

OFFICE MEMORANDUM

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MICHIGAN

STATE HIGHWAY DEPARTMENT

October 8, 1965

To: E. A. Finney, Director
Research Laboratory Division

From: R. C. Mainfort

Subject: Testing of "Chempact" and "Road Packer." Research Project 47 E-12.
Research Report No. R-552.

As requested in R. L. Greenman's memorandum to you of August 9, 1965, I am furnishing the following information concerning Road Packer soil stabilizing agent. According to the container label Road Packer is: "A complex chemical compound that makes a solution acting as a catalyst, that cleans the soil, preparing it for physical compaction Road Packer solution prepares existing on-site fine soil aggregates in such manner that they may now be compacted and knit back together by the necessary mechanical means, closely resembling solid rock."

Chemical analysis of Road Packer indicates that it is the same material as Chempact, which we investigated some time ago. This is also obvious from the descriptive literature of the two products which are very similar and in which the same "inventor" is mentioned for each.

We tested the original Chempact sample in 1962 to check some of the more important claims made by the manufacturer. Results of these tests indicated that when applied in the recommended concentration the solution:

- a. Had no ability to remove a significant amount of organic matter from soils,
- b. Caused no change in the plasticity index or other Atterberg limits of an Ontonagon clay,
- c. Caused no change in the maximum density and optimum moisture of an Ontonagon clay, and
- d. Caused no change in the specific gravity or settling rate of a dispersed Ontonagon clay when tested by the normal hydrometer method.

Recently, we have tested Road Packer with a clay from the Detroit area. In these tests the quantity of standard Road Packer solution was varied from 1 to 30 percent based on the dry weight of the soil. None of these variations caused any change in the test results and none produced results significantly different from those obtained with distilled water. Soil test values using the standard Road Packer solution, as compared to those obtained using water, are as follows:

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	<u>Water</u>	<u>Road Packer</u>
Liquid Limit	29.7	29.9
Plastic Limit	16.7	15.6
Plasticity Index	13.0	14.3
Hydrometer (24 hr)	22.5	23.0

Based on these test results, chemical analysis, and a study of literature furnished by the manufacturers, we feel that Chempact (or Road Packer) when applied at the recommended concentration can neither harm nor benefit a soil. Its addition merely produces the same effect as water. The only ingredient present that could possibly fulfill any of the claims made for the solution is sulfuric acid. Chemical analysis, however, shows that each gallon of the recommended solution contains only five drops of sulfuric acid--hardly enough to have a significant effect on soil properties.

As a result of our laboratory tests and a study of the scientifically meaningless brochure furnished by the manufacturer, we feel that the fantastic claims made for Road Packer as a soil modifying agent are worthy of no further consideration by the Department.

Attached to this memorandum are copies of the chemical analysis of Chempact and Road Packer, as reported by John Ellis of the Spectroscopy and Photometry Section, and a copy of my report dated September 17, 1962, describing the application of Chempact to a county road near Kalamazoo. Neither during construction nor since has there been any indication that Chempact benefited the foundation of this road.

OFFICE OF TESTING AND RESEARCH

R. C. Mainfort, Supervisor
Soils Unit
Research Laboratory Division

RCM:nw

Attachments

September 10, 1965

E. A. Finney, Director
Research Laboratory Division

J. T. Ellis

Comparison of "Road Packer", 65 MR-215 with "Chempact"

In accordance with your request, a limited chemical analysis of "Road Packer" was conducted. The object of the analysis was to determine if "Road Packer" was the same or similar to "Chempact". The analysis performed and the results are listed in the following table:

Analysis Performed	Chempact	Road Packer
Specific Gravity	1.0792	1.1151
pH	About 0.3 (very acid)	about 0.3 (very acid)
% H ₂ SO ₄	11 percent	17 percent
% Ash	1.09	.29

Both materials are dark brown in color and have an odor of burned or charred organic material. They both contain surface active agents as indicated by foaming and retention of foam upon shaking. However, Road Packer appears to foam somewhat less than Chempact upon shaking, indicating a smaller amount of surface active agents. This may also account for the smaller amount of ash in Road Packer than in Chempact. The reason the pH of both materials is reported as being 0.3, even though Road Packer has a higher acid concentration than Chempact, is because the pH meter is unable to measure small differences at such low pH values.

Infra-red spectra of the neutralized solids and various solvent extractions show no significant differences between Road Packer and Chempact. It is believed that Road Packer is a somewhat more concentrated solution of essentially the same ingredients as contained in Chempact.

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John T. Ellis

John T. Ellis, Chemist
Spectro-Chemistry Unit

JTE:em

September 17, 1962

E. A. Finney, Director
Research Laboratory Division

R. C. Mainfort

Experimental Application of "CHEMPACT" Soil Stabilizer

L. T. O

This experimental application of Chempact was made by Kalamazoo County on a one-mile length of "S" Avenue just east of Portage Road. Application was made on September 11, 1962.

Chempact was represented by Messrs. Ross, Anderson and Brimhall of Replogle Sales Company, the Michigan representatives for this material. The job was under way when Ed Novak and I arrived. The base course being treated had formed part of a gravel road which had been surfaced with an asphalt seal and had begun to break up. The base consisted of a well graded aggregate (close to MSHD 23-A gradation) into which was mixed the scarified and broken seal coat. Chempact was applied in quantities of one gallon of solution per 1,000 gallons of water, added to the distributor as it was filled. The diluted solution was added to the roadway by gravity feed-off of a splashboard. The treated area was 34 feet wide and was to receive 34,000 gallons of the diluted Chempact solution for the one-mile length. Construction was slow, with long intervals between application, mixing and shaping. When we left, the repeated applications had raised the moisture content of the base to well over optimum with still more liquid yet to be added. The Chempact representatives stated that the material would not work unless applied in the specified one gallon of Chempact to 1,000 gallons of water ratio. The roadway was to be allowed to cure for 72 hours before final compaction, shaping and surfacing.

Representatives of the Chempact Company seemed to be sincere in their belief in the value of Chempact as a soil stabilizer but admitted that its value had not been proven in Michigan. Vague references to its use in California, Iowa and South Dakota added little to its background. They claim that 17 counties in Michigan will have test sections of Chempact by the end of this year. Unfortunately, the Chempact organization seems to know little of roadway stabilization problems or even the type stabilizer required. Construction is left largely up to the County involved. The composition of Chempact is apparently a deep mystery and is known only to its inventor - a Mr. Reynolds of California. There are supposedly 17 ingredients in the basic material to which have been added five secret ingredients that are the cause of its effectiveness. Attempts by various agencies have failed to identify any of the secret ingredients which appears to be a source of considerable satisfaction to its sponsors. In fact, other than a few trace materials, all tests have shown Chempact to consist entirely of water. This is easily understandable, say the Chempact people, because people and milk also consist of ninety some percent water. One gallon of the concentrate solution (with its over 90 percent water) sells for \$25.00.

We did find out that the solution contains sulfuric acid plus some petroleum products and that if not properly diluted will cause foaming when applied to salt-treated roads. According to the Chempact representatives, the acid action cleans the soil particles, dissolves organic matter, and releases a gas which is beneficial to stabilization. Further, the cleaned soil will compact better and stay compacted longer. The action was demonstrated by placing a dry soil clod in a pool of Chempact solution on the road. The clod, quite naturally, broke up on contact with the liquid just as it would with water.

Among additional uses and qualities of Chempact were the following:

1. Chempact will not migrate or evaporate from the soil. If it dries out, rains will reactivate it and, paradoxically, will drive it deeper into the soil where its benefits will continue.
2. Chempact cannot be evaluated by any laboratory tests because its composition requires contact with the "electrolytic action of the Earth" to become effective.
3. The inventor, Mr. Reynolds, drinks two drops of Chempact every day in his morning coffee, presumably for therapeutic reasons.
4. Goldfish will live many days longer in a sealed plastic bag of Chempact than under the same conditions with water.
5. Chempact enriches soil and promotes the growth of grass, shrubs and trees.

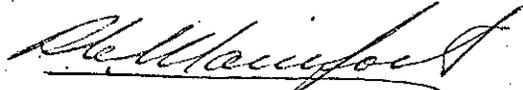
Although we could obtain little information concerning the "manufacture" of Chempact, we did learn that there are no production facilities set up for this purpose. The basic ingredients are obtained from a large oil company and the five secret ingredients are added, personally, by Mr. Reynolds. It was insisted that the basic ingredients were not ordinary waste products of the oil industry.

It is my opinion that Chempact is a diluted pickling acid used in some process in the oil industry. Dow Chemical analysis of Chempact showed some iron sulfate. This chemical and sulfuric acid are used in certain metal pickling compounds. The petroleum products contained in Chempact could be part of the residue from the cleaning process. The five added ingredients could be used merely to adulterate the solution and allow patent claims. Both sulfuric acid and pickling liquors have been tested as soil stabilizers and reported in the literature.

The appearance of the solution on the road was exactly the same as that of water. It is hard to see how a solution containing over 90 percent water, further diluted 1000 times, could produce much effect as a soil stabilizer and especially fulfill the claims made by Chempact. However, it is still possible that someone may stumble onto a solution of the soil stabilization problem. We will follow the progress of this test section and also the two adjacent

projects which are to be treated with rock salt and a local salt brine, respectively. A sample of Chempack has been promised for our laboratory study.

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R. C. Mainfort

RCM:em

cc: R. L. Greenman
K. A. Allemeier
File

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MICHIGAN
STATE HIGHWAY DEPARTMENT
JOHN C. MACKIE, COMMISSIONER

January 17, 1963

To: R. C. Mainfort, Supervisor
Soils & Pavement Evaluation Unit

From: John Ellis

Subject: Chemical Analysis of Chempact. Research Project 47 E-12.

Chempact was received from the Soils Section on September 20, 1962, for chemical analysis as part of Research Project No. 47 E-12.

Chempact is a dark brown, very strongly acid, solution with a pH of 0.3. It has an odor of burnt or charred organic material. It is a weak reducing agent. The material is non-combustible, but upon strong heating gives off a white to gray smoke which is mostly sulfur trioxide gas, but partly burning aromatic compounds. It cannot be evaporated to dryness at temperatures under 100 C because of the presence of a non-volatile liquid, but after neutralization with sodium hydroxide the material can be dried. The residue is a light brown powder. Ignition of the whole material at 600 C yields a reddish-brown powdery residue. Chempact contains surface active agents as indicated by foaming and retention of foam upon shaking.

Chemical analysis of Chempact shows it consists of about 86 percent water, about 11 percent free sulfuric acid and approximately 3 percent salts of a mixture of sulfonic acids. The salts are probably a mixture of magnesium and sodium sulfonates since both of these metals are present in small amounts. A trace amount of iron is also present. There is also some indication of the presence of very small amounts of unsaturated hydrocarbons which accounts for the reducing action of the material.

Infrared spectra indicate the sulfonic acids are primarily aromatic and probably substituted benzene derivatives. Such compounds are known to have surfactant properties.

X-ray diffraction patterns of the dry, neutralized residue show the material is largely sodium sulfate which is the product of adding sodium hydroxide to sulfuric acid. This confirms the presence of large amounts of sulfuric acid.

There is much to indicate that Chempact is at least partly sludge sulfuric acid, a by-product of the petroleum industry. This is indicated by the dark color, odor, presence of unsaturated hydrocarbons, and the fact that in the refining of lubricating oil fractions with sulfuric acid the main chemical by-products of the treatment are sulfonic acids,

R. C. Mainfort

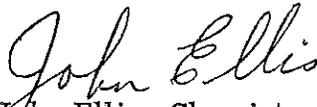
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presumably of aromatic rings present in the original oil. The acids and their salts are used in emulsifying and wetting agents, foaming agents and dust laying compounds.

If Chempact has any soil stabilizing value it is probably due largely to the sulfuric acid present. Sulfuric acid acts as a dehydrating agent and when concentrated, as an oxidizing agent. The manufacturer recommends diluting one gallon of Chempact with 1000 gallons of water. Based on 11 percent sulfuric acid in Chempact each gallon of diluted solution will contain about 5 drops of concentrated sulfuric acid. At this concentration it is questionable that Chempact will have any dehydrating or oxidizing ability.

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John Ellis, Chemist
Spectroscopy & Photometry Section
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JE:nl

cc: E. A. Finney