

Recycling and Reuse Technology Transfer Center

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Report on "Salt cake," A By-Product in the Pulping Process at Four M Paper Corporation

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**Report on "Salt cake," A By-Product in the
Pulping Process at Four M Paper Corporation**

Nate Snyder, Research Associate
University of Northern Iowa

6/28/95

Salt cake is a by-product of the wood pulping process that Four M Paper Corporation utilizes in order to produce the kraft paper board used to line corrugated cardboard boxes. The raw materials used in the pulping process are as follows: 50% wood chips from saw mills, 45% of which is what is known as whole tree chips that contain branches, leaves and bark; the other 45 to 50% comes from corrugated box clippings. These wood chips are sprayed with a liquor in a digester and then cooked for about 14 to 16 minutes in a live bottom cyclone. The burning of this liquor is what actually produces the salt cake. The main components of this liquor are 1 lb/gallon of Na_2SO_3 and $\frac{1}{3}$ lb/gallon of Na_2CO_3 . The chips then travel from the cyclone to the press finer, in which 60% of the liquor is pressed out of the chips. It is at this time that the salt cake enters its solid state. Throughout the course of the average working day, the paper mill generates approximately 15 to 17 tons and around 7000 tons per year. The company is currently selling to one glass company on a limited basis for \$25 to \$30 per ton. The salt cake is used as a raw material for pulling out the impurities and air bubbles in the glass. However, the majority of the by-product is currently being shipped by rail to various land fills within a 400 mile radius. Currently it is costing the company approximately \$50,000 to ship the salt cake to these landfills.

Salt cake is a solid compound and appears as small, round granules. Tests run by Four M shows that it is comprised of 67.9% sodium sulfate, 31% sodium carbonate, 0.7% potassium, 0.3% chloride, 0.04% iron, 0.04% aluminum, and 0.03% manganese. Independent laboratory testing has indicated a pH of 11.8, thereby demonstrating that salt cake can act as a very strong base. It's coloration is off-white granules mixed in with some tan and black granules. However, there are some samples where the coloration is almost exclusively tan. This change in color has been correlated with an increase in the chloride levels of the compound. The reason for this increase is not

known. However, it is speculated that the increase is in some way related to the wood used in the pulping process. The geographic location of the wood used at that time may play some role in the increased chloride levels.

At this point in time, research indicates that somewhat immediate reuse/recycling options are quite limited for the company. It was stated earlier that Four M was selling to a glass company on a limited basis. In order for the salt cake to be of any use to the glass manufacturer, it must stay within + or - 2% for Percent Sodium Sulfate. In a meeting with Henry Hentzel, mill engineer for the plant, the issue was brought up as to why the company did not sell more to the glass industry, since it was said that before the mill changed owners there was extensive business between the two industries. Mr. Hentzel said that before Four M took over, the salt cake percents were not closely monitored. At one time the Percent Sodium Sulfate fell out of acceptable range before detection, resulting in the glass company suffering a loss of profits when it produced some faulty glass. Although the mill is under new ownership and the monitoring of the salt cake percentiles has been rectified, there is still that history to contend with.

However, it appears that the glass industry is their most viable option. A major drawback to that course of action is that the number of glass manufacturers in the state of Iowa large enough to be able to utilize salt cake is very small. There are currently two companies that may be able to use the salt cake as a raw material in their processes: Cardinal Insulated Glass, Greenfield, IA, 515-343-7113, Manager: Jim Miller; PPG Industries, Inc., Burlington, IA, 319-753-2961. Another possibility is a company called Guardian Industries will be building a glass plant sometime this year in DeWitt. They will be producing windows, doors, table tops, mirrors, skylights, and curtain walls.

While currently being the most obvious choice, there are some other options besides the glass industry. There are some other uses for sodium sulfate, such as: filler

in synthetic detergents; ceramic glazes; dyes; freezing mixes; and as a laboratory reagent. However, these options require more in depth research. Before these industries could be exploited, it would first have to be determined whether or not salt cake can be broken down into it's component parts, and if so would the benefits justify the cost of that process. Another option would be to incorporate salt cake into the hazardous materials industry as a neutralizer or buffer. As it was stated before, the pH of salt cake, with the help of Professor Wiley of the University of Northern Iowa, was determined to be 11.8. This means that salt cake is quite basic. With Professor Wiley's help once again, the neutralizing power of salt cake was demonstrated by adding approximately 15mL of concentrated sulfuric acid to 25mg of the compound. The acid was instantly neutralized. A contact for information on the possibility of further pursuing this particular option is Ron Snyder, Environmental Training Center, PO Box 2068, 6301 Kirkwood Blvd. SW, Cedar Rapids, Iowa 52406, Ph. 319-398-5678 or Fax: 319-398-1250.

To: Henry Hentzel
Mill Engineer
Four M Paper Corporation
P.O. Box 250
Fort Madison, IA 52627

From: Nate Snyder
Research Associate, UNI

Date: June 28, 1995

Re: Summary of research on reuse/recycling of the by-product "salt cake."

My research indicates that your most viable option for reusing the by-product salt cake at this time is still the glass industry. I found two glass companies that may be able to use salt cake as a raw material. I have not taken the liberty of contacting these companies myself. Here are the addresses and phone numbers if you wish to contact them.

Cardinal Insulated Glass
Greenfield, IA
515-343-7113
manager: Jim Miller

PPG Industries, Inc.
Burlington, IA
319-753-2961

A third glass company, Guardian Industries, will be building a new glass plant in DeWitt sometime this year. They will be producing windows, doors, and mirrors among other things. I do not have a contact number for Guardian, but you could probably obtain one from the Chamber of Commerce or some comparable organization in DeWitt.

Other possibilities, although more vague, do exist. However, some laboratory research may be needed to more fully develop these venues. Sodium sulfate has been used as a filler in the synthetic detergents industry, in ceramic glazes, and as a laboratory reagent. The biggest obstacle here is whether or not the sodium sulfate can feasibly be separated from the rest of the compound.

There is a final possibility which, due to my training in hazardous materials, I find the most enticing. I determined, with the help of Professor Wiley of the UNI Chemistry Department, that the pH of salt cake is 11.8. This high pH makes the compound a great neutralizer.

Ron Snyder, Environmental Training Center
Kirkwood Community College, Cedar Rapids, IA 52406
319-398-5678 or Fax: 319-398-1250

I hope this information will help you find a solution to your problem. Thank you for your cooperation.

Kathy,

I came across this information this morning just before sending the fax, so it is not included in my report. From appearances, this company may be able to help test salt cake as a HAZMAT response tool. Thought I would include it as another suggestion. The contact person would be:

Kristi Mejeur

Vice President, Environmental Solutions, Inc.

319-364-1099 Fax: 319-364-7095



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6301 Kirkwood Blvd. SW
P.O. Box 2068
Cedar Rapids, Iowa 52406
319/398-5411



FACSIMILE TRANSMISSION

Fax # 319 - 398-1250

Environmental Training Center

TO: Kathy Zeman
RRTTC, UNI

FROM: Nate Snyder

DATE: Wednesday, June 28, 1995

NO. OF PAGES (INCLUDING THIS COVER SHEET): 09

IF THERE ARE ANY PROBLEMS IN THE CLARITY OF THE MATERIAL
PLEASE CALL (319) 398-5678

Kathy,
Here is my paper on the by-product
salt cake, produced by Four M Paper Corp. in
Fort Madison. If you have any questions, give
me a call at 319-648-4517 tonight or 515-522-9310
over the weekend. Thanks for your patience.

Nate

95-048

Optimization of Scrap Tire Pyrolysis Using a Continuous-feed Steam Environment Tim W. Burrell, Samantha R. Frank, Michaela L. Rich, Michelle Hammer, Gilles Cobac, and Curtiss D. Hanson, Department of Chemistry, University of Northern Iowa, Cedar Falls, IA, 50614-0423

Estimates of the generation of scrap tires produced in the United States are on the order of 2 million tons per year. Although these tires contain a high percentage of useful hydrocarbons, steel and carbon black, approximately 70% are not effectively recycled. Recently, pyrolytic recycling of scrap tire (*thermal decomposition in the absence of O₂*) is receiving renewed interest because of its ability to produce valuable hydrocarbon products. We have developed a process which permits a continuous feed processing of scrap tires in a non-combustible stream environment. This system utilizes a soft seal system that operates at atmospheric pressures while minimizing any fugitive emissions. This process increases the efficiency and control of present approaches by lowering the energy requirements while maximizing the collection of valuable products. Initial bench-scale results will be presented