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# PRESERVATIVES, PRIORITIES, AND PROCESSES

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# PRESERVATIVES, PRIORITIES, AND PROCESSES[1]

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Like most other industries at this time, the wood-preserving industry finds itself facing a serious emergency. During the year 1941 wood preservers treated a considerably larger quantity of lumber and timber than in 1940. No actual statistics are available on the amount of material treated in 1941 and it will be some months before such data can be published. The statements made by various individual plant operators, however, indicate strongly that 1941 will show a larger amount of timber treated than any other year since 1930. Whether this rate will be maintained in 1942 depends chiefly upon the demands for new construction for military purposes or munitions production.

## Creosote Supplies

In the face of a great increase in demand for creosoted wood, there has been a substantial decrease in the amount of creosote available owing to a great decrease in the amount of creosote imported. This shortage is felt most keenly by plants on or near the Atlantic, Gulf, and Pacific Coasts, which have depended largely upon imported creosote but it is being felt to some extent throughout the country.

The import statistics for the last quarter of 1941 are not available for publication but for the 9 months ending September 30, 1941, they are reported by the Department of Commerce to have amounted to 12,971,656 gallons, which is probably very close to the total for the year. This is about 1/3 of the amount imported in 1940 and about 35 million gallons less than the average importation for the years 1936 to 1940 inclusive, as is indicated by the data in table 1.

What the creosote imports in 1942 will amount to, no one can safely predict. There appears to be plenty of creosote in the United Kingdom for export despite its use there for fuel and, presumably, we could look forward to an ample supply if the oil could be transported more freely. Since all

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imports and exports are under strict control, however, and are governed primarily from the standpoint of military strategy and war-time economy, other factors than the needs of the American wood-preserving industry must determine the creosote import policy in 1942. Those in control realize that creosoted wood is being used very largely on national defense construction, that it is a necessity in the maintenance of our transportation, communications, and power distribution systems, and that it is increasing in importance as a substitute for steel in many types of construction. It seems probable that enough foreign creosote could be allowed to enter the United States in 1942 to avoid plant shutdowns but it is certain that unlimited imports will not be permitted and that surplus stocks of imported creosote will not be accumulated.

There apparently was a large amount of creosote in storage in the United States at the beginning of 1941. Treating plant operators could see the prospective shortage coming and some of them, at least, kept their storage tanks well filled. There was also a large quantity of creosote in the tanks of the creosote producers and importers at the beginning of the year. There is no way to obtain an accurate estimate of the amount of creosote carried over from 1940 but it may have been 30 to 40 million gallons. This was about enough to make up for the shortage in imports and was a very important factor in enabling plant operators to increase the volume of timber treated in 1941 despite the shortage of imports. This condition does not exist at the beginning of 1942, however, since the stored creosote has been used up, and both the treating plants and the creosote suppliers have entered the new year with very low stocks. One important supplier reports that, although he will produce considerably more creosote in 1942 than in 1941, he will have less oil to sell in 1942 because he enters the new year with storage tanks practically dry.

A factor that has favored creosote plant operators in 1941 is the increase in the amount of domestic creosote produced. This increase is difficult to estimate with any degree of accuracy, but it seems certain to fall considerably short of compensating for the decrease in importations. The increase in creosote production has been brought about by an increase in the amount of tar available for distillation, an increase in the average yield of creosote per gallon of tar distilled and, to a lesser extent, an increase in tar distilling capacity.

The increase in the amount of tar produced in the country during 1941 has been a reflection of near-capacity operations of steel mills and coke ovens. However, tar production has by no means run parallel with coke production. The average yield of tar per ton of coal carbonized has fallen off as a result of the short coking periods which prevailed throughout the year in response to a heavy demand for coke; accordingly, tar production will show a much smaller increase during 1941 than will coke production. The increase in tar production has been offset to some extent by the large amounts of tar that were burned in open-hearth furnaces, especially during the first half of 1941. Local shortages of fuel oil or of tank cars, increased cost of fuel oil, and difficulties of obtaining fuel oil of suitable quality, have all encouraged the use of tar as fuel in open hearths. Thus

statistics for 1941, as compared with 1940, are expected to show a large increase in coke production, a smaller increase in tar production, and a still smaller increase in the amount of tar available for distillation.

Other conditions being the same, the yield of creosote per gallon of tar decreases with the coking period during which the tar is formed. However, a compensating factor has been an over-all increase in the distillation residue of the creosote which has been brought about to some extent by a refusal of some distillers to make a low-residue oil but, to a larger extent, by cooperation between producers and consumers. A considerable amount of low-residue oil has resulted from the production of roofing pitch and so-called electrode pitch which is a soft pitch that has been needed in relatively large amounts by the aluminum industry. One large steel company has continued to distill to a soft pitch to blend with fuel oil for open-hearth fuel and, in so doing, has produced a low-residue creosote. However, the general trend has been in the direction of higher residues.

The outlook for 1942, of course, is uncertain, but indications point to a further increase in domestic production of creosote over that of 1941. The supply of tar available for distillation seems to be the limiting factor; tar distilling capacity has not yet been fully utilized. The active demand by defense industries for coal-tar products other than creosote, especially naphthalene and the tar acids required for the manufacture of plastics, should influence the official policy in a manner favorable to the wood-preserving industry. The O.P.M. apparently has already been responsible for an increase in the amount of tar available for distillation by inducing certain steel mills to substitute fuel oil for tar. It does not seem likely, however, that domestic production alone, even when accelerated to the extent that may reasonably be expected, can supply all the creosote needed at the 1941 rate of consumption. On the other hand, a decrease in demand for creosoted timber would ease the situation appreciably.

## Supply of Salt Preservatives

The supply of salt preservatives in 1941 apparently was sufficient for we have received no reports that the operation of any treating plant has been hindered by a shortage of salt preservatives, although the amount of timber treated with preservative salts in 1941 was probably somewhat greater than in 1940. This favorable situation will not necessarily continue in 1942, however, for it can very easily be changed by military requirements and the decisions of the controlling agencies.

At the time this is written, there seems no immediate danger of a serious shortage of zinc chloride. The supplies of zinc ore and hydrochloric acid appear to be adequate and there is no immediate prospect that this situation will change but we have ample evidence that changes can take place very suddenly. The amount of zinc chloride used for wood preserving in 1940, including that used straight as well as that in chromated zinc

chloride, totalled about 4-1/2 million pounds (14)[2]. The 1941 total is, of course, not yet available, but it was undoubtedly higher.

Zinc is also a necessary ingredient in zinc-meta-arsenite, of which some 200,000 lbs. were used for wood preservation in 1940. In preparing this preservative, the zinc is used in the form of zinc oxide and the aresenic in the form of arsenious oxide ($AS_2O_3$). The supply of either one is not unlimited but has apparently been equal to the need thus far.

Chromium salts are, of course, important ingredients in several of the salt preservatives in extensive use. Sodium dichromate makes up about 18 percent of the weight of chromated zinc chloride and about 50 percent of Celcure, while Tanalith (Wolman salt) averages about 37-1/2 percent sodium chromate. The amounts of these preservatives reported used in 1940 (14) and the calculated amounts of chromium salts they contained are as follows:

| Preservative | Amount used in 1940 | Chromium salts included |
|---|---|---|
| | Pounds | Pounds |
| Celcure | 242,739 | 121,370 (sodium dichromate) |
| Chromated zinc chloride | 3,960,896 | 712,961 (sodium dichromate) |
| Wolman salts (Tanalith) | 1,062,048 | 398,268 (Sodium chromate) |
| Total chromium salts | | 1,232,599 |

The 1-1/4 million pounds of chromium salts used for wood preservation in 1940 were no doubt considerably exceeded in 1941.

With chromium salts, the situation is quite different than with zinc chloride for dependence must be placed almost entirely upon imported chromium ores. As a result, the amounts of chromium ore that refineries may consume and the uses and allocations of chromium and chromium chemicals are under very strict control by the Government. Naturally, the most urgent national defense uses receive highest priority ratings and nondefense uses are largely eliminated. The increase in chromium salts used by wood-preserving plants in 1941 over 1940, in the face of these restrictions, is possibly attributable to the fact that salt treatments in 1941 were considered mainly

[2] Numbers underlined in parentheses refer to list of references at the end of this paper.

for high-priority national defense structures. A prediction by the writers of what to expect in 1942 with regard to the chromate supply would be sheer guesswork.

In addition to the chemicals named above, sodium fluoride, sodium arsenate, and dinitrophenol are necessary ingredients in Wolman salts. Copper sulphate constitutes 50 percent of Celcure preservative. Of these chemicals, dinitrophenol and sodium fluoride are under close control but the supplies of all have been low for some time and their availability for wood preservation in 1942 will be so largely determined by needs for other uses that it cannot be predicted by the writers.

## Other Preservatives Should be Considered

Although an acute preservative shortage does not appear certain, treating plant operators and users of treated wood will be unwise if they ignore the possibility that economic and military developments may change the entire picture. During 1918 to 1921, for example, when the supply of creosote was limited, there was plenty of zinc chloride available and the amount consumed per year rose from 26 million pounds in 1917 to more than 51 million pounds in 1921. That is not likely to happen this time, however, because there are other substitutes for creosote that are much better than zinc chloride for outdoor use. During the 1918 to 1921 emergency, also, the use of creosote-petroleum solution began in earnest but this practice has proved so effective that it has increased greatly since that time.

In considering what can be done in the event of inadequate supplies of creosote and of the customary salt preservatives, it is well to see what has already been done in some cases.

One large consumer of creosote-petroleum solution, who customarily has used not less than 50 percent of creosote in the mixture has had to reduce the percentage of creosote by half. In view of the uncertainty that this preservative will be sufficiently effective in the usual absorptions, he has increased the absorption from about 8 to 10 pounds per cu. ft. The net result of the change is that the ties receive only 3.5 lbs. of creosote per cu. ft., which is a net saving of at least 1.5 lb. of creosote per cu. ft. No general shortage of petroleum for wood preservation is anticipated but there may be temporary or local shortages due to transportation difficulties.

Other consumers, who have for many years insisted on creosotes with not over 20 percent (or 25 percent) distillation residue about 355°C. have been unable to secure adequate quantities of such oil and, for the time being, have raised the acceptable limit to 30 percent or even higher. Steps are now being taken to amend the Federal specifications for creosote and for creosote-petroleum solutions, for the duration of the war, so as to permit residues up to 35 percent. In general, a 5 percent increase in residue above 355°C. should increase the yield of creosote from tar by about the same percentage, which is important in a time of shortage.

The consumers referred to felt that they had good reasons for their former preference for a high percentage of creosote in their creosote-petroleum solutions and for relatively low residue creosote. The changes made do not constitute an abandonment of their former preferences but merely a realistic attitude and a logical conformance to the requirements of an emergency. Their emergency preservatives are still good preservatives, even though they may be less desirable in some respects than their preferred preservatives, to which they will probably return when that becomes practicable.

Treating practices, wood species, and the availability of suitable materials vary considerably throughout the United States and the supply of usable preservatives may also vary at any place from month to month. For these reasons, it is not to be expected that any one material can serve as the universal substitute when supplies of creosote or preferred salt preservatives fail. It is desirable, therefore, for both plant operators and users of creosoted wood to study the various possible substitutes and thus to have several to choose from, according to local availability of materials and the needs of the job to be done. The following discussion of preservatives and processes is presented in the hope that it will be useful in that connection.

## Toxic Oils Other Than Creosote

Certain toxic oils other than coal-tar creosote are available to the wood-preserving industry. Some have been tested in service so that their degree of effectiveness is reasonably well established; others are still unproven and their use is attended with greater uncertainty as to results. In either event, they should receive careful consideration.

Chlorinated phenols.--Solutions of polychlorinated phenols in petroleum solvents have been attracting attention for some years as prospective competitors of both creosote and salt treatments. The most prominent of the group in the last few years has been pentachlorphenol but tetrachlorphenol and 2-chlororthophenylphenol have also received attention. All three have high toxicities to wood destroying fungi. Bateman and Baechler (4) report killing points of 0.002 against the fungus "Madison 517" for penta- and tetrachlorphenol. Carswell and Hatfield (6) reported a killing point of 0.006 for pentachlorphenol and Hatfield (10) reported 0.009 to 0.01 for 2-chlororthophenylphenol. These toxicity values are not strictly comparable because of some differences in methods. They also cannot be compared directly with creosote toxicities for the latter vary widely, according to the character of the creosote. The toxicity of penta- and tetrachlorphenol, however, appears to be from 10 to 100 times that of coal-tar creosote, depending upon the creosote and the toxicity values used for comparison. Even when diluted to 5 percent concentrations, the toxicities of the 3 chlorinated phenols appear to be equal to or greater than the toxicities of the coal-tar creosotes in common use. From the standpoint of toxicity then, 5 percent solutions of these chemicals appear suitable for wood preservation when used in sufficient absorptions.