	May 24, 99
5	1:4		Mar. 12, 99	June 3, 99

3.2 For the analysis of the sludge before drying, please see Table 2 and Annex A.

3.2.1 Shanghai Luwan Environmental Monitoring Station was entrusted to carry out the analysis with paid service.

3.3 Conditions and requirements of the drying tests

3.3.1 The Water Purification Plant of Shanghai Jinshan Petrochemical Refinery (SJPR) who owns the sludge fluidized bed dryer was entrusted to carry out the fluidized bed-drying test with paid service. According to the entrustment agreement, the consignee should carried out the tests based on the plan provided by the consignor and with offer service.

3.3.2 The main points of the tests are as follows:

- technical conditions: based on the technical parameter of the fluidized bed drier , under 80°C and oxygen free, the final product with 95% of dry solids
- times of tests: five times
- mixture ratio: 1:1, 1:3, 1:5, 1:2, 1:4
- sludge consumption: basically, the drier was started from 100 tons of mixed sludge
- test schedule: once a week and the total tests period of about 2 months

3.4 For the analysis of the dried residual please see Table 3 and Annex A.

3.4.1 Shanghai Luwan Environmental Monitoring Station was entrusted to carry out the analysis with paid service.

3.5 For the test and analysis (chromium) of the wash out liquid of the dried residuals please see Table 4 and 5.

3.5.1 The test method was provided by Dr. U. Frings and the wash liquid was taken as three kinds of acidic (pH 4.5), neutral (pH 7) and alkaline (pH 8.5) to simulate the different situation of rain or water and detect the transferring of chrome.

3.5.2 The analysis method of TCr, Cr III and Cr IV was based on National Standard Methods GB 7466-87and GB 7467-87.

3.5.3 The laboratory of Effluent DEPT. SRL performed the test and analysis.

3.6 For the application test of drying residual for road pavement please see Annex B.

The application test for road material was committed and carried out by Shanghai Huaning Construction Engineering Company.

4 Discussions and Comments

4.1 Explanation of tests conditions

4.1.1 SJPR gave the strict requirements of the tannery sludge with 80-85% of water content. The difficulty in achieving this requirement was owing to the water content of the dewatered sludge remained around 70-75%. At the same time the tested sludge should not contain rubbish or grits which would probably damage the fluidized bed dryer and also take the conveying into consideration.

4.1.2 The drying equipment is enclosed type and automatically screw feeding without mixing, therefore, the mixture ratio was not very accurate and even.

4.2 Comments of the dried sludge of its physical appearance:

4.2.1 The physical appearance of the dried sludge was a sort of fine hard solid particle whose size was close to powder, of the black brown color.

4.2.2 Exposing to the indoors open air for one month, no obvious accumulations of moisture was observed. Keeping under the water for 72 hours, it turned out to be insoluble or little soluble.

4.2.3 From the dried sludge, no obvious stinking or strange smell was observed.

4.2.4 The volume and weight of the dried sludge, compared with the dewatered sludge, was much smaller. The hygienic quality was much more improved; therefore, it was much easier for transportation and final disposal.

4.3 The data comparison of pre/post sludge drying test

4.3.1 Before the sludge test, the data obtained through analysis was basically OK. The total content of chrome was originally very little and it became even less after the drying test. All the content of chrome as of valence III and the chrome of valent VI had not been found. This was to say that the chrome content was relatively stable during the sludge drying process through the fluidized dryer. In addition, in the environment of low temperature with no oxygen existence, the possibility of the chrome content to be oxidized was almost none.

4.3.2 The chrome and manganese content in the dried sludge was extremely little and in a quite stable state. There were high percentage for other volatile substance and ashes, which made the final safe disposal of the dried sludge feasible.

4.3.3 There were certain amount of nitrogen and organic substance in the dried sludge, which made it practically valuable and feasible to use the dried sludge as a sort of fertilizer (greenery plantation).

4.4 Comment s of the analysis of dried sludge wash out liquids

4.4.1 By putting in the acids or alkaline or neutralized liquids and having been subject to 24 hours continuous shake and centrifugal stirring, no chrome has been fund extracted from the wash out liquid.

4.4.2 The wash out liquid was lighting yellow and slightly turbid, but sometimes was hard to be seperated. Maybe it was because there was

some side products from the petroleum chemical industry or the organic substance from the leather industry. The liquid was basically clear after centrifugal stirring.

4.4.3 The test displayed that the chrome content in the mixed dried sludge was extremely little. Its state was quite stable and did not tend to transfer/move. The possibilities of creating secondary pollution were extremely little, and therefore, the final disposal of dried sludge was quite safe.

4.5 Comments of the test using dried sludge as roadbed materials

4.5.1 This was only a tentative test. After follow up observation for more than six months, nothing abnormal had been noticed within the testing road area.

4.5.2 As one of the final way of disposal and utilization of dried sludge, this is still to be formally approved by the Government Supervision Body and the Road Construction Company.

5 Conclusions

5.1 According to the Implementation Plan of Tannery Sludge Disposal, the concerned items of Project Contract (No. 98/148) and Annex B, SRL has totally completed the whole tasks stipulated by the UNIDO project (Shanghai) of the fluidized bed drying test and analysis of tannery sludge, studied and proved the technical feasibility of efficiently solving the problem of safely disposing the tannery sludge by using of the sludge fluidized bed dryer.

5.2 Test results show that the dried residuals containing 95% of dry matters, without moisture absorption, or obvious odor. The hygienic quality was much more improved. Both the volume and the weight of the sludge have been much more reduced so it is convenient to transport and dispose (landfill or dumping) and utilize (for roadbed or brickmaking) the sludge. It should be noted that no hexavalent chromium have been detected in the five tests and even the trivalent chromium was comparatively stable and without transferring, the possibility of secondary pollution is very little and the final disposal of the dried disposal is safe.

5.3 This test is depended on the exported equipment of fluidized bed dryer (CT Umwelttechnik, Germany). The test cost was very high due to the energy consumption, detection and management therefore it is hard for the tannery

to afford it from the view of economy and also the extent of spreading and application was much more limited.

6 Finance Balance

The finance was balanced by controlling the actual expenses and the budget limitation of the project tests based on the Project Contract and the Implementation Plan. For details please see Table 6.

7 Problems and Suggestions

7.1 Problems of progress

7.1.1 The Final Report was prescribed in the contract being submitted no later than Nov. 1998 while different unexpected difficulties occurred during the period of implementation. The first test was started from Oct. 20 1998 and the last one was ended in May 99 which lasted seven months owing to the troubleshooting of the dryer.

7.1.2 The dried residuals were originally planned being sent to Nanjing Tannery for brickmaking test by using 5-10% of residuals. However the opportunity was lost because the brickmaking test had been already finished when the drying test in Shanghai was finally ended with delay.

7.2 Suggestions on popularization of project achievements

7.2.1 It is suggested that CLIA organize an inform discussion on tannery sludge treatment for colleagues from the tanning trade who can be benefited from mutual discussions. So the treatment methods suiting local conditions can be popularized.

7.2.2 It is suggested UNIDO deepen the assistance connotation of the project or introduce new project with the aim of designing and making the fluidized bed dryer suiting the tannery sludge. For example, to make the dryer with low energy consumed easily controlled and low price for tannery sludge application so to popularize it in the middle and small-scale tanneries.

表2
Table 2

污泥干化试验分析数据表
analysis data Sheet of sludge drying test

US/CPR/97/022
Shanghai Richina Leather

单位：%
Unit: %

项目item / 样品sample	总铬 TCr	三价铬 CrⅢ	六价铬 CrⅥ	锰 Mn	有机质 Organic matter	总氮 TN	总磷 TP	水份 moisture	灰份 ash	挥发物 Volatile matter
污泥样品（1） NO.1.sludge(1:1)	0.36	0.36	未检出 None	0.032	7.04	0.95	0.047	69.1	9.76	80.33
污泥样品（2） NO. 2 .sludge(1:3)	0.21	0.21	未检出 None	0.025	5.16	0.83	0.041	73.8	10.82	81.96
污泥样品（3） NO. 3 .sludge(1:5)	0.37	0.37	未检出 None	0.025	5.04	1.08	0.044	65.95	13.24	79.31
污泥样品（4） NO. 4 .sludge(1:2)	0.38	0.38	未检出 None	0.033	5.61	1.29	0.11	69.7	10.26	87.44
污泥样品（5） NO. 5 .sludge(1:4)	0.36	0.36	未检出 None	0.029	6.24	1.20	0.12	73.0	8.85	90.07

* 根据 SLEM 提供的原始分析数据 Based on the original analysis report of SLEM

表3
Table3

污泥干化试验分析数据表
analysis data Sheet of sludge drying test

US/CPR/97/022
Shanghai Richina Leather

单位：%
Unit: %

项目item / 样品sample	总铬 TCr	三价铬 Cr^{III}	六价铬 Cr^{VI}	锰 Mn	有机质 Organic matter	总氮 TN	总磷 TP	水份 moisture	灰份 ash	挥发物 Volatile matter
干化物样品(1) NO.1.drying products(1:1)	0.10	0.10	未检出 None	0.033	5.76	4.01	0.364	5.95	31.37	55.32
干化物样品(2) NO.2.drying products(1:3)	0.15	0.15	未检出 None	0.050	5.02	3.29	0.397	6.2	31.47	58.56
干化物样品(3) NO.3.drying products(1:5)	0.06	0.06	未检出 None	0.045	6.08	2.65	0.632	8.61	32.81	56.35
干化物样品(4) NO.4.drying products(1:2)	0.022	0.022	未检出 None	0.023	5.57	4.36	0.86	7.76	31.40	66.50
干化物样品(5) NO.5.drying products(1:4)	0.025	0.025	未检出 None	0.022	5.82	4.64	0.93	8.73	31.47	66.02

* 根据 SLEM 提供的原始分析数据 Basecl on the original analysis report of SLEM

表4
Table 4

污泥干化物洗出液试验分析数据表
analysis date Sheet on wash out test for sludge drying products

US/CPR/97/022
Shanghai Richina Leather

单位：%
Unit: %

试验次数 Test No	干化物重量 克/g weight of drying product	加入不同水量 毫升/ml Volume of put in different water pH4.5	pH7	pH8.8	翻动时间 小时/hour shaked time	分离方法 separated method	洗出液 wash out liquid 体积 ml Volume	颜色 Colour	总铬 mg/l TCr	六价铬 mg/l Cr_{VI}	三价铬 mg/l Cr_{III}	备注 Remarks
样品(1) sample(1:1)	100	1000			24	离心分离 separated by instrument	800	浅黄 weak orange	0.086	未检出 None	0.086	
			1000				850		未检出 None	未检出 None	未检出 None	
				1000			800		0.08	未检出 None	0.08	
样品(2) sample(1:3)	100		1000		24	离心分离 separated by instrument	650	浅黄 weak orange	未检出 None	未检出 None	未检出 None	
样品(3) sample(1:5)	100	1000			24	离心分离 separated by instrument	810	浅黄 weak orange	未检出 None	未检出 None	未检出 None	
			1000				800		未检出 None	未检出 None	未检出 None	
				1000			820		未检出 None	未检出 None	未检出 None	

* 洗出液试验方法按照弗林斯先生提供资料；铬测定分析方法按照GB7466－87、GB7467－87。
The test method according to special information by Mr.Frings;Chrome content analysis method accordance with GB7466, GB7467.

表5
Table 5

污泥干化物洗出液试验分析数据表
analysis date Sheet on wash out test for sludge drying products

US/CPR/97/022
Shanghai Richina Leather

单位：%
Unit: %

试验次数 Test No	干化物重量 克/g weight of drying product	加入不同水量 毫升/ml Volume of put in different water pH4.5	pH7	pH8.8	翻动时间 小时/hour shaked time	洗出液 wash out liquid 分离方法 separated method	总铬 mg/l TCr	六价铬 mg/l Cr_{VI}	三价铬 mg/l Cr_{III}	备注 Remarks
样品(4) sample(1:2)	100	1000			24	洗出液难以过滤 wash-out liquid can not be seperated	未检出 None	未检出 None	未检出 None	
			1000				未检出 None	未检出 None	未检出 None	
				1000			未检出 None	未检出 None	未检出 None	
样品(5) sample(1:4)	100	1000			24	洗出液难以过滤 wash-out liquid can not be seperated	未检出 None	未检出 None	未检出 None	
			1000				未检出 None	未检出 None	未检出 None	
				1000			未检出 None	未检出 None	未检出 None	

* 洗出液试验方法按照弗林斯先生提供资料；铬测定分析方法按照GB7466－87、GB7467－87。
The test method according to special information by Mr.Frings;Chrome content analysis method accordance with GB7466, GB7467.

Budget Balance of Project

Table 6

Unit: RMB Yuan

Budget Item	Implemented	Budget	Paid	Balance	Remarks
1. tannery sludge analysis (5 times)	1. tannery sludge analysis (5 times)	15,000	5,000	+10,000	A. The cost of drying tests included tests operation, sludge transport, loading, mixing and feeding which were paid to Jinshan and environmental sanitary company as agreed B. The filter cloth was forced renewing because the tests required sludge with 80-85% of water content which was higher than 10% of normal content and caused badly sticky cloth, part of them damaged and part taken off and cleaned
2. dried residuals analysis (5 times)	2. dried residuals analysis (5 times)	15,000	5,000	+10,000	
3. drying tests (5 times) including *tests* *transportation and loading* *mixing and feeding*	3. drying tests (5 times) including *tests* *transportation and loading* *mixing and feeding*	60,000 *20,000* *25,000* *15,000*	60,000 *20,000* *25,000* *15,000*	0	
--	4. wash out liquid analysis of residuals	--	4,000	-4,000	
4. study of residuals disposal	--	10,000	--	+10,000	
5.plan selection and expert's proof	--	2,000	--	+2,000	
--	5. test drying residuals for roadbed	--	5,000	-5,000	
--	6. renewal of filter cloth of press	--	34,000	-34,000	
6.contingency	--	10,000	--	+10,000	
	7. others (travel, transport and others)	--	2,000	-2,000	
Total		112,000	115,000	-3,000	

Annex A

（ 环监 ）监字第 号

环境监测测试报告
Environmental Monitoring Report

（本报告共 1 页）

US/UPR/97/022--98/148

项目名称： 制革污泥处理试验项目 ）
Title

委托监测
仅供参考

被测试单位：上海富国皮革有限公司
Client

报告日期 1999 年 1 月 28 日
Reporting Date

上海市卢湾区环境监测站
专用章
Shanghai Lu Wai Qu Environmental Monitoring Station

地址：兴业路222号7楼
Address:

电话：63263396
Tel:

邮政编码：200020

电传:

上海市废水监测报告

Wastwater Report of Shanghai Environmental Monitoring

单位地址：　　　　　电话：　　　　所属街道：　　　　　联系人：　　　　　第 1 页
Address　　　　　　Tel　　　　　District　　　　　　Associate　　　　　Page

采样地点 Sample site		上海富国皮革有限公司（1998.9.27--1999.1.6自送）						备注
项目 Item	采样时间 Time	干化前 1998 9.27	干化后 1998 11.4	干化前(2) 1999 1.6	干化后(2) 1999 1.6	干化前(3) 1999 1.6	干化后(3) 1999 1.6	注
水份		69.1	5.95	73.8	6.20	65.95	8.61	
灰份		9.76	31.37	10.82	31.47	13.24	32.81	
挥发份		80.33	55.32	81.96	58.56	79.31	56.35	
总磷		0.047	0.364	0.041	0.397	0.044	0.632	
有机质		7.04	5.76	5.16	5.02	5.04	6.08	
总铬		0.36	0.10	0.21	0.15	0.37	0.06	
三价铬		0.36	0.10	0.21	0.15	0.37	0.06	
六价铬		未检出	未检出	未检出	未检出	未检出	未检出	
锰		0.032	0.033	0.025	0.050	0.025	0.045	
总氮		0.95	4.01	0.83	3.29	1.08	2.65	

报告编制：　　　　室主任：　　　　站审核：
Report Compiler:　　　Department Director:　　　Auditor:

注：以上分析数据除PH值、色度外，其它项目所用单位都为mg/L。

(环监)监字第 号

(94)量认(沪)字(U0254)号

环境监测测试报告
Environmental Monitoring Report

(本报告共 1 页)

US/UPR/97/022--98/148

项目名称: 制革污泥处理试验项目
Title

委托监测
仅供参考

被测试单位: 上海富国皮革有限公司
Client

报告日期 1999 年 6 月 10 日
Reporting Date

上海市卢湾区环境监测站

Shanghai Lu Wai Qu Environmental Monitoring Station

地址: 兴业路222号7楼
Address:

电话: 63263396
Tel:

邮政编码: 200020
Zip Code:

电传:
Fax:

上海市废水监测报告

Wastwater Report of Shanghai Environmental Monitoring

单位地址: Address　　电话: Tel　　所属街道: District　　联系人: Associate　　第 1 页 Page

采样地点 Sample site	上海富国皮革有限公司 (1999.5.24)												备注
项目 Item / 采样时间 Time	4-干化后	5-干化后	4-干化前	5-干化前									
水份	7.76	8.73	69.7	73.0									
灰份	31.40	31.47	10.26	8.85									
挥发份	66.50	66.02	87.44	90.07									
总磷	0.86	0.93	0.11	0.12									
总氮	4.36	4.64	1.29	1.20									
有机质	5.57	5.82	5.61	6.24									
总铬	0.022	0.025	0.38	0.36									
三价铬	0.022	0.025	0.38	0.36									
六价铬	未检出	未检出	未检出	未检出									
锰	0.023	0.022	0.033	0.029									

报告编制: Report Compiler:　　室主任: Department Director:　　站审核: Auditor:

注: 以上分析数据除PH值、色度外, 其它项目所用单位都为mg/L。

Note:The units for above parameter execptor PH and colourity are mg/L.

Annex B

Test of Using Drying Residuals of Tannery Sludge for Roadbed of Highway

1. Cooperation Unit of Test

Shanghai Huaning Construction Engineering Company

2. Date of Test

November 6, 1998

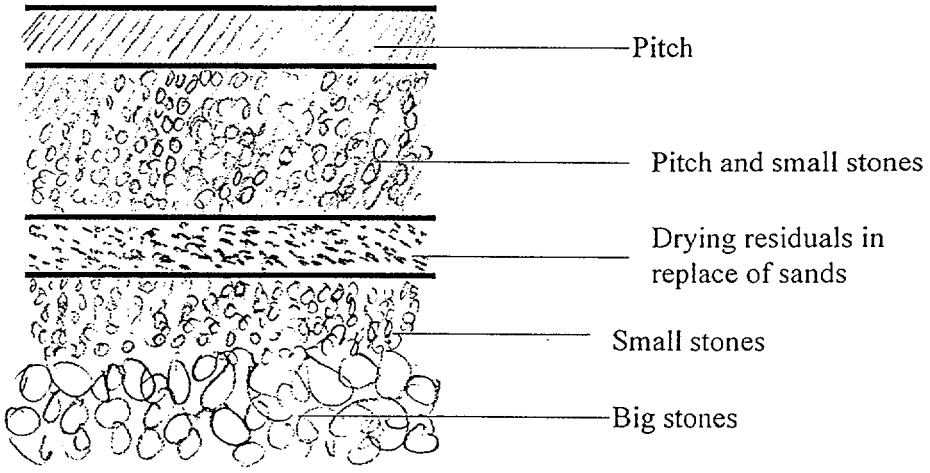
3. Date of Report

May 6, 1999

4. Preparation of Test

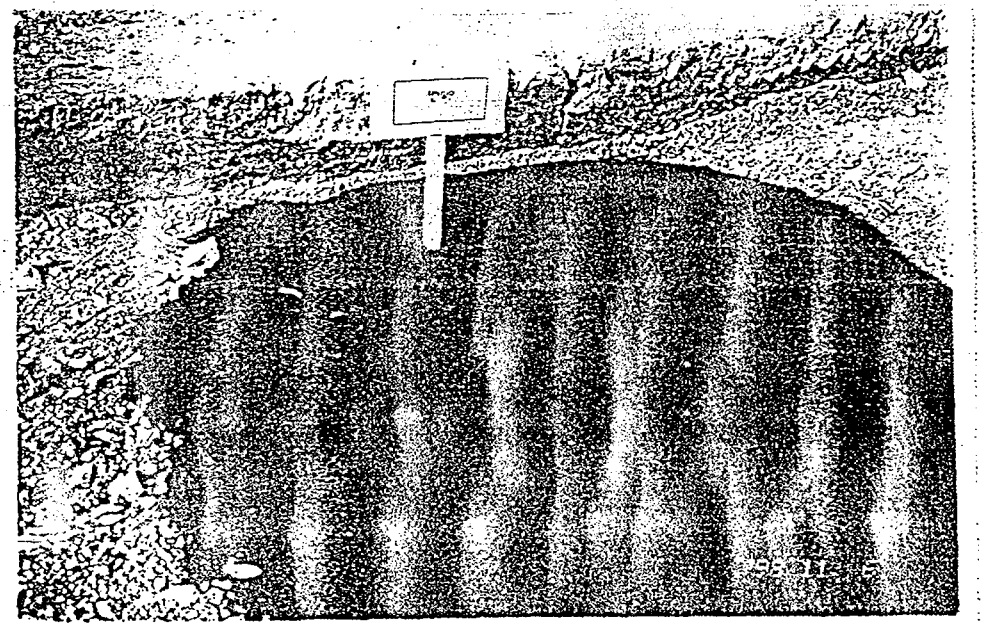
- Weight of drying residuals 50 kg ±
- Source of drying residuals from No. 1 test (1:1)
- Site of test east of SRL, Nanda Road
- Volume 1500*1200*30 mm^3

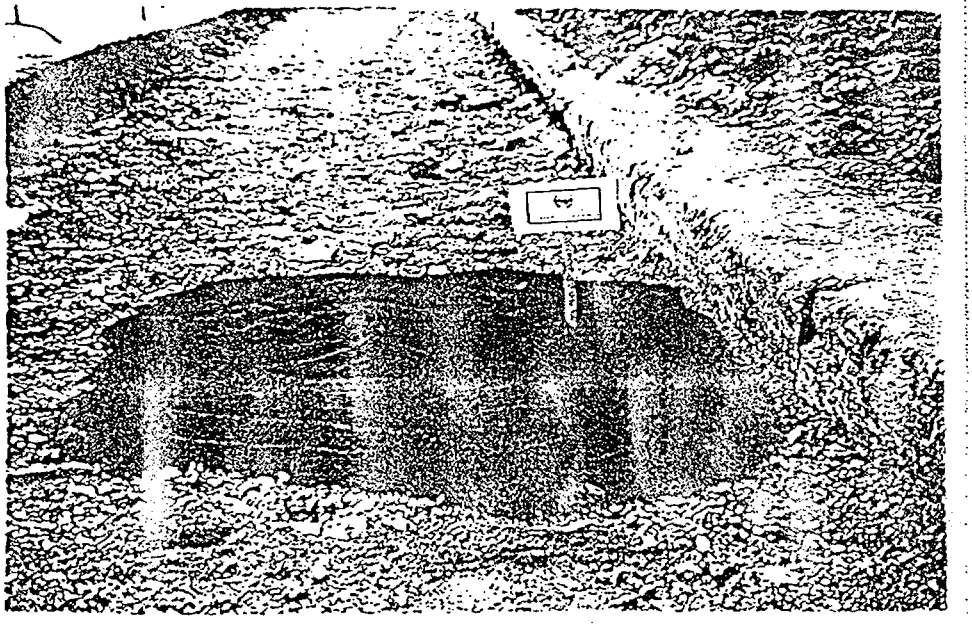
5. Section Diagram of Roadbed



6. Results of Test

- No abnormal phenomena found after six months of test of using drying residuals of tannery sludge in replace of sands for roadbed.
- This is only a small type test. As one of the ways for final disposal and safe utilization of drying residuals, it is still to be formally approved by the Government Supervision Body and Road Construction Company.





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To Mr. B. Suyavanam	From Wen Zumou	
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UNIDO Assisted Project

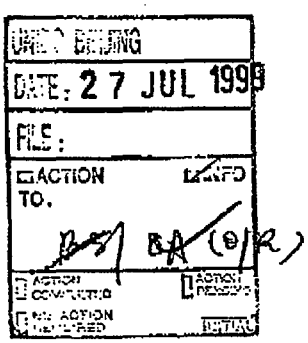
Supplement to the Final Report of Fluidized Bed Drying Test of Tannery sludge

Shanghai Dachang

Project No. CPR/120/022

Contract No. 98/148

Implementation Unit: Shanghai Richina Leather Co., Ltd.



1. Background

According to Dr. U. Frings by telephone, after his reading the Final Report, the implementation unit was required to supplement the paragraph of conclusion of the Final Report with the following contents:

- To go further in the explanation of the practical significance and the potential utility of the sludge drying test as one effective way for safe disposal of sludge, in the light of environmental protection and technical feasibility.

- To compare the costs of the three ways of sludge disposal: present disposal, test and application to industry, in the light of economic feasibility and on the basis of the test results.

- To look forward to the prospects of environmental protection in tanning industry.

2. Supplements

This part is to be added to Item 5: conclusion of the Final Report.
The Item of 5.1, 5.2 and 5.3 are omitted, please see Item 5 of the Report, page 6-7.

5.4 In accordance with the explanation in Item 5.1 and 5.2, being considered the physical state (for example, the appearance, particle, color and odor, moisture adsorption and hygienic characteristics) and the chemical characteristics (moisture, organic matters, total nitrogen and stability of little trivalent chromium) of the drying residuals of tannery and petrochemical sludge, the method of sludge drying, as one effective way of sludge safe disposal, in the light of environmental protection and pollution control, is of the following practical significance and potential utility:

- Realization of quantity minimization of the discharged contaminants It'll be more convenient to transport or dump or dispose owing to the significant reduction of volume and weight of the drying residuals with 95% of dry solids.

- Realization of no harm to environment
  The drying residuals don't contain hazardous hexvalent chromium. The little quantity of trivalent chromium contained is comparatively stable and hardly transferring/moving, without the possibility of secondary pollution. It'll be convenient for safe disposal and resources development.

- Realization of resources development of the discharged contaminants
  The sludge drying residuals may be developed and used as a kind of resource. For further study on resources development, it can be started from the study on use of roadbed material, bricks, thermal insulation material and mixed fuels or plants fertilizer etc.

5.5 On the basis of the explanation in Item 5.3, we compare the costs of the three ways: present situation, test and application in industry as followed:

	(1) present situation	(2) drying test	(3) test results applied in industry
described qualitatively	• entrust local environmental department to transport outside and concentratedly dispose with payment service • no aftermath responsibility	• entrust SJPR to carry out the drying test on the basis of the agreement with payment service • the drying residuals were returned to the consignor for self disposal	• SJPR can not hastily offer the quotation without negotiation of two sides on operation or the letter of intent • far distance between two sites and expensive transportation cost • special disposal for the large quantity of returned drying residuals

calculated quantitatively	• transportation fee of 40 RMB /ton is paid to the consignee by the consignor	• the cost of test and transportation of 600 RMB/ton is paid to consignee by consignor according to the agreement	• no quotation offered (supposed as x) for application in industry • the distance of about 100 km between Baoshan and Jinshan, the transportation cost will be 100 RMB/ton
compared	—	(2)/(1)=600/40=15	(3)/(1)=(x+100)/40 suppose x is 500-100 RMB/ton then (3)/(1)=15-5

3. Prospects

In the world of today, the tendency of systematization, institutionalization and internationalization of environmental policy has shown up. The Chinese policy shows that environmental protection has been put the sustainable development strategy and agenda of twenty-one century. In fact, to protect the environment and control the pollution is of importance to the nation's economy and the people's livelihood, human civilization and world progress. The globe attention has been paid. In many countries and areas, the government, society, corporations and groups have cooperated and scientifically popularize the different measures on protection and treatment. It is a hard job but with good future.

In tanning trade, it's been underway to popularize green chemistry, green engineering and green labels and explore the treatment of both symptoms and principles.

* First of all, to popularize clean technology and production, reduce displacement, try to effectively control and treat the pollutants

produced during the production, turn the terminal control to end-end control.

- Then, continuously strengthen effective treatment of terminal pollution, and try to realize quantity minimization, no harm and resources development of the end discharged pollutants.

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