Copra Sampling, Inspection and Analysis

By P. W. TOMPKINS

THE present extensive demand for copra, market changes due to large European consumption, the varying quality and grades obtainable or desired by crushers, regulations resulting in improved quality in some localities, the absence of such regulations in most places, and many other factors, makes the subject of inspection complicated, and requires someone in charge who is familiar with conditions, if anything like practical results are to be expected.

The character of cocoanut oil obtained, must necessarily reflect the quality or grade of copra from which it was derived and while some crushers have their own buyers on the spot to aid them in their selection, others reply on inspection at points of entry.

From time to time we are asked to outline methods which should be followed as a guide for unified procedure, but there is little more to be added to that which has already been touched upon in several previous articles appearing in these columns, beyond correlating the data as a whole and bringing the subject up to date.

Interpretation of results must be based on the knowledge of the particular copra grade or type being inspected. No independent interpretation can be made without this knowledge, since the characteristics of the copra from any one locality or district may normally be quite

Copra schooners loading at one of the Tahiti ports

different from that of another. For example, Cebu Sundried, Cook Island Sundried, Tahiti Sundried, and Fiji Sundried, etc., are distinctive types both in appearance and analysis, but the greatest difference lies in their appearance and the color and fatty acids of the oil. The smokedried copra and mixed copras from various places differ in like manner. Furthermore the record of maximum, minimum and average run of any type from any locality must cover a long period and knowledge of copra, if practical decisions are to result. As the phrase "fair average quality of the season" cannot be known until the season has passed, it renders this term quite meaningless without a full knowledge of conditions as they exist.

According to the character and origin of the copra, the fluorescence of the oil varies in intensity. Sundried copras which become dark in color as a result of age and exposure to elements of attack, yield oils with much more pronounced fluorescence than do the whiter, better preserved copras. Oil from smokedried copra shows marked fluorescence as a rule, but not more than that of the dark colored sundried copras. Smokedried copra has marked resistance to spoilage and insect attacks and particularly dampness, molding and fatty acid development resulting from dampness, the smoke acting as a preservative.

Causes of Variations

Copra types and characteristics are an inseparable reflection of the producing district and the environments surrounding harvesting and curing in the particular locality from where derived. When one stops to consider the tropical conditions prevailing where this commodity is grown commercially, and methods of handling and curing by the natives, it is natural to anticipate wide variations, which characterize the output of the numerous points of origin.

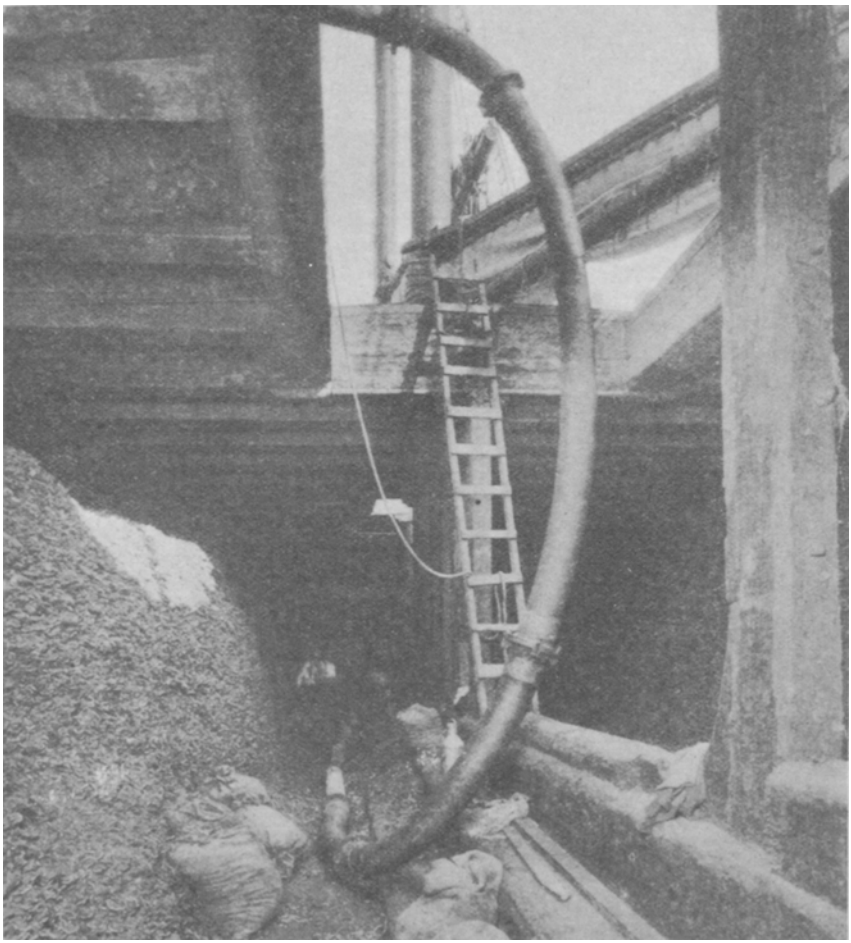
Differences occurring in copra inspection and analysis originates almost entirely in a lack of understanding the subject, and in the majority of cases, discrepancies are directly traceable to the manner of procuring and preparing the sample, and not to the examinations which follow. Unless the entire operation (sampling and preparation for analysis) can be handled in a representative manner, the results obtained are little short of useless. Without due precautions in sampling, no results, whether physical or chemical, can ever reflect what the sample is intended to show.

With such methods as prevail for harvesting copra by the natives and unforseen influences of transportation so frequently affecting the commodity, the idea of guaranteeing analytical results of primary material or that afloat is quite impractical. The use to which analytical results can reasonably be applied, is as a helpful means of determining or controlling grades not defined by appearances and to assist in factory control operations. Furthermore, until a uniform and comprehensive system of inspection is generally understood and followed, the results will fluctuate in proportion to the efficiency with which each step of the operation has been conducted. And as often as there are inaccurate samples, there will be inaccurate deductions, whether physical or chemical.

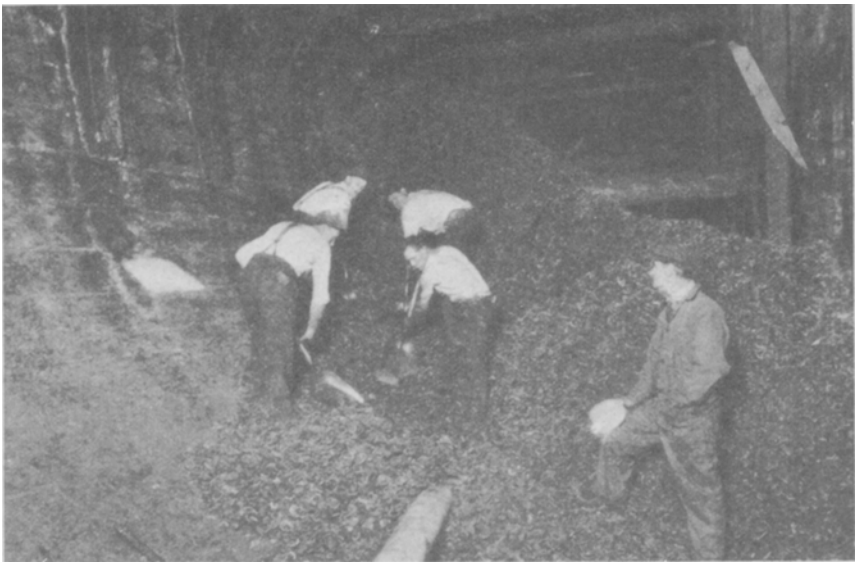
Methods of Sampling

Since the ratio of existing parts of any cargo can only be typified by eliminating elements of personal equation, selective hand sampling is obviously objectionable. There is no use of trying to represent, in a few pounds, something that by its very nature is visually as well as mathematically obscure in its proportions.

Foreign Commerce Association Rule No. 560, as well as the uniform copra contract, requires that samples be drawn "from at least every tenth sling load as discharged from the vessel," which is none too much where such large tonnage is involved. Let us see how this procedure works out in practice, taking for example a concrete case, where some 1050 long tons of copra were loaded into 30 cars and every eighth bucket sampled. As the



Two wings of copra boat with pneumatic system installed ready for discharge



Intake at mouth of pneumatic tube. Samples drawn near that point

average box car holds about 112 buckets, the entire shipment would represent about 3360 buckets. The scoop used for taking the sample is intended to hold sufficient material to permit a fair average being represented, and by this means about one and a half pounds is taken from each bucket. As every eighth sling was sampled, it in turn represented about 420 buckets, from each of which about one and a half pounds of copra was removed, or a total of about 630 pounds to represent the shipment as a whole.

When copra is discharged through the medium of the pneumatic system, the time required to load the average box car of approximately 35 tons requires about 60 minutes. It is then necessary to take a scoop full (1-½ pounds) about every five minutes, or in round figures approximately 12 times during the loading of the average car. If, as in the former example, 1050 long tons were being loaded into 30 cars, it would take about 30 working hours, and as the copra is sampled approximately every five minutes, one would have taken 360 samples, or about 540 pounds, to represent the shipment as a whole. The samples are drawn some three feet away from the suction intake at the required intervals, and as the copra is constantly shifting, mixing is continually going on at the point where the samples are drawn. Where sacked copra is involved 2 to 10 per cent of the lot should be sampled, and treated in every other respect as with the bulk material.

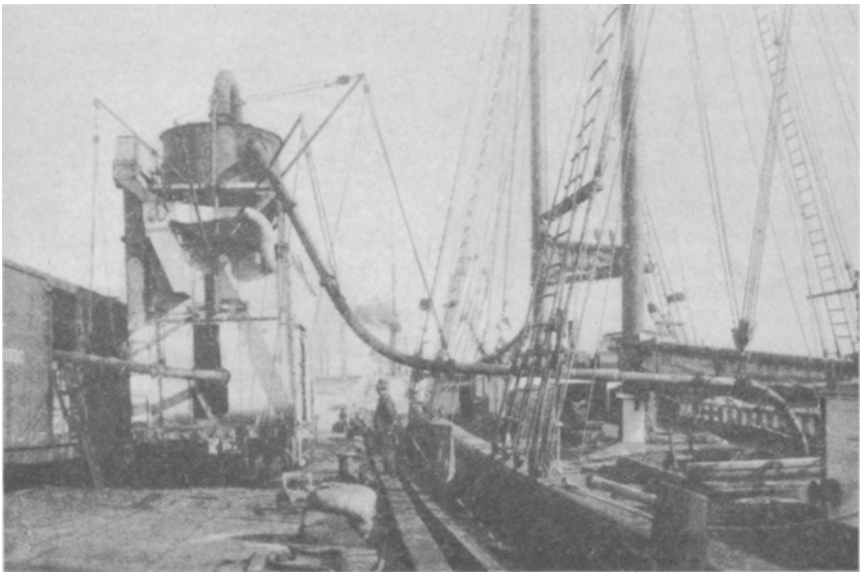
Preparing the Sample

Generally speaking, the bulk sample derived from each fifth or tenth sling, or every five minutes, as the case may be, is mixed, quar-

tered and reduced in size to about 100 to 200 pounds, depending on the tonnage (balance returned to cargo), which is sufficient to retain the average characteristics of the shipment when intended for analysis. The bulk sample, however, can only be reduced in this way to an amount that will not alter the proportionate ratio of existing parts of the shipment, in order to characterize the condition of the consignment as a whole. Only when the trade custom of grading copra by physical appearance is involved, can the bulk sample be further reduced without affecting any property of the sample that the eye is capable of discerning.

Of this reduced sample (100 to 200 pounds) about three-fourths is coarsely cut in a suitable power driven machine, mixing and quartering as usual. One of these quarters is again cut finer by a special copra shredder, mixed and quartered and a quarter of this put through a smaller disk of the shredding machine, which reduces it to the necessary size for laboratory use. It should be understood that appliances used for cutting or shredding copra for laboratory use must leave the oil intact and equally distributed, and is unlike crushing for large manufacturing purposes where the oil removed does not figure in any analytical results.

All these attempts at thoroughness are useless efforts if, after properly drawing the samples, only a few pieces are ground in some small hand mill. In such an event, the whole operation might just as well be omitted and any small grab sample taken, which will serve the purpose equally as well. Differences as a rule are not attributable to the



Pneumatic tubes from boat to box car. Compressed air pulls the copra from the vessel and discharges it under pressure into the box car

analysis, but to inefficient methods of procuring and preparing laboratory test samples. One has only to review some of the officially adopted methods of sampling coal, ores and other commodities, to realize that sampling and the preparation of samples for analysis has become an important scientific operation in industrial transactions.

It should be understood by those requiring copra sampling, that the amount necessarily taken to properly represent a cargo is considered a part of the delivery. Aside from that portion ground for analysis, a small type sample is always retained for three months, and if no requests are made for these reserves during the official period for which they are held, should be called for at the expiration of this time, as otherwise they are disposed of.

Methods of Analysis

Copra is usually examined for moisture, total oil yield, color of the pressed oil, free fatty acids (as oleic) and the proportion of loose dirt. When loose dirt is reported, it should state the size of screen used, without which the results will lack definite meaning or value. We always use Number 4 mesh screen for this purpose. The loose dirt being low in oil and high in free fatty acids (about 35 to 60 per cent of the oil), and usually carrying grits, which if in appreciable amounts clog and scratch the expellers, retarding the output and it is therefore advantageous to keep loose dirt as low as possible.

Oil is determined by extracting 10 grams with alcohol free ether or petroleum spirit distilling below 40°C for about 4 hours. The thimble is then removed, adhering solvent allowed to evaporate, and the copra ground in a mortar with fat free sand and re-extracted overnight, after washing the mortar and pestle. The solvent is distilled and the residue dried at 98 to 100° C, care being exercised to avoid over-heating, or too long heating which would result in lowering the free fatty acids by volatilization.

No attempt should be made to report the free fatty acids or color on the pressed oil unless the equipment is adequate to remove practically all the oil, leaving not *more* than 10 per cent in the cake. The free fatty acids and color determined in a partly expressed copra is usually higher than if completely expressed and much more so where the fatty acids are high. This is readily explained by the effect produced on exposed parts where the tissues are softened by elements of attack, and when in this state yield oil more freely, and are the portions highest in fatty acids and color. The harder and more resistent parts nearest the shell, having better protection are lower in fatty acids and color and require greater pressure to dislodge the oil.

It will therefore be seen, that if any methods are employed they should (in the absence of a proper press) be on the basis of the extracted oil only, since any properly equipped laboratory would have ample facilities for extraction. In this way reasonably uniform results (excluding color) can be obtained, as all the oil is recovered from the copra and on no other basis will concordant or trustworthy returns be procured. Furthermore, no analysis of copra should be reported on at all, unless adequate facilities are available for reducing

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