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Battelle Memorial Institute

505 KING AVENUE COLUMBUS 1, OHIO

April 12, 1960

Mr. H. L. Warner
Office of General Counsel
Johnson and Johnson
New Brunswick, New Jersey

Dear Mr. Warner:

This letter report covers the flotation studies made in our laboratory in connection with the preparation of the patent application "Platy Talc Beneficiation".

All of the experiments discussed in this report were made using Italian No. 2 talc. The first five experiments were made to determine whether anionic surface active agents other than the Aerosols, 18 or OT, were effective in selective flotation of platy talc. Four anionic reagents were selected for the study. These are listed in Table 1.

TABLE 1. ANIONIC REAGENTS STUDIED

Trade Name	Class or Formula	Main Uses
Duponal ME	Sodium lauryl sulfate	Detergent, dispersant, emulsifying agent
Anatren L215	Alkyl amide sulfonate	Detergent
Tergitol F26	Sodium di (2-ethyl hexyl) phosphate	Wetting agent, emulsifying agent
Igepon T	A substituted amide $C_{17}H_{35}CON(CH_3)C_2H_4SO_3Na$	Detergent

Based on the available flotation literature, it appears that two of the reagents, Anatren L215 and Igepon T, have the same formula. The difference between them is that they are marketed as powders at different concentrations, Anatren L215 at 16 per cent and Igepon T at 33 per cent.

The results of the experiments in the current program, as well as the results of seven previously reported experiments, are presented in Table 2.

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TABLE 2. SUMMARY OF FLOTATION EXPERIMENTS WITH SURFACE ACTIVE REAGENTS

Experiment	Flotation					Results, Float 1(a)						
	Feed Solids, %	pH	Reagents, lb/ton of flotation feed			Mineral Count, per cent						Per Cent Dolomite(c)
			Dowfroth 250	Other Reagents		Weight Per Cent(b)	Platy Talc	Nonplaty Talc	Dolomite	Tramolite	Others	
163(d)	7.2	6.8	—	—		36.3	95(e)	>4(e)	trace	trace	trace	0.4
162(d)	7.2	6.4	1.79	—		34.4	96	4	trace	—	trace	0.2
96(f)	8.4	7.5	1.75	—	0.07 - Dowfroth 200	64.8	98	1	—	<1	trace	0.5
134(f)	8.0	6.7	1.77	0.07		59.0	98	1	<1	<1	trace	0.3
187(d)	7.3	7.5	—	—	1.32 - Aerosol OF	69.7	>97	>2	trace	trace	trace	0.9
182(d)	7.4	6.8	1.73	0.04	0.74 - Aerosol 18	70.8	<99	>1	trace	trace	trace	0.4
189(d)	7.0	6.8	1.80	0.04	0.62 - Aerosol 18	70.4	>98	>1	trace	trace	trace	0.6
328	8.6	7.2	1.38	0.05	0.47 - Sodium Lauryl Sulfate - Anionic	93.0	>97	2	<1	trace	trace	0.8
329	8.7	7.0	1.37	0.05	0.058 - Sodium Lauryl Sulfate - Anionic	70.8	>98	<1	trace	trace	trace	0.3
330	8.4	7.2	1.42	0.05	0.48 - Alkyl Amide Sulfonate - Anionic	56.5	>98	<1	trace	trace	trace	0.2
331	8.4	7.1	1.42	0.05	0.18 - Sodium di (2-ethyl hexyl) Phosphate - Anionic	69.3	>98	<1	trace	trace	trace	0.3
332	8.7	7.2	1.37	0.05	0.46 - Substituted Amide $C_{17}H_{33}CON(C_2H_5)_2C_2H_4SO_3Na$ - Anionic	70.8	>98	1	trace	trace	trace	0.3
334	8.8	6.9	1.35	0.04	0.46 - Trimethyl-n-dodecyl ammonium chloride - Cationic	71.0	>98	>1	trace	trace	trace	0.2
335	8.8	7.4	1.35	0.05	0.46 - Trimethyl-n-dodecyl ammonium chloride - Cationic	75.6	98	>1	trace	trace	trace	0.3
336	9.0	7.6	1.31	0.04	0.45 - Octylamine - Cationic	88.1	96	>3	<1	trace	trace	0.7
337	9.0	7.5	1.32	0.04	0.11 - Octylamine - Cationic	71.2	>97	>2	<1	trace	trace	0.3
338	8.9	7.3	1.35	0.05	0.17 - Hexadecyl Dimethyl Amine - Cationic	70.9	99	trace	trace	trace	trace	0.3
339	8.8	6.8	1.36	0.05	0.46 - Sorbitan Monolaurate - Nonionic	77.2	99	trace	trace	trace	trace	0.3
340	8.6	7.2	1.39	0.05	0.47 - Sorbitan Monolaurate Polyoxyethylene Derivative - Nonionic	72.8	<99	<1	trace	trace	trace	0.2
341	8.6	6.7	1.39	0.05	0.47 - Secondary Amide of Lauric Acid - Nonionic	72.9	99	trace	trace	trace	trace	0.2
342	9.0	7.0	1.32	0.04	0.45 - Nonyl Phenyl Polyethylene Glycol Ether - Nonionic	82.6	>98	1	<1	trace	trace	0.5
343	9.0	6.6	1.31	0.04	0.44 - Oleic Acid Plus Sodium Oleate - Anionic Collector	78.5	<95	4	1	trace	trace	0.9

(a) Float 1 is froth removed in five minutes.

(b) Based on flotation feed

(c) Calculated from CO_2 assay.

(d) See "The Physical Concentration of Italian No. 2 Talc by Flotation—Investigation of Flotation Reagents", Battelle Progress Report, January 31, 1960.

(e) This is a corrected figure. The figure shown in the January 31, 1960, report was 92 per cent. A recount (in duplicate) was made of the product and showed it to be 95 per cent platy.

(f) See "The Physical Concentration of Talc Ores—Flotation of Italian No. 2 Talc", Battelle Progress Report, July 31, 1959.

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The results of Experiments 328 to 332, inclusive, revealed that three of the four anionic reagents tested were about as effective as the Aerosols; the data for the fourth were not conclusive.

The only reagent that did not give results as good as the Aerosols was Anetron L215, Experiment 330. It appears that the low recovery of 86.8 per cent may have been due to an insufficient amount of the reagent. Recoveries equal to that obtainable with the Aerosols were achieved with the other reagents, and in addition the dolomite content was lower. Had the anionic surface active agents been ineffective, it would have strengthened the patent application for the Aerosols.

When the results from the experiments using anionic reagents were available, Mr. Warburton transmitted this information to you by telephone. The decision was made to proceed with a limited amount of additional laboratory work in order to obtain some idea of the scope to be included in the application.

Since the experimental work previously described was limited to anionic surface active agents, it was decided to broaden the field. Therefore, cationic and nonionic surface active reagents, as well as one fatty acid type collector, were selected for the new investigations. Eight reagents were chosen, primarily because of their definite composition and availability; these are shown in Table 3.

TABLE 3. CATIONIC, NONIONIC, AND ANIONIC REAGENTS STUDIED

Trade Name	Class or Formula	Type	Main Uses
Arquad 12	Trimethyl-n-dodecylammonium chloride	Cationic	Wetting agent, detergent
Armeen 80	Octylamine	"	Collector
Armeen 160	Hexadecyl dimethyl amine	"	Collector
Span 20	Sorbitan monolaurate	Nonionic	Emulsifying agent
Tween 21	Sorbitan monolaurate polyoxy-ethylene derivative	"	Wetting agent, dispersant
Natsyn	A secondary amide of lauric acid	"	Wetting agent, detergent
Targitol NPX	Nonyl phenyl polyethylene glycol ether	"	Wetting agent
—	Oleic acid-sodium oleate emulsion	Anionic	Collector

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Experiments 334 to 342 gave results not only equal to that obtainable with the Aerosols, 18 or G, but better. In Experiment 342, a weight recovery of 82.6 per cent of the flotation feed with a platy tale content of 98 to 99 per cent, and a dolomite assay of 8.8 per cent was obtained in the standard 5-minute period designated Float 1. In Experiment 182, in which Aerosol 18 was used, the weight recovery in Float 1 was 70.8 per cent.

The only experiment in this series in which the results were not satisfactory was 343. In it, an emulsion of oleic acid and sodium oleate was used. The froth product from Experiment 343 contained almost 1 per cent dolomite and contained thick chunklike particles of tale, which definitely could not be classed as platy.

The conclusions from this work are as follows:

- (1) Eleven more reagents have been found, and there may be many more, that can be used to float platy tale selectively, i.e., when the starting feed is 98 per cent platy tale.
- (2) The reagents tried and shown to be successful in this study of the Italian No. 2 tale should now be tried on lower grade tale ores such as the Mondavron run-of-mine tale where the magnitude of the upgrading is so much greater.
- (3) These reagents should be tried in the absence of any Dmfroths. This was not done in Experiments 338 to 343, inclusive, because the bulk of the previously reported work, and likewise the best experiments, were carried out using a combination of the Aerosols, either 18 or G, and Dmfroth.
- (4) These reagents should now be considered for use in any new pilot-plant run.
- (5) The experiments should be confirmed by duplicate tests.
- (6) The best reagents should be evaluated with relation to their cost per ton of feed.

A portion of the closing remarks in the Battelle report, "The Physical Concentration of Italian No. 2 Tale by Flotation--Investigation of Flotation Reagents", January 31, 1960, are also applicable to this latter report and are repeated below.

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"This report fulfills the commitment for the evaluation of additional reagents for the detection of platy taie; undoubtedly, other reagents neither investigated nor considered might do as well or even better. However, to uncover them would require a much more comprehensive program."

The original notes on the laboratory work described in this report are recorded in Battelle Laboratory Record Book No. 16888, pages 6 to 30, inclusive.

We would be pleased to answer any questions that you may have regarding this work.

Very truly yours,

H. E. Chass

WEC:lb

In duplicate

cc: Mr. W. H. Ashton (2)