BETZ LABORATORIES, INC.

SOMERTON ROAD, TREVOSE, PENNSYLVANIA 19047 • TELEPHONE: AREA 215 • 355-3300

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. 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.

	ppm	ppm
Initial Suspended Solids	532	1076
Initial Turbidity	204	400
Initial Organic Carbon	52	70

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	ppm	ppm
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.

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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

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.

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.

WATER ANALYSIS

FOR Monsanto Company
Anniston
Alabama

BETZ
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) 21 F(2) 19
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

(1) Shaken Sample
(2) Filtered Sample

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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.

W. John Soost

W. John Soost
Project Engineer
Consulting Division

WJS/abd

Enclosures

cc: 42

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