

Attachment 3

BETZ

LABORATORIES, INC.

300 EIGHTH AVENUE, TREYBOSCH, PENNSYLVANIA 15067 TELEPHONE AREA 412 338-0210

December 29, 1970

Monsanto Company
P. O. Box 249
Anniston, Alabama 36201

Attention: Mr. W. F. Taffee
Engineering Supervisor

Re: Clarification of Neutralization
Pit Effluent

Gentlemen:

Enclosed are the results of the laboratory clarification and analytical testing of your neutralization pit effluent. The tests were conducted in accordance with your letter of November 2, 1970, from Mr. W. F. Taffee and conversations with our Mr. M. L. Mitchell and local representative, Mr. A. S. Freeman.

Our laboratory test results leads us to recommend a treatment consisting of a bentonite clay and a strongly cationic polyamide polyelectrolyte at a chemical cost of approximately two cents per thousand gallons. ^{at 500 gpm = 60¢ / hr. \$14.40 / day} The laboratory jar tests showed that the addition of these chemicals followed by a four to ten minute rapid mix at 100 rpm and one minute of settling immediately after rapid mixing produced the following quality of supernatant.

	<u>ppm</u>	<u>ppm</u>
Initial Suspended Solids	532	1076
Initial Turbidity	204	400
Initial Organic Carbon	52	70

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STLCOPCB4084149

	<u>ppm</u>	<u>ppm</u>
Supernatant Suspended Solids	16-26	6-26
Supernatant Turbidity	2-7	1.5-6
Supernatant Organic Carbon	1-2	2-3

The suspended solids and turbidity in the jar test supernatant are a result of some floating solids which are normally present due to insufficient turbulence at the waters' surface during mixing. In actual practice this problem should not occur due to improved mixing and the mechanics of a solids contact clarification system.

Analytical Data Sheet (ADS No. 1) shows the analysis of a gallon plant effluent sample collected on October 27, 1970. Your November 2, 1970, letter indicates that the analysis of this sample should adequately describe the quality of the four one-gallon neutralization pit effluent samples submitted for the clarification tests. ADS No. 1 shows that the sample contained high concentrations of calcium and chloride, 220 and 224 ppm respectively. The 0.1 ppm phosphate and 0.2 ppm iron are low. The 9 ppm of organic carbon in the sample was reduced to only 8 ppm by laboratory filtration. The sample of neutralization pit sludge contained sixty percent solids.

Initial Screening Test

In order to conserve the samples of neutralization pit effluent, the initial jar testing was conducted on a waste solution produced by mixing a portion of the sludge sample with demineralized water. This prepared waste sample had

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a pH of 6.7, turbidity of 220 ppm, and approximately 500 ppm suspended solids. The 500 ppm solids concentration was selected since it was midway between the 0.01 - 0.1 percent solids concentration anticipated in the neutralization pit effluent.

The initial jar test screening evaluations are summarized in ADS No. 2. Alum and ferric chloride at concentrations up to 50 and 25 ppm, respectively did not produce satisfactory flocculation and solids removal. The use of a high molecular weight anionic polyelectrolyte with the primary coagulant resulted in additional solids removal; however, the lowest turbidity level found in the highest quality supernatant was 58 ppm.

The initial screening tests indicated that the maximum reduction of suspended solids and turbidity could be obtained with 15 ppm of SPV bentonite clay and 7.7 ppm of a liquid strongly cationic polyelectrolyte; Betz Poly-Floc 1170. The chemical treatment combination in test No. 20 was utilized in test No. 22 but with additional rapid mixing and no flocculation mixing at 30 rpm. The solids reduction to a turbidity of 11 ppm in test No. 22 appeared economical and was the basis for the tests summarized in ADS No. 3.

The tests and results shown in ADS No. 3 employed two different types of bentonite clay and a strongly cationic liquid polyelectrolyte. The Coaguloid clay has a higher cost per pound and thus lower concentration was used in the test in order to permit comparison of the two clays on an equal cost basis.

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Comparison of the results from tests 1 through 6 indicate that at a neutral pH the treatment using the Coaguloid clay reduced the turbidity to levels similar to but slightly lower than with the SPV clay. The initial solids concentrations ranging from 200 to 800 ppm did not adversely affect the results when the same concentrations of treatment chemicals was employed.

Comparison of the results from tests 7 through 12 show that at the lower pH of 5.0 the Coaguloid clay and polyelectrolyte was less effective. The SPV clay and polyelectrolyte produced excellent results under the same test conditions.

Final Testing and Recommended Treatment

The results of final testing are shown in ADS No. 4. This exhibit summarizes the recommended clay and cationic polyelectrolyte treatment. These tests were conducted on neutralization pit effluent samples mixed with 500 and 1000 ppm of solids from the sample of neutralization pit sludge. All samples were mixed for four to ten minutes at 100 rpm in order to produce good flocculation and a rapid settling floc.

Although the additional fast mixing improved the performance and rate of floc settling within the one minute settling period evaluated, a five minute rapid mix followed by a short flocculation mixing and settling in a solids contact clarifier should provide an effluent with a low organic carbon concentration and a suspended solids concentration lower than the values shown in the laboratory testing results. It is recommended that you equip your pilot plant clarification facility with an external rapid mix basin to further evaluate this parameter.

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Under separate cover we are submitting waste, supernatant, and sludge samples collected during the tests shown in ADS No. 4.

We thank you for the opportunity to provide these services and trust that the test results meet with your approval. If you should have any questions regarding the information presented, please do not hesitate to contact this office or our local representative, Mr. A. S. Freeman.

Very truly yours,

BETZ LABORATORIES, INC.

A handwritten signature in dark ink, appearing to read "W. John Soost", is written over the typed name.

W. John Soost
Project Engineer
Consulting Division

WJS/abd

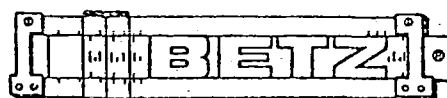
Enclosures

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WATER ANALYSIS

FOR Monsanto Company
Anniston
Alabama



TREVOSE, PENNSYLVANIA 19047

SAMPLE DATED: October 27, 1970

SAMPLING POINT	Gallon Sample Plant Effluent					
Total Hardness as CaCO_3 , ppm	310					
Calcium as CaCO_3 , ppm	220					
Magnesium as CaCO_3 , ppm	90					
Phenolphthalein Alkalinity as CaCO_3 , ppm	0					
Methyl Orange Alkalinity as CaCO_3 , ppm	44					
Sulfate as SO_4 , ppm	60					
Chloride as Cl, ppm	224					
Silica as SiO_2 , ppm	13.5					
Total Phosphate as PO_4 , ppm	0.1					
Ortho Phosphate as PO_4 , ppm	0.1					
pH	6.6					
Total Iron as Fe, ppm	0.20					
Biochemical Oxygen Demand, (BOD), ppm	16					
Chemical Oxygen Demand, (COD), ppm	42					
Total Carbon, ppm	S(1) F(2) 21 19			(1) Shaken Sample (2) Filtered Sample		
Inorganic Carbon, ppm	12 11					
Organic Carbon, ppm	9 8					
Specific Conductance Micromhos, 18°C	650					
Total Solids, ppm	708					
Total Fixed Solids, ppm	296					
Suspended Solids, ppm	10					
Suspended Fixed Solids, ppm	1					
Color Units	10					

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ANALYSIS

FOR | Monsanto Company
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BETZ
 TREVOSE, PENNSYLVANIA 19047

SAMPLE DATED:

Coagulation Jar Testing

SAMPLE IDENTIFICATION: Prepared Waste Sample: Distilled water mixed with 500 ppm of solids from the neutralization pit sludge. pH = 6.7

Initial Screening Evaluations

<u>Test No.</u>	<u>Treatment Chemicals</u>	<u>Type of Mixing</u>	<u>Supernatant Turbidity after one minute of Settling</u>
0	None	-	220 ppm
1	10 ppm Alum	A	110 ppm
2	25 ppm Alum	A	70 ppm
3	50 ppm Alum	A	74 ppm
4	10 ppm FeCl ₃	A	137 ppm
5	25 ppm FeCl ₃	A	150 ppm
6	1 ppm Poly-Floc 1160	A	58 ppm
7	10 ppm Alum, 0.5 ppm Poly-Floc 1100	B	99 ppm
8	25 ppm Alum, 1.0 ppm Poly-Floc 1100	B	65 ppm
9	25 ppm Alum, 0.5 ppm Poly-Floc 1100	B	88 ppm
10	10 ppm FeCl ₃ , 0.5 ppm Poly-Floc 1100	B	115 ppm
11	15 ppm SPV Clay, 0.5 ppm Poly-Floc 1160	B	137 ppm
12	15 ppm SPV Clay, 1.0 ppm Poly-Floc 1160	B	121 ppm
13	25 ppm Alum, 1.0 ppm Poly-Floc 1100	C	117 ppm
14	25 ppm SPV Clay, 1.0 ppm Poly-Floc 1160	C	95 ppm
15	25 ppm SPV Clay, 2.0 ppm Poly-Floc 1160	C	95 ppm
16	25 ppm Alum, 2.0 ppm Poly-Floc 1100	C	58 ppm
17	15 ppm SPV Clay, 5.1 ppm Poly-Floc 1170	C	35 ppm
18	15 ppm SPV Clay, 1.0 ppm Poly-Floc 1160	C	114 ppm
19	15 ppm SPV Clay, 5.1 ppm Poly-Floc 1170	C	55 ppm
20	15 ppm SPV Clay, 7.7 ppm Poly-Floc 1170	C	23 ppm
21	15 ppm SPV Clay, 3.8 ppm Poly-Floc 1170	C	92 ppm
22	15 ppm SPV Clay, 7.7 ppm Poly-Floc 1170	D	11 ppm

Type of Mixing

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- A - 5 minutes at 100 rpm and 15 minutes at 30 rpm.
 B - 2 minutes at 100 rpm for primary coagulant, 3 minutes at 100 rpm for flocculant (polymer), and 15 minutes at 30 rpm.
 C - 1 minute at 100 rpm for alum or clay, 5 minutes at 100 rpm for flocculant, and 15 minutes at 30 rpm.
 D - 10 minutes at 100 rpm for flocculant after first adding clay. No slow mix.

Flocculants

Betz Poly-Floc 1100; anionic organic copolymer of acrylamide, white powder.
 Betz Poly-Floc 1160; cationic organic copolymer of acrylamide, white powder.
 Betz Poly-Floc 1170; strongly cationic organic polyamide, amber liquid.

ANALYSIS

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BETZ
 TREVOSE, PENNSYLVANIA 19047

SAMPLE DATED:

Coagulation Jar Testing

SAMPLE IDENTIFICATION: Prepared Waste Samples: Distilled water mixed with neutralization pit sludge at solids concentrations of 200, 500 and 800 ppm and pH adjusted, where shown, to 5.0.

Comparison of SPV and Coaguloid Clays

Test No.	Treatment Chemicals (1)	Waste Sample Analysis			Supernatant Turbidity, ppm 1 Minute Settling
		Suspended Solids, ppm	pH	Turbidity, ppm	
1	15 ppm SPV Clay	200	6.8	102	11
2	and	500	6.8	220	12
3	7.7 ppm Poly-Floc 1170	800	6.8	380	13.5
4	5 ppm Coaguloid	200	6.8	102	11
5	Clay and	500	6.8	220	7
6	7.7 ppm Poly-Floc 1170	800	6.8	380	8
7	5 ppm Coaguloid	200	5.0	102	24
8	Clay and	500	5.0	220	16
9	7.7 ppm Poly-Floc 1170	800	5.0	380	9
10	15 ppm SPV Clay	200	5.0	102	5
11	and	500	5.0	220	4
12	7.7 ppm Poly-Floc 1170	800	5.0	380	3

- (1) All samples mixed for ten minutes at 100 rpm followed by one minute of settling prior to collection of supernatant sample for turbidity measurement.

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ANALYSIS

FOR | Monsanto Company
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BETZ
 TREVOSE, PENNSYLVANIA 19047

SAMPLE DATED:

Coagulation Jar Testing

SAMPLE IDENTIFICATION: Effluent and Solids from Neutralization Pit

Final Testing and Recommended Treatment (1)

	<u>pH</u>	<u>Turbidity, ppm</u>	<u>Suspended Solids, ppm</u>	<u>Organic Carbon, ppm</u>
<u>WASTE SAMPLE; 500 ppm</u>	7.1	204	532	52

Supernatant Sample Analyses (2)

<u>Test No.</u>	<u>Rapid Mix at 100 rpm</u>			
1	4 Minutes	7	24	2
2	7 Minutes	6	26	-
3	10 Minutes	2	16	1

<u>WASTE SAMPLE; 1000 ppm</u>	7.4	400	1076	70
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Supernatant Sample Analyses (2)

<u>Test No.</u>	<u>Rapid Mix at 100 rpm</u>			
4	4 Minutes	6	26	2
5	7 Minutes	3.5	16	-
6	10 Minutes	1.5	6	3

(1) All samples treated with 15 ppm SPV Bentonite Clay and 7.7 ppm of a cationic polyelectrolyte; Betz Poly-Floc 1170.

(2) Samples collected after one (1) minute of settling.

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