GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

PROJECT INITIATION

Date September 8, 1966

roject Title: Industrial Waste Disposal Studies

roject No.: A-972

roject Director: R. S. Ingols

ponsor: Mallary & Evans, Inc.

ffective: September 1, 1966 Estimated to run until: Open

ype agreement: Industrial

Amount: Open

Reports: As required

Contact Person: Mr. Bob W. Dean
Mallory & Evans, Inc.
691 DeKalb Industrial Way
Decatur, Georgia

ssigned to Chemical Sciences & Materials Division

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GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

PROJECT TERMINATION

Date January 2, 1975

PROJECT TITLE: Industrial Waste Disposal Studies

PROJECT NO: A-972

PROJECT DIRECTOR: R. S. Ingols

SPONSOR: Mallory & Evans, Inc.

TERMINATION EFFECTIVE: 6/30/74

CHARGES SHOULD CLEAR ACCOUNTING BY: 6/30/74

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EES 402 (R10-62)

A- 972

GEORGIA INSTITUTE OF TECHNOLOGY
ENGINEERING EXPERIMENT STATION

225 North Avenue, Northwest · Atlanta, Georgia 30332

November 21, 1968

Mr. Bob Dean
Mallory & Evans, Inc.
646 Kentucky
Scottdale, Georgia

Re: Project A-972

Dear Bob:

Enclosed is a report on the effect of various components of the chemicals that are used in the Magee Carpet Mill at Perry.

In preparing a dye bath, the chemist adds dye, either polyphosphate or borate as sequestering agents and surfactant. The amount of each varies with the specific dye but is generally in excess of one pound of the sequestrants and surfactant per 500 gallons of water in the dye bath. Following each dye bath, the carpet is rinsed in another 500 gallons. Assuming each batch of carpet needs one pound of polyphosphate or borate plus one pound of detergent and one thousand gallons of water this means that the sequestering agents and surfactants are each present in 125 parts per million. Some dye baths use more than one pound of each component in essentially a constant volume of water.

In observing the operation of the dye becks, it was seen that generally the hot dye baths (95°C) are emptied sequentially as the crews are able to take care of the sampling and servicing of the becks. However, at least once in the 16 hours of observation, all four becks were draining into the sewer at one time. I was informed in discussing this later that the sewer line from the screen pit would not take all of this but assuming that it could, then 2000 gallons at 80°C added simultaneously to the aerators at 30°C should increase the temperature in the aerators by one degree. Sudden changes in temperature are generally very undesirable for bacterial activity.

Just what can be done to improve the effluent is still not clear. We have tried polyvalent ions with very little success.

Sincerely,

Robert S. Ingols,
Research Professor

RSI:jw
Encl.
cc: F. Bellinger
H. Baker
C. Starling

Report on Factors Affecting Activated Sludge Floc

by

R. S. Ingols

Problems with floc formation or with the maintenance of floc in the treatment of waste water with the activated sludge process have been rare in the author's experience and in literature reports. Factors, which have been studied and are known to control the formation of floc, include both food concentration and the aeration period as well as the identity of the food molecules. Thus, domestic waste water at 300 mg per liter BOD requires 6 hours detention under aerobic conditions to give a consistently dense floc. If the BOD is lower a shorter aeration period is possible and the converse is also true. When the mineral nutrient balance is poor, at the same food concentration the floc character changes by the shift from one colonial microorganism to another.

In some places, single home units have been very successful, in other areas, the single home aerobic treatment devices have failed to form floc. This failure has resulted in a very poor quality effluent. In some textile finishing plants excellent floc has developed in the waste water treatment aeration tanks (Canton, Ga., Gainesville, Ga.) while other aeration units have failed to develop floc (Perry, Ga.).

Various reasons for the failure of floc formation or the disintegration of floc have been considered: (1) The low concentration of free divalent ions because of an excess of sequestering agents (polyphosphates and/or borates), (2) An excess of surfactant, or (3) a combination of these. Phosphates and polyphosphates are essential components of all living cells but borates are toxic to insects and are normal to plants only in trace concentrations. It is possible, however, that either sequestrant may block bacterial metabolism from a nutrient difficiency in the slime of Zooglea.

Thus, activated sludge floc was brought into the laboratory and subjected to varying concentrations of sequestrant and detergent formulations. One gram of food (half glucose and half peptone) was fed to two grams of sludge and aerated for 22 hours in each of several tubes equipped with aerators. After settling the supernatant was decanted. The sludge was diluted, fed and aerated for another 22 hours. When 100 mg sodium borate was added to the second aeration tube the supernatant for the first two days was very turbid in comparison to the control. When an excess of calcium ion (as 200 mg calcium chloride) was added to the sample for the third period of aeration there was a dramatic improvement in the turbidity. The clarity of the supernatant continued through numerous feedings. However, other aliquots of the sludge were fed commercial detergent formulations. These gave very turbid supernatants and the sludge volume was reduced (The reduction may have occured in the foam which spilled out of the aeration device). Because too many factors are involved simultaneously in a laundry detergent formulation, a second experiment was set up to evaluate the sequestrant without and with excess calcium and mixtures of these with surfactant.

The control was fed one gram of food per day and the sludge concentration was controlled by maintaining a constant volume of sludge. Borates only were added to a second aerator. Borates plus an excess of calcium to a third. Polyphosphates were added to the fourth aerator while polyphosphates plus calcium to a fifth. Then a pure sample of surfactant, sodium dodecylbenzenesulfonate, was added to 4 aerators which repeated #2 through #5. After 24 hours aeration, the tubes with sequestering agents had much more turbid supernatants while the ones with calcium were similar to the controls as can be seen by examining the data in Table I and the curves of Figures 1 and 2. After several days, however, there were no appreciable differences in the supernatant or sludge quality of the first 5 tubes. The samples receiving surfactant all appeared very different from the tubes with no surfactant. The sludges in 6, 7, 8 and 9 were all bleached and stringy with considerable reduction in volume (possibly from mechanical loss). The stringy sludge was composed of a fungus with branching mycelia and an obvious septum between individual cells (no other attempts at identification were made). With one sequestrant, the supernatant was better at first with an excess of calcium and then deteriorated with time. The converse was true with surfactant and the other sequestrants.

The filamentous floc in these experiments are very different from Sphaerotilus in other respects. Sphaerotilus is voluminous and settles poorly, this floc is so dense that it is difficult to maintain it in suspension during the aeration portion of the cycle.

It should be noted that the 5 sludge samples without surfactant all were nitrifying by the end of the first week. None of the tubes with surfactant showed any signs of having nitrifying organisms. Because of the importance of the nitrification process in controlling the pH, the lack of nitrifying reactions is probably correlated with disappearance of the Zooglea floc (the nitrifying organisms are also floc forming organisms).

Thus, the observations indicate that a surfactant concentration of 100 mg per liter is highly damaging to the Zooglea floc and to the nitrifying organisms which are generally a part of the floc. The use of calcium chloride and magnesium sulfate do not, however, give any relief from this dilemma though dramatic improvement was observed on a one dose observation. An abstract of the Russian literature is enclosed; observations indicate trouble with surfactants.

Any recommendation for improvement of operating results at Perry would still be speculative. The cause of failure or the means for successful operation of the home sized activated sludge units is also unavailable from the data.

The interference of some of the dyes in use at Perry may compound the difficulties of floc formation as shown by an earlier thesis report. Data obtained in the Tech thesis has already been submitted to all those receiving this report.

A second phase of the investigation involved direct observations of Magee Carpet Co. operations at Perry. A composite sample was prepared under my direct observation where a portion of each dye and rinse cycle was dipped out of each beck just before each drain valve was opened. Several gallons were brought back to the laboratory. Analyses of the composite are shown in the first column of Table II. The analyses of a spot sample of the effluent, taken during the same day of compositing of the present facilities are shown in colume #2 of Table II. The high calcium value in the composite is not understood but there must be an interference present, for the analysis of the effluent for calcium which was done simultaneously is normal.

The composite BOD agrees with calculated values and is normal. The BOD of the effluent shows that there has been considerable biological activity, but that it is still two or two and a half times the concentration considered necessary by the Water Quality Control Board of Georgia.

Observations of supernatant quality after 22 hours aeration with 1g per liter food initially (0.5g glucose plus 0.5g peptone) in all tubes. The eight tubes are modified as indicated.

		Days	1	2	3	4	5	6	7	8	9	10
1	Control	O.D.	5	8	10	8	3	5	8	4	4	3
		COD	155	194	190	170	---	---	180	150	110	90
		pH	8.1	7.8	7.2	7.9	7.6	7.4	6.7	6.8	6.8	7.0
2	Plus Borax	O.D.	8	5	6	10	6	8	8	3	2	3
		COD	186	155	160	160	---	---	220	160	100	120
		pH	8.4	8.5	8.0	8.2	8.0	8.2	6.9	8.0	7.2	7.2
3	#2 + Calcium	O.D.	6	4	7	10	10	9	12	5	6	5
		COD	145	143	180	200	---	---	280	230	170	150
		pH	8.3	8.3	7.3	7.8	8.0	7.9	6.9	7.0	6.8	6.8
Control Plus	Polyphosphate	O.D.	4	6	8	7	4	5	10	3	4	2
		COD	206	143	160	180	---	---	190	130	100	100
		pH	8.3	8.1	8.2	8.3	8.1	8.1	6.8	6.7	6.5	6.6
5	#4 + Calcium	O.D.	11	6	16	17	17	15	14	7	5	3
		COD	155	133	200	250	---	---	300	190	150	110
		pH	7.7	7.9	6.8	7.0	7.2	7.5	6.8	6.7	6.7	6.7
6	#2 + Surfactant	O.D.	19	22	24	18	18	23	12	13	10	5
		COD	465	540	328	360	---	---	330	140	200	160
		pH	8.0	8.6	8.9	8.9	8.9	8.9	9.1	9.1	9.1	9.1
7	#3 + Surfactant	O.D.	9	9	8	8	28	33	33	38	40	40
		COD	186	278	184	160	---	---	520	550	510	560
		pH	8.2	8.6	8.8	8.6	8.8	8.8	8.7	8.7	8.6	8.6
8	#4 + Surfactant	O.D.	7	17	11	19	31	36	20	8	10	30
		COD	175	366	290	260	---	---	440	230	190	510
		pH	8.2	8.5	8.8	8.8	8.8	8.8	8.8	8.6	8.8	8.8
9	#5 + Surfactant	O.D.	13	8	10	10	16	12	8	8	8	6
		COD	320	265	260	290	---	---	220	210	180	120
		pH	8.0	8.6	8.8	8.7	8.8	8.7	8.6	8.7	8.7	8.6

O.D. optical density of supernatant
COD Chemical Oxygen Demand
pH hydrogen ion concentration

Perry Samples (August 29, 1968) Results.

Test	Composite	Spot Effluent
BOD	610 mg/l	110 mg/l
COD	850 mg/l	300 mg/l
pH	7.745	7.345
Ca^{++}	5×10^{-1}M (20000 mg/l)	2×10^{-3}M (80 mg/l)
$S^{=}$	0	0
Na^{+}	9×10^{-3}M (207 mg/l)	138 mg/l (6×10^{-3}M)
Cl^{-}	6×10^{-3}M (213 mg/l)	126 mg/l (35×10^{-3}M)
Ln^{++}	1 mg/l	0.0
NH_4^{+}	----	1.2 mg/l
Total Solids	0.062%	0.039%
Fixed Solids	0.029%	0.014%
Hardness (EDTA)	2325 mg/l	208.32 mg/l

From Chemical Abstracts 66 (1967)

[illegible] effect of the synthetic detergent prepared from

NP-1 according to the BMS-8 recipe on the performance of purification installations of a municipal sewage system. O. Y. Bolotina, V. L. Bar, M. M. Malyusova, and P. G. Novozhilov. *Nauch. Tr. Akad. Kommun. Khoz.* No. 37, 44-65(1965)(Russ). The effect of a synthetic detergent prepd. from Sulfonol NP-1 on biochem. clarification of sewage in aeration tanks and on fermentation of the sediment was studied on lab. and semi-industrial app. with muncipal sewage contg. different amts. of synthetic detergent. A 20 mg./l. addn. of detergent did not have a neg. effect on biochem. clarification. An increase in this content to 40 and, esp., 70 mg./l. resulted in inhibition of biochem. clarification leading, in turn, to an increase in the suspended solid concn. and in 5-day B.O.D. of the clarified waters, and to retardation of nitrification processes and formation of a froth. These effects were caused by accumulation of the detergent in the active mud. The latter performed normally as long as the detergent concn. in the active mud did not exceed 7 mg./g. solid substances. Addn. of detergent to the sediment fermenting under mesophilic conditions in an amt. of 200 mg./l. sediment resulted in a marked decrease in gas liberation on the 8th day, which was accompanied by an acid shift in fermentation. In the fermented sediment of exptl. CH_4 tanks Sulfonol NP-1 content was higher by a factor of 3 than in the control. Under thermophilic conditions, inhibition of biochem. fermentation began at 400 mg. detergent/l. sediment. In all cases inhibition of fermentation was accompanied by a decrease in decompn. of org. substances (esp. gases, and to a lesser extent nonash substances). The detergent had a considerable

68705 *Chemical Abstract*

unfavorable effect on fermentation of carbohydrates, and a lesser neg. effect on fermentation of fats and protein substances. From *Ref. Zh., Khim.* 1966, Pt. II, Abstr. No. 24I476. MVRK

ENGINEERING
GEORGIA INSTITUTE OF TECHNOLOGY
EXPERIMENT STATION

225 North Avenue, Northwest · Atlanta, Georgia 30332

March 14, 1969

Mr. Bob W. Dean
Mallory and Evans, Inc.
691 DeKalb Industrial Way
P. O. Box 447
Decatur, Georgia

Re: Project A-972, Industrial Waste Disposal.

Dear Mr. Dean:

Enclosed is the second interim report on the Magee Carpet Company waste water treatment facility at Perry, Georgia.

I believe that the report contains recommendations which should correct the deficiency in BOD reduction.

Very truly yours,

Robert S. Ingols,
Project Director

RSI:jw
Encl.

COPY

GEORGIA INSTITUTE OF TECHNOLOGY
ENGINEERING EXPERIMENT STATION
ATLANTA, GEORGIA 30332

March 14, 1969

Mr. Bob W. Dean
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691 DeKalb Industrial Way
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Very truly yours,

Robert S. Ingols,
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Encl.

COPY

Interim Progress Report

Magee Carpet Company Waste Water Studies

Robert S. Ingols

Because of difficulties in obtaining a low biochemical oxygen demand (BOD) in the effluent of the waste water treatment facility at the Magee Carpet Company at Perry, Georgia, studies of possible treatment procedures were required.

The data submitted by Magee to Mallory and Evans indicated that the wastes should have an average BOD (as reported for their parent mill) of 130 mg per liter and a COD average of 230 mg per liter. Enclosed are copies of six reports of data submitted to Magee in 1966. It has been observed frequently in our analyses of raw wastes from the Perry Mill that the BOD of the waste water has a value of 600 mg per liter and a COD of 1000 mg per liter. The basis for the discrepancy is not known, but should be remembered.

The Perry plant needs remodeling (1) because of the larger BOD load observed and (2) adverse effect of synthetic surfactants on rates of biological activity, (3) temperature fluctuations in the aerator from the high temperature of the discharge from the dye becks with colder weather during inactive periods, and (4) observed toxicity of certain dyes.

It is believed that the Water Quality Control Board's BOD requirement at approximately 30 mg per liter can be met by:

1. Constructing an equalizing tank of 24 hours detention ahead of the aeration tanks.
2. Increasing the capacity of the aeration tanks and increasing (lowering the mixers) the effectiveness of the mechanical aerators.

3. Constructing a settling tank with suction, sludge removal mechanism for returning the activated sludge to the aerators.

These conclusions are based on the following:

1.) Observation of the waste treatment facility of the C.H. Maslon Co. at Atmore, Alabama.

a) On 26 February, I travelled to Atmore, Alabama at the suggestion of and in the company of Charles Starling of the State Water Quality Controll Commission technical staff. A discussion of the chemicals used indicated that no surfactants were included in the dye formulations. The chemist indicated that dyes and buffers were used with Nylon and Acrylon fabrics. A carrier, biphenyl, was used when dying polyester fabrics which appeared to be an important part of the company's production.

b) The Atmore facilities were designed with three large tanks of the same size; two had no aerators while the third tank had two mechanical aerators. Each of the three tanks was designed to provide 24 hours detention. A fourth small tank was a typical circular vacuum-sludge withdrawal, settling tank with 2 hours detention to provide sludge return to the aeration basin. These facilities provide a conservative design to give excellent BOD reduction for an influent BOD of 175 mg per liter. No data was available at the time on the exact quality of the effluent.

2.) The laboratory observation of treating the spent dye bath solutions obtained at Perry.

a) Two samples of spent dye baths have been obtained from Perry. Aliquots of each have been used in laboratory cylinders with some of the contents of the aeration pond at Perry for microbiological seed and aeration for 23 hours with one hour settling. After several days of repeated cycles of aeration, settling, decanting and feeding a visible sludge layer formed and has increased since then. One cylinder has been dosed with one volume of the spent dye solution plus three volumes of tap water. The seed and then the "sludge" layer has always been maintained at 20 percent of the total volume for each subsequent daily change although the depth of sludge layer itself was only a small fraction of the original volume of seed. After 12 days the sludge may occupy eight percent of the total volume (80 ml per liter). A second cylinder has been dosed with one volume of spent dye solution and one volume of tap water approximating the dye solution plus rinse water and its treatment at Perry with 24 hours detention. The data given in Table I indicates that the lower dye concentration provides for a better effluent. The adverse effect of the new dye solution at the seventh day during the first twenty-four hours aeration with concentrated feed and the absence of an adverse effect in the mixture with the dilute feed indicates the basis for recommending an increase in the aerator capacity to reduce the probability of dye toxicity in the aerator. It is not knownif the toxicity of the dye studied is representative of other dyes used. Specific studies of each dye formulation would be required for a complete answer.

b) Storage of the spent dye bath solutions in completely filled stoppered glass bottles has failed to change the dye color after 50 hours by comparison with other aliquots that are fully and/or partially aerobic. Thus, dyes will enter the aeration tank in spite of an anaerobic equalizing facility.

3) The observations on surfactants used at Perry.

a) Attempts to degrade Ekalone G flakes under anaerobic conditions have yielded negative data. When the surfactant was added to a normally functioning digester receiving daily increments of food and surfactant no increment in gas production occurred from the potential food value of the surfactant. When all feeding was stopped all gas production stopped and no gas was produced for 10 days. An analysis of the filtered supernatant liquor gave a COD value which indicated complete recovery of the surfactant plus 10 percent more than the value calculated from pure compound analyses.

b) BOD studies indicate that bacteria at the dilution required for BOD tests use Ekaline G at the lowest concentration much faster than at any higher concentration. The data of Table II show a BOD at a concentration of 1.2 mg per liter which is three to four times the BOD at ten times this concentration when each are reported as mg BOD per mg surfactant.

Table I. COD of Effluent after sequential 23 hour aeration periods with Magee pond water as a seed when dosed at two different concentrations. Sludge allowed to settle as formed and returned to the subsequent aeration period.

Time of Aeration Days	Dye Water plue 1 Volume of rinse water			Dye Water plue 3 Volumes of rinse water		
	COD	Improvement mg/l	Improvement percent	COD	Improvement mg/l	Improvement percent
0	1200	---	---	670	---	---
1	1100	100	9	520	150	22
2	1160	40	3	600	70	11
3	1300*	---	---	580*	90	13
	1100**	100	9	410**	260	40
4	1340*	---	---	600*	70	11
	1070**	130	11	320**	350	53
5	890*	310	25	520*	150	22
	720**	480	40	300**	370	55
6	510*	690	57	440*	230	34
	250**	950	79	350**	320	48
7	800***	---	---	420	---	---
	610*	200	25	350*	70	17
	475**	320	40	260**	150	38
8	510*	300	37	240*	180	43
	270**	530	68	160**	260	60
9	420*	380	48	280*	140	33
	230**	570	71	140**	280	67
10	390*	---	---	290	130	30
	210**	---	---	140	280	67

* After settling to remove heaviest suspended solids.
** After removing all suspended solids by centrifuging.
*** A new dye solution obtained at Perry.

Table II. BOD results observed at daily intervals with known concentrations of "alkonal". (These concentrations of the surfactant apparently interfere with nitrification in the dilution water which has no acclimated seed added).

Alkonal concentration	BOD at Time of Observation 1 Day no correction	2 Days no correction	3 Days no Blank correction		with correction for seeded blank		4 Days no correction
mg/l	mg/l	mg/l	mg/l	mg/mg	mg/l	mg/mg	mg/l
1.15	0.4	0.9	2.8	2.4	1.2	1.0	4.5
3.8	0.1	1.7	3.2	0.8	1.7	0.34	5.5
11.5	0.1	3.8	5.1	0.4	3.2	0.30	7.8+*

*No residual DO.

M. J. REIDER ASSOCIATES

Industrial Consultants · Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-5129

August 1, 1966

CERTIFICATE OF ANALYSIS

Industrial Waste, Latex Effluent Submitted for Analysis
Sample Received July 25, 1966

pH	7.6
Settleable Solids	0.1 ml/Liter
Total Solids	292. ppm
Volatile Solids	197. ppm
Fixed Solids	95. ppm
C.O.D.	360. ppm
B.O.D.	142. ppm
Total Suspended Solids	170. ppm
Volatile Suspended Solids	166. ppm
Fixed Suspended Solids	4. ppm

Note: Acid coagulation effective only on long contact time and very little material is precipitated, resulting solution is clear.

Respectfully submitted,

M. J. REIDER ASSOCIATES

For: Magee Carpet Company
Bloomsburg,
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #7011

M. J. REIDER ASSOCIATES

Industrial Consultants - Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-5129

May 23, 1966

CERTIFICATE OF ANALYSIS

Dyehouse Waste Sample Submitted for Analysis
Sample Received on May 12, 1966

	Sample No. 1 5-11 to 5-12
pH	6.8
Settleable Solids	1.0 ml/Liter
Total Solids	1088. ppm
Volatile Solids	62. ppm
Fixed Solids	1026. ppm
Suspended Solids	60. ppm
Suspended Volatile Solids	56. ppm
Suspended Fixed Solids	4. ppm
Dissolved Solids	1028. ppm
C.O.D.	267. ppm
B.O.D.	129. ppm
ABS Determination	0.8 ppm

Sample taken during 24 hours on dates shown

Respectfully submitted,

M. J. REIDER ASSOCIATES

M. J. Reider, Ph.D.

For: Magee Carpet Company
Bloomsburg
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #8901

M. J. REIDER ASSOCIATES

Industrial Consultants - Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-5129

May 23, 1966

CERTIFICATE OF ANALYSIS

Dyehouse Waste Sample Submitted for Analysis
Sample Received on May 13, 1966

	Sample No. 2 5-12 to 5-13
pH	8.9
Settleable Solids	0.5 ml/Liter
Total Solids	1299. ppm
Volatile Solids	582. ppm
Fixed Solids	717. ppm
Suspended Solids	67. ppm
Suspended Volatile Solids	52. ppm
Suspended Fixed Solids	15. ppm
Dissolved Solids	1232. ppm
C.O.D.	190. ppm
B.O.D.	111. ppm
ABS Determination	1.68 ppm

Sample taken during 24 hours on dates shown

Respectfully submitted,
M. J. REIDER ASSOCIATES

M. J. Reider, Ph.D.

For: Magee Carpet Company
Bloomsburg
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #3903

M. J. REIDER ASSOCIATES

Industrial Consultants - Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-6129

May 23, 1966

CERTIFICATE OF ANALYSIS

Dyehouse Waste Sample Submitted for Analysis
Sample Received on May 14, 1966

	Sample No. 3 5-13 to 5-14
pH	6.0
Settleable Solids	0.4 ml/Liter
Total Solids	1437. ppm
Volatile Solids	375. ppm
Fixed Solids	1062. ppm
Suspended Solids	71. ppm
Suspended Volatile Solids	8. ppm
Suspended Fixed Solids	63. ppm
Dissolved Solids	1366. ppm
C.O.D.	100. ppm
B.O.D.	115. ppm
ABS Determination	1.16 ppm

Samples taken during 24 hours on dates shown

Respectfully submitted,
M. J. REIDER ASSOCIATES

M. J. Reider, Ph.D.

For: Magee Carpet Company
Bloomsburg
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #8906

M. J. REIDER ASSOCIATES

Industrial Consultants - Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-5129

May 23, 1966

CERTIFICATE OF ANALYSIS

Dyehouse Waste Sample Submitted for Analysis
Sample Received on May 17, 1966

	Sample No. 4 5-16 to 5-17
pH	7.4
Settleable Solids	0.5 ml/Liter
Total Solids	1570. ppm
Volatile Solids	358. ppm
Fixed Solids	1212. ppm
Suspended Solids	49. ppm
Suspended Volatile Solids	39. ppm
Suspended Fixed Solids	10. ppm
Dissolved Solids	1521. ppm
C.O.D.	256. ppm
B.O.D.	174. ppm
ABS Determination	1.63 ppm

Sample taken during 24 hours on dates shown

Respectfully submitted,

M. J. REIDER ASSOCIATES

M. J. Reider, Ph.D.

For: Magee Carpet Company
Bloomsburg
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #8909

M. J. REIDER ASSOCIATES

Industrial Consultants - Research Chemists

Process Research and Development
Industrial Waste Treatment
Textile Processing
Quality Control
Detergents
Water

107 ANGELICA STREET
READING, PA.
Telephone
374-5129

May 23, 1966

CERTIFICATE OF ANALYSIS

<u>Dyehouse Waste Sample Submitted for Analysis</u>
<u>Sample Received on May 18, 1966</u>

	Sample No. 5 5-17 to 5-18
pH	6.8
Settleable Solids	0.5 ml/Liter
Total Solids	2113. ppm
Volatile Solids	599. ppm
Fixed Solids	1514. ppm
Suspended Solids	114. ppm
Suspended Volatile Solids	104. ppm
Suspended Fixed Solids	10. ppm
Dissolved Solids	1999. ppm
C.O.D.	195. ppm
B.O.D.	106. ppm
ABS Determination	1.09 ppm

Sample taken during 24 hours on dates shown

Respectfully submitted,

M. J. REIDER ASSOCIATES

M. J. Reider, Ph.D.

For: Magee Carpet Company
Bloomsburg
Pennsylvania

Att: Mr. Harry Fry

Lab Work Order #8911

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