CITRUS PRODUCTS WASTE DISPOSAL

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The State Board of Health is charged by law with preventing pollution of the waters of the State by industrial waste. A decade or so ago very little pollution was caused by the citrus processing industry. This is no longer the case today. The phenomenal growth of the industry and the construction and enlargement of canning plants have caused the pollution load on our lakes and streams to reach alarming proportions.

Some idea of this burden may be gained from a consideration of a few figures derived from preliminary work on the problem. It has been determined that the volume of waste produced in canning operations at an average plant is approximately 50 gallons per case of 24 No. 2 cans. Marketing reports show that the seasonal production of canned fruit and juices in the State is in the order of 45,000,000 to 50,000,000 cases. This means that something like 2¼ to 2½ billion gallons of waste are discharged into our lakes and streams each year. This estimate of waste volume has very little significance in itself. It does assume considerable importance, however, when studied in the light of the chemical and biological characteristics of the uncontrolled waste from the average plant.

The composition of citrus processing waste varies over a wide range depending on the fruit processed and the form of the final product. There are marked differences in the waste produced in juicing and sectionizing operations; and obviously further differences in characteristics appear in plants employing secondary processes and by-products recovery refinements. Differences in volume and composition of the liquid waste are influenced to a great extent by the mechanical lay-out of the plant itself. For instance, where the can cooling water is wasted without being mixed with press liquor or peel bin drippings, practically 90 percent of the total plant waste can usually be discharged into receiving waters without causing significant pollution. In many plants that have been studied by this Bureau, it has been found that this tremendous volume of relatively clean water has been combined with other wastes with the idea of providing a high dilution factor and thereby obtaining satisfactory disposal. This has proved to be a mistake in practically every case. The effect has been to produce a highly polluted waste in unmanageable volumes.

Analyses that have been made on mixed effluents from various plants have given results approximately as follows:

Product	Total Solids (ppm.)	Organic Solids (ppm.)	5-day B. O. D. (ppm.)	pH
Juice	700	550	350	6.5
Section	3500	3500	2000	5.8
Juice and Sections	1400	1200	600	7.2

It may help to clarify the picture of citrus processing pollution to present general data converted into more conventional units. If we may assume that all the waste now being produced is uniform in composition and contains average values of polluting characteristics, it can be shown that during the operating season the industry discharges approximately 18,000 tons of solids into receiving waters. In terms of B.O.D. loading the waste discharged by the citrus processing industry amounts to something in the order of 9,500 tons. To understand what this means, this load can be converted into equivalent volume of average strength sanitary sewage for comparison study. Average strength municipal sewage in Florida has values of total solids in the order of 800 ppm. and a 5-day B.O.D. strength of 200 ppm. In a 6-month operating season, therefore, the *daily* discharge of citrus processing waste is roughly equivalent to 60 million gallons per day of raw sanitary sewage, which would be equivalent to a population of approximately 60,000 people.

The analysis presented herein is not, of course, intended to reflect scientifically accurate results. It is intended to set forth broad approximations of the scope of the problem based on logical deductions from the data at hand.

THE POLLUTION ABATEMENT MOVEMENT

A generation ago it was common practice for municipalities and industrial plants to discharge their sewage and waste into any convenient body of water. This practice has grown out of the rapid expansion and development of the country and had acquired what many considered to be a vested right. As a result, however, many streams and lakes began to show signs of distress under the increasing pollution loads being imposed on them. Obviously such practice could not be allowed to go on uncontrolled without causing complete destruction of the favorable attributes of surface and underground water resources.

The Congress of the United States, under the provisions of the Constitution, has control over all navigable waters. Under this authority the Federal Government has from time to time passed laws relating to the use of navigable waters and has delegated certain authority to the War Department and other agencies.

Control over nonnavigable waters is under the cognizance of the respective States. Under the police power of State government the various legislatures have adopted such pollution control measures as seem to be most suitable for their respective States. Florida, of course, has such legislation in the statutes and places the responsibility for supervision of water supplies and pollution in the State Board of Health.

The general stream and surface water improvement under the existing authority has been extremely disappointing. So much so, in fact, that many national authorities and various interested groups have for some time sought to obtain rather rigid Federal control of local pollution as a means of ending flagrant misuse of natural water resources. Accordingly, many so-called anti-pollution bills have been submitted to the Congress for consideration.

In the final hours of the 80th Congress a "Water Pollution Control" act was passed and became Public Law 845. This act deals with the pollution of interstate waters in or adjacent to any State or States.

It is the personal opinion of the writer that this is merely an interim bill, and

the next step will be Federal control of *intra*state waters. A bill may be passed such as has been tried for years such as the Mundt Bill.

The Bureau of Sanitary Engineering may be considered to endorse Federal Water Pollution Control if it is true that satisfactory results cannot be obtained on the State level. The record to date would certainly indicate that the efforts of the responsible State agency have been something less than completely successful in bringing about correction of the generally bad situation. But when the problem is considered from a broad long-range viewpoint the Bureau feels that some measure of accomplishment has been achieved and that there is a fair prospect for substantial improvement in the near future. To substantiate this optimistic attitude the Bureau can cite the fact that detailed planning and engineering study by principal cities in the State have been underway and approved by the Bureau looking to the construction of some 88 projects covering both sewer extensions and treatment at an estimated cost of over $30,000,000 in the next few years. Day by day contact with city officials and consulting engineers leads us to expect a considerable volume of construction in this field on the first approach of normal business conditions.

The only large item remaining to dilute this optimistic view is the relatively untouched problem of pollution attributable to industrial operations. The apparent magnitude of this item has been described elsewhere in this paper.

The Industrial Waste Problem

There are relatively few industries in Florida that cause the discharge of waste in volumes sufficiently great to constitute specific regional problems. Without any intent to arrange them in order of value or volume the list would include mining, paper manufacture, and, of course, citrus processing including canning, molasses manufacture, and cattle feed prepared from citrus pulp.

The mining industry is fairly well concentrated in certain areas of the State where the raw material can be removed economically. In terms of economic value to the State the industry is extremely important; yet this industry has demonstrated its awareness of responsibility for solving its pollution problem by underwriting an extensive research study of the problem with the view to correcting existing bad practice in disposal of waste. Similarly the pulp and paper industry has sponsored the organization and administration of a research group known as the National Council for Stream Improvement. It is expected that both of the above-mentioned groups will in time obtain results which will be reflected in abatement of present pollution problems being created by these respective industries in the State.

In the opinion of the Bureau the citrus processing industry is in a less favorable position in respect to its contribution to the pollution of the waters of the State. This is due, of course, to many factors and extenuating circumstances of which this office is fully aware. The seasonal nature of the business, the variety of products processed, the further variations in waste composition due to mechanical design of plants, the broad range in type and character of waste receiving waters, all tend to complicate the problem and make a rational solution more difficult to obtain.

The Bureau is by no means unmindful of the work that has been done on this problem under the sponsorship of the

Citrus Commission and the Canners Association. Furthermore, it is well known throughout the State that several plant owners have gone to considerable expense and effort to develop methods of byproducts recovery and waste treatment. However, it must be conceded that much work remains to be done before a satisfactory treatment process is evolved that will not be prohibitive in cost.

Suggested Procedure for Further Study by the Citrus Industry

Mention has been made of the general pollution problem in Florida, the trend of thought on both the national and State level on methods of obtaining abatement of the problem, and some comment has been presented on the status of planning for treatment works by municipalities. Mention has also been made of the magnitude of the industrial waste load with some notes on action being taken by several of the more important industries in the State.

It seems logical to conclude from the above-mentioned review that there is an urgent need for a fresh approach to the problem of citrus processing waste. The Bureau, therefore, has made a preliminary study of this subject with the view to presenting the industry with a plan for an intensive investigation of the problem in the belief that the time for such an integrated approach is now at hand.

In the absence of a permanently established pollution control research agency such as that set up by the pulp and paper industry, the Bureau is prepared to offer its good offices as the preliminary research agency for the citrus processing industry. It is proposed that the industry, by any means it deems most suitable, provide funds for the detailed survey of the problem and, at the appropriate time, establish a permanent research station with qualified full-time technical staff. It would be the principal function of the research station to pursue such lines of attack on the waste disposal problem as seem most promising of success according to results obtained in the survey proposed to be made under the general direction of the Bureau.

The Bureau has made an estimate of the cost of the detailed survey described above. This estimate assumes that full factual data on each processing plant in the State will be obtained. Such data will include the following items:

1. A detailed physical survey of the plant to determine the amount of water used; where water is used in each stage of the process; the rate of waste discharge at each point in the process; the chemical, physical, and biological quality of each component source of total waste.

2. Further physical study of the plant to investigate alternate waste collections systems and probable effect on total waste strength.

3. Correlation of water demand rates and waste discharge rates with fruit process production; correlation of waste characteristics with the various products of operation. From these data design values will be derived for use in future treatment research studies and in the design of treatment facilities.

4. Complete hydrological, chemical, and biological data on receiving waters; analytical studies designed to reveal data on degree of treatment required to maintain satisfactory quality in receiving waters; investigation of the influence of citrus process pollution in relation to the economic use of receiving waters. This will involve studies of potential as well as existing use for public water supply,

final disposal for treated municipal sewage, and recreation.

5. Assemble and evaluate existing data on treatment processes that have been investigated in the past and results now being achieved in studies now being made. The purpose of this item will be to screen out processes that have failed to give satisfactory results or which seem to promise little hope for success in order to channel research into more promising fields.

The cost of the study outlined above is estimated tentatively at about $50,0000 per year. The length of time required to accomplish the aims of the program will depend on several factors; perhaps 3 to 4 years may be required to define the problem in sufficient detail to satisfy the pollution abatement authorities and to get research studies advanced to a point where economical and adequate treatment processes are in sight. It is the considered view of the State authority—that is, the Bureau of Sanitary Engineering of the Florida State Board of Health—that the industry will be more than repaid in financing the program to defend the State from a rapid deterioration in one of its most important attractions. According to conservative marketing estimates the annual cost will be in the order of one-tenth of a cent on each case of fruit produced.

This, then, is offered to the industry with a request that it be given an honest appraisal. The Bureau is presenting this prospectus with full knowledge of obstacles in the way of such a scheme, but with confidence that the industry will receive it in the spirit in which it is offered. The Bureau will be glad to meet with any committee or representative group from the industry to discuss the subject in more detail and consider any alternative that may be suggested.

One thing is certain: some action must be taken to advance the solution of this problem at a more rapid rate than is now being experienced if the State is to avoid outside interference in its local affairs.

CANNING AND BYPRODUCTS RESEARCH AT THE CITRUS EXPERIMENT STATION[1]

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INTRODUCTION

Excellent facilities for research in canning and byproducts have been provided at the Citrus Experiment Station through the cooperation of growers, processors, State and Federal agencies, and many other persons, who are today interested in the welfare of the Florida citrus industry. The 11 research personnel now working in the canning and byproducts department at the Station includes three food technologists, three chemical engineers, four chemists, and one bacteriologist. All of the research being carried on at the present time is a result of the cooperation of personnel of both the Station and the Florida Citrus Commission. All of the personnel are desirous of doing research, which will benefit the

[1] Paper presented at the 61st Meeting of the Florida State Horticultural Society, West Palm Beach, Florida, October 28, 1948.