THE

J. A. S. T.

QUARTERLY

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THIRD COMBINED MEETING OF THE ENGINEERING & CHEMICAL SECTIONS HELD SATURDAY 29th JULY 1944.

The third combined meeting of the Engineering and Chemical Control Sections of the Association was held at the Lecture Hall of the Junior Centre, Institute of Jamaica, on the 29th July 1944 at 9.30 a.m.

Present were:—

Hon. H. H. Croucher,	Chairman.
Mr. W. Ryle-Davies,	Actg. Secretary.
Mr. L. W. Brandford,	Asst. Secretary.

Engineers:

Mr. J. B Cuthill,
" L. L Henzell,
" P. M. Graham,
" R. Y. Pickering,
" John Munro,
" H. A. Dalley,
" B. Thornton,
" J. Bennie,
" A. F. Dougal,
" C. Robinson.

Chemists:

Mr. G. T Macdonald,
" J. R. McFarlane,
" R. D. Smedmore,
" M. B. Floro,
" H. B. Springer,
" W. McMillan,
" A. D. Dixon,
" L. A. M. Robertson,
" K. G. Hall,
" P Meghoo,
" D. Meghoo,
" W. M. Phillips,
" C. Fraser,
" Gyles.

Mr. J. G. Davies,
Mr. A. S. Campbell,
Mr. Guy Campbell.

Apology for Absence.

Apology for absence was received from Mr. L B. Whittaker who was unable to attend the meeting owing to illness.

The Chairman mentioned that at the last meeting they had adopted the procedure of having a different Chairman for each paper and, as it worked so successfully, he suggested the same procedure be followed. Members were in agreement.

Minutes of the Last Meeting.

The Minutes of the last meeting which had previously been circulated were taken as read and confirmed. Mr. Smedmore moved their confirmation and Mr. Macdonald seconded the motion.

STUDIES ON THE STEAM CONSUMPTION OF POT STILLS DURING THE DIFFERENT DISTILLATION CYCLES.

M. B. FLORO, Chief Chemist, Frome Central, West Indies Sugar Co.

Mr. McFarlane was asked to take the chair and opened the discussion by saying that very little was known about the working of stills. Mr. Floro had, however, made a study of steam consumption of stills in various parts of the cycle and he was sure all members would find the paper very interesting.

Mr. Floro then read his paper, as follows:—

General Remarks:

Although Rum Distilleries equipped with Pot Still have been in operation in Jamaica for years, there appear to be very little information available on the actual steam requirements of this type of Still during operation.

The object of this investigation therefore is to secure some reliable data on the steam consumption of Pot Stills of different designs and sizes, based on actual operating conditions. This necessarily involves separation of the Distillation cycle into steps. It is recognized that steam consumption in a given Still generally goes up in proportion to the increase in Distilling time, all things being equal, and during the tests particular attention was given to the time required for the completion of each step in the cycle. It is noteworthy that on the completion of tests an analysis of the time requirement gave definite directions where savings can be made thus enabling a Distillery to increase its Distilling capacity without additional equipment. This is particularly important at the moment when Rum demand is at a high level and Distilling equipment practically unprocurable.

The factors mainly influencing the steam consumption of a Pot Still are generally well known and may come under one or a combination of the following:—

(1) Cleanliness of Heating Surface.
(2) Design of Still — including vapour pipes and Retorts.
(3) Ratio of Heating Surface to Still capacity.
(4) Radiation Losses.
(5) % Alcohol in Wash.
(6) Temperature of Incoming Wash.
(7) Steam Supply.

In order to reduce the steam consumption to a common basis the results obtained are given in Lbs. steam per Proof Gallon of Rum.

Equipment used:

Still Type.	Capacity.	Heating Surface.	Insulation.
Booth Coulter	2,000 Gallons.	85 Sq. ft.	Unlagged.
Booth Coulter	2,000 Gallons.	87 Sq. ft.	do.
Booth Coulter	1,500 Gallons.	78 Sq. ft.	do.
Blair Campbell	1,500 Gallons.	82 Sq. ft.	do.

Other Data:

Average Pressure—Steam Supply	—	25 lbs. per Sq. inch.
Coils reasonably clean	—	
Ave. Alcohol in Wash	—	10.50% Proof Spirits.
High Wine Distilled	—	10.50% Still Capacity.
Low Wine Distilled	—	12.00% Still Capacity.
Boiling Temperatures Wash	—	202 — 218°F.
Boiling Temperature of Low Wine	—	185 — 212°F.
Boiling Temperature of High Wine	—	168 — 208°F.

Results:

Still Capacity	—	2,000 Gallons.
Temperature Wash	—	88°F.
Total Time for Cycle	—	5.24 Hours.

	Yield Rum Proof Galls.	Steam Used Lbs.	% Total Steam Used	% Total Time	Steam Used per Proof Gallon
Preheating to 121°F.		850	12.95	7.42	
Heating from 121°F. to Boiling.		1592	24.25	18.02	
Boiling to Rum.		579	8.82	9.89	
Rum	205	555	8.45	14.31	
High Wine		1073	16.34	18.73	
Low Wine		1917	29.19	31.63	
Totals—	205	6566	100.00	100.00	32.02

Still Capacity — 1500 Gallons Booth Coulter.

Temperature Wash — 88°F.
Total Time for Cycle — 5.03 Hours.

Preheating to 121°F.		660	14.44	5.71	
Heating from 121°F to Boiling.		1158	25.34	13.81	
Boiling to Rum		362	7.92	10.68	
Rum	105	290	6.35	8.47	
High Wine		700	15.32	18.42	
Low Wine		1400	30.63	42.91	
Totals—	105	4570	100.00	100.00	43.53

Still Capacity — 1500 Gallons — Blair Campbell.

Temperature Wash — 88°F.
Total Time for Cycle — 4.39 Hours.

Preheating to 121°F.		680	14.38	5.01	
Heating from 121°F. to Boiling.		1036	21.90	11.62	
Boiling to Rum		386	8.16	13.21	
Rum	116	410	8.67	11.39	
High Wine		771	16.30	19.82	
Low Wine		1447	30.59	38.95	
Totals—	116	4720	100.00	100.00	40.78

Significance of Results:

The results obtained can in no way be regarded as conclusive. It is realized that the actual Steam consumption should be smaller if all units are properly insulated. It is proposed to lag some of the units for Crop 1945 and then further comparative tests will be made. The recorded steam consumption therefore may be regarded as the maximum requirement and perhaps fairly representative of actual conditions in the majority of Jamaican Distilleries.

Noteworthy points are:—

1. It appears that the capacity of Still units has a direct relation to the steam consumption of the unit per Proof Gallon of Rum — being less as capacity increases.

2. The type of Still used, provided the auxiliary units are properly designed, does not affect the steam consumption per Proof Gallon of Rum — to the same degree as it affects the time cycles. Blair Campbell Stills due to smaller hydrostatic heads appear to boil faster than the Canadian types.

3. The percentage of steam used for each step in the cycle appears to be approximately the same for different types and sizes of Stills.

4. With regard to the Time Cycle it appears that a big saving in time can be accomplished in the following directions:—

   (a) About 6% of Total Time if Wash is preheated to about 120°F before feeding into Stills. 120°F is chosen, as from our experience preheating above that temperature in open heaters may likely result in loss of Alcohol.

   (b) Approximately 11.00% of Total Time is used in heating the charges in the Retorts before Rum comes over in the condenser. If heating coils are installed in the Retorts and the charges are preheated to within 20°F of their boiling points another 5% of the total may be saved by shortening the period elapsing from the time the Still starts boiling until the time Rum comes over.
   In neither of these cases will steam be saved, but the indicated savable time of 11% of Total Time will mean a great deal to those Distilleries deficient in Distilling capacity.

Mr. MacFarlane mentioned similar work done at his factory where the still is smaller than that at other factories. The approximate velocity of the still is 2.5 times as fast as Mr. Floro's still. He had found the total time of boiling to rum was 16% as against Mr. Floro's 11%. He had carried out experiments in regard to first heating the retorts by means of coils and had saved 15 minutes. He had figures of the time taken and the steam consumption with the preheater and the retorts—the saving was about 5% of the time when the retorts were heated first. In regard to pre-heating he had found that through a 4" coil there was sufficient heat to bring the temperature of the water to 114°F. and it could even be raised to 120°F. The other possibility of heating the water was to use dunder. It was possible that with modern exchanges it might be possible to recover 85% of the heat from the dunder. If the heat were raised to 150° it would mean keeping the still closed in which case much steam and time would be saved.

Mr. J. G. Davies said that a considerable amount of heat was lost in the discharged dunder. He wondered whether some could not be recovered by the use of a heat exchanger. He then presented some calculated figures to show the extent of the loss. Mr. MacFarlane had emphasised the saving of time but he felt much could be done to save steam.

Mr. Floro said it was difficult to find a suitable heat exchanger and **Mr. J. G. Davies** mentioned that in low fibre countries they used heat exchangers to pre-heat juice.

Mr. Floro remarked that their dunder was discharged through copper pipes. The heated dunder was found to be highly corrosive and the copper piping had to be changed two or three times during crop. He suggested the use of wooden pipes when they were available.

Mr. Dalley outlined experiments he had undertaken using factory exhaust steam for pre-heating in conjunction with a high velocity juice heater, preheating wash to a temperature of 180°F. He strongly recommended the use of exhaust steam in distilleries wherever possible. The heater used was the normal type of juice heater, with copper tubing and cast iron heads. In spite of the heated wash corrosion of tubing was negligible.

Mr. Floro said that in any distillery the exhaust steam could be stored up and used for pre-heating.

Mr. Dalley suggested connecting the main exhaust pipe from the factory with the pre-heater which would be a very cheap investment. In a properly operated factory with normal fibre in the cane, there should be sufficient bagasse to have a surplus which could be used in the boiler to make steam in the exhaust line and so prevent waste.

Mr. McMillan said that in his factory they had used for seven or eight years a heater with brass tubes for preheating purposes and the method had been very satisfactory.

Mr. Floro however said that in his experience corrosive damage to copper tubing was great.

Mr. McMillan asked to what temperature could pre-heating be undertaken without causing deterioration.

Mr. Floro replied that pre-heating up to 20° below the indicated boiling point could be undertaken with safety.

Mr. MacFarlane then thanked Mr. Floro for his paper and pointed out that Mr. Floro was a pioneer in applying science to distilleries.

Mr. Floro in replying paid tribute to the work done by Mr. Mcfarlane who, more than anyone else, had worked on the modern operation of distilleries.

Mr. Cuthill took the chair and suggested transposing Items 3 and 4 in view of the urgency of determining means of satisfactory disposal of dunder.

A REPORT ON THE WORKING OF THE DUNDER DISPOSAL PLANT AT BERNARD LODGE.

Mr. Henzell was asked to take the chair and he asked Mr. Munro to give his report.

Mr. Munro suggested that the item be held in abeyance pending the completion of the work being undertaken by Mr. J. G. Davies and himself.

In reply to a request to comment on the investigations already undertaken **Mr. J. G. Davies** said he would mention that the aid of Mr. Innes, Senior Agricultural Chemist, and Dr. Grant of the Bacteriologist's Laboratory had been enlisted. They had not yet seen any light on the problems.

Mr. Springer said that, while on the subject of Dunder Disposal, he would refer members to a short paragraph of the June issue of the International Sugar Journal, page 166, in regard to a patent by C. J. Brockman. In the review of his patent there was a short description of the process which involved the addition of ½% of sodium chloride to hot dunder and the wash was electrolysed. The resultant generation of chlorine accelerated the reduction of the dunder. The method appeared to be economical. He felt that the method was worthy of investigation locally.

Mr. J. G. Davies informed the meeting that he had sent for a copy of the patent with the full details of the process.

Mr. Cuthill suggested that while the method would be economical in the laboratory it might not be so in commercial operation but **Mr. Springer** stated that no details were given of total current required.

Mr. Floro suggested that isolation of bacteria in pig manure and sewage systems might be worthy of investigation as it was possible that such bacteria might also be used to render dunder innocuous.

Mr. J. G. Davies stated that experiments with the use of pig manure had proved it to be unsuitable and that Mr. Munro and he were now investigating the first of four other possible sources of bacteria which would be tried out one by one.

Mr. Henzell told of the work done at Caymanas where he had used a bull-dozer and dug ponds of a total capacity of 2,000,000 gallons which meant

that 1,000,000 gallons of dunder could remain in the ponds for one month by which time it was rendered innocuous. The ponds could be used alternatively, treating 1,000,000 gallons at a time. This method had proved most successful. Apart from this, he understood that the toxic power of dunder could be greatly reduced by dilution with water. In this connection he had gauged the flow of the Ferry River and estimated that 1.300,000 gallons of water passed under the Ferry Bridge every hour so that if a small amount of dunder did get into the river it would be hardly likely to affect the fish.

Mr. MacFarlane explained that although no bacteria had been introduced into the ponds, in one particular set of observations it had been found that fermentation had started up after four days and it was observed that the B.O.D. had been reduced.

In reply to a question by Mr. Henzell, **Mr. MacFarlane** said the dunder coming out of the ponds was not in his opinion of sufficiently reduced B.O.D. to be innocuous.

A COMPARISON OF SUCROSE BALANCE DETERMINATIONS BY THE INVERTASE METHOD AS AGAINST DETERMINATIONS BY THE POLARISATION METHOD.

H. B. SPRINGER, A.I.C.T.A., Chief Chemist, Monymusk,
West Indies Sugar Company.

Mr. MacDonald was asked to take the chair. He stated he was very glad that Mr. Springer's paper of results of work in the last crop had already been circulated.

Mr. Cuthill suggested that Mr. Springer, instead of reading through his paper which is given below, should give a summary of its contents to the meeting.

During week ended 1st April, certain analyses were undertaken for the purpose of calculating a sucrose balance. The invertase method was used to determine the gravity purity of the following samples:—

1. **Mixed Juice:** 50 ml. of filtrate from each of the routine 6-hourly pol determinations were kept for 24-hourly sucrose tests.
2. **Refinery Reject Syrup:** Treated similarly to mixed juice.
3. **Export Raw Sugar:** Sucrose on weekly composite sample.
4. **Raw Sugar Refined:** do do
5. **Final Molasses:** do do

The following analytical results were obtained:—

Date	MIXED JUICE		REFINERY REJECT SYSTEM	
	Purity	Gravity Purity	Purity	Gravity Purity
March 26	83.59	85.59	87.78	88.66
27	84.00	84.88	88.64	89.61
28	84.06	85.48	88.23	89.37
29	84.07	85.52	87.63	87.74
30	84.00	86.32	90.06	91.02
31	83.68	85.87	88.17	89.01
April 1	84.00	84.39	89.66	90.82
Weighted Average:	83.92	85.44	88.52	89.37

measurement, with an error below 1% and which could be adapted to practical conditions of stopping and starting without affecting accuracy. Mr. J. G. Davies on his visits to estates might be able to give some assistance in the matter.

Mr. Munro thanked Mr. Graham on behalf of the meeting for his paper.

Mr. J. G. Davies asked that his paper on Graining Methods be left till after the luncheon interval so that he could put up photomicrographs relevant to his paper for members to see during that interval.

AN ANALYSIS OF DISTILLERY LOSSES IN RELATION TO THE MORE ECONOMICAL UTILISATION OF MOLASSES.

M. B. FLORO, Chief Chemist, Frome Central, W. I. Sugar Company.

Mr. Ryle-Davies took the chair and stated that the paper to be read would be circulated to members as early as possible. Mr. McFarlane, at Mr. Floro's request read the latter's paper on the above subject.

Under the present state of the Rum Market and with the projected Yeast Food Factory requiring the excess Mollasses as Raw material, this bye-product of the Sugar Factory becomes extremely valuable and its economical utilization in the Distillery should be the chief aim of Distillery owners and operators

In the light of Rafael Arroyo's recent article (April issue of Sugar—1944) it appears by comparison that the efficiences of Jamaican Distilleries as a whole fall far below those attained in Puerto Rico. For comparative purposes however, the following has to be taken in consideration:—

(1) That Jamaica Rum is distinctive in quality and totally different from other Rums.

(2) That in the manufacture of Jamaica Rum the production of Alcohol from the Sugars in the Raw material is not the only aim and it has to be accompanied by production of volatile acids, esters and other secondary products so necessary for the make-up of the product called Jamaica Rum.

Admittedly there is room for improvement in our distillery operations and it is for us to find the best methods of approach to the problem of improving efficiences and of more efficient molasses use. For finding a solution to this problem a comprehensive knowledge of the nature and sources of all Distillery Losses is essential and it is with this end in view that we will try to outline a detailed analysis of such losses based on actual operating results.

Classification of Losses:

Broadly speaking during the processing of Molasses into Rum, losses may occur during the two main steps—

(1) Fermentation.

(2) Distillation.

In order however, to present a clearer view of the whole operating losses in a Jamaican Distillery and its relation to quality production we would prefer to classify all such losses as—

(a) Preventable Losses.

(b) Quality Losses—or Losses inherent in production of Quality.

Control Data:

Initial Temperature of Wash	—	79°F.
Maximum Temperature	—	98°F.
Ave. Total Sugars as R. S. per Gallon Live Wash	—	1.346
Ave. Total Sugars as R. S. per uncoverted in Dead Wash	—	.103
Indicated % of Total Sugars unconverted	—	92.35
Ave. % Proof spirit in dead Wash—end of Fermentation	—	10.43
Ave. % Proof spirit in dead Wash—before Distillation	—	9.02
Increase in Acid contents of wash calculated as Acetic Acid during Fermentation	—	.88%
Increase in Acid content of wash—from end of Fermentation to before Distillation	—	.26%
% Proof Spirit in Spent Wash	—	Nil.
% Proof Spirit in Spent Lee Water—H. Wine Retort	—	.60

Calculated Yields and Losses based on 100 lbs. Total Sugar as R. S. Processed.

a.	Theoretical Yield of Alcohol	—	51.10 lb.
b.	Calculated Yield based on Sugars converted	—	47.19 "
c.	Actual Alcohol in wash at end of Fermentation	—	35.11 "
d.	Actual Alcohol Content of Wash before Distillation	—	30.34 "
e.	Actual Alcohol charged to Stills—97% of total quantity — 3% allowance for bottoms and frothing	—	29.43 "
f.	Actual Alcohol recovered in Distillation	—	28.34 "
g.	Total Losses in conversion of Sugars to Rum	—	22.76 "
h.	Indicated overall Recovery of Alcohol % of Theoretical	—	55.466
i.	Indicated Total Losses of Alcohol % of Theoretical Yield	—	44.534

Analysis of Losses:

A — Preventable Losses.

1. 7.65% or 3.91 lbs. of Alcohol in unfermented Sugars.
2. 6.44% or 3.29 lbs. Alcohol lost by evaporation and entrainment.
3. 1.78% or .91 lbs. Alcohol lost in Fermenter Bottoms and frothing.
4. .041% or .021 lbs. Alcohol lost in Lee from High Wine Retort.
5. .293% or .150 lbs. Alcohol allowed for Miscellaneous losses as vapour leaks and leaks of Distillates.

Tot: 16.204%—8.281 lbs. Alcohol

B — Quality Losses.

1. 17.20% or 8.79 lbs. Alcohol converted into acids between (b and c).
2. 9.33% or 4.77 lbs. Alcohol converted into Acids, Esters and other secondary products between end of Fermentation and before Distillation.
3. 1.80% or .919 lbs. Alcohol assumed used for esterification during Distillation.

Note:
No allowance made for Loss in Alcohol from Sugars used in Yeast reproduction.

28.33% — 14.479 lbs. Alcohol.

The most significant fact which may be gleaned out of the above analysis is that the Losses under "A" form only 36.38% of Total Losses. It appears therefore that in the production of Rum having definite characteristics, even if no losses occur under "A" the maximum attainable recovery would be only

71.67% of the Theoretical. Of course under Type classification of Jamaica Rum, qualities required for each type differs and it can be presumed that the lighter the type the less should be the quality losses specially under B-2.

Basing a study of the Losses listed above, the method of approach to the problem of more efficient Molasses use should then be on the following lines:

(1) Elimination or reduction to a minimum of Losses in "A" Group.

(2) Use of an alternative method in quality production.

We shall not attempt to deal in great detail on the factors influencing the occurrence and magnitude of the losses given under "A"; they will doubtless vary in different Distilleries but broadly speaking the losses may be traceable to—

(a) Losses under A—1 to—

1. Either weakened Yeast strain due to Bacterial contamination.

— or —

2. High percentage of unfermentable R. Sugars in the molasses (no way of preventing this loss).

(b) Losses under A—3 — to

1. Excessive Fermentation temperatures, and may possibly be minimised by installation of cooling coils. The cost of equipments and availability of water are factors to be considered.

2. The use of many small open fermenting units naturally increases the loss by evaporation and entrainment with the gases evolved, by increasing surface area exposed. The use of so many small fermenters is rather typical of a Jamaican Distillery.

(c) Losses under A—3

Due to bottoms and frothing ditched cannot be completely prevented. The bottoms contain the sediments and dead yeast bodies which if fed to stills result in scaling of heating surfaces and adversely affects flavour of Distillates.

The use of centrifugal separators however, is not a distant possibility and aside from savings in Alcohol it will also make available for stock feed the highly nitrogenous yeast bodies now being discharged into waste.

With regard to the quality Losses we have to admit that the present methods of quality production are crude, slow and wasteful—and no doubt can be greatly improved by carrying the symbiotic process along more scientific lines. This necessarily involves a big capital outlay. Will those who control the purse strings of the Industry feel justified, even under the **boom** on Rum, in undertaking big capital expenditures at present in the face of skyrocketing prices of Labour and Material?

Going back into the history of the Rum Industry in Jamaica we will find that the uncertainty of the Rum Market in the past has been the biggest drawback and the biggest deterring factor for any large scale modernization and consequent improvement of efficiences of Jamaican Distilleries.

It may be inferred from the foregoing that as we see it at present, so long as the qualities demanded by the Market for Jamaica Rum are to be maintained no very great improvement can be expected in the present standards of recovery as attained by the bigger and more up-to-date Distilleries without involving big capital outlays. This does not preclude however, continued explorations of inexpensive means of savings in Alcohol Yields in the directions not in any way affecting the standard of quality of the final product.

Before concluding we would like to call the attention of this Association to another source of Alcohol Loss which, though occurring outside the Distillery, is yet closely bound in the Economics of Distillery Operation. We refer to the destruction or elimination of Reducing Sugars orginally entering in the Cane Juice processed by the Factory during the process of Sugar Extraction. Theoretically and under ideal conditions of processing all such sugar should find its way in the Final Molasses allowing for what goes out in the Commercial Sugar bagged and in the Filter Cake. Looking at the problem from the point of view that each lb. of R. Sugar represents a theoretical equivalent of .511 lbs. of Alcohol any large scale elimination or destruction in the different Factories representing the Sugar Industry represents a sizable loss not only to the individual Factory concerned but to the Industry as a whole. We believe there is a good deal that can be done in this direction and the inclusion in Factory control work of necessary analysis which will give the required data for a Reducing Sugar Balance should be the first step. Such a balance when used with the Sucrose Balance should prove to be a useful guide for tracing points where destruction of R. Sugars or Inversion of Sucrose takes place.

Mr. Floro informed the Chairman that he would like to hear the views of members as to whether they considered alcohol was being lost before distillation.

Mr. J. G. Davies was of the opinion that such losses ocurred to a greater extent than was generally realised. The ordinary method of control was partially responsible and he felt that the suggested idea of establishing a reducing sugar balance a good one, but its success would be dependent on the same basic requirements as for a sucrose balance in the factory — correct means of weighing juice, final molasses etc.

In reply to a question in regard to the destruction of reducing sugars throughout the factory process, **Mr. J. G. Davies** informed the meeting that work had been undertaken at the College in Trinidad on Reducing Sugars and the results were available in the circulars issued to members by the College. There was a surprising amount of reducing sugar destroyed together with a drop in the pH from clarified juice to syrup.

Mr. Cuthill stated that as distillery matters were being discussed Mr. Dalley who had had experience with the Arroyo process in Panama should be asked to inform the meeting of his experience with this method.

Mr. Ryle-Davies stated the Sugar Manufacturers Association had expressed the wish that Mr. Dalley be asked to discuss the Arroyo process at this meeting and he asked Mr. Dalley to address the meeting on this subject.

Mr. Dalley explained that the factory in Panama, of which he was chief engineer, had not been giving satisfactory returns. Dr. Arroyo of Puerto Rico, a bacteriologist and an expert on fermentation, had been approached to suggest improvements in the alcohol distillation process. He visited Panama and after study of the factory process stated that by the use of his patented process he could guarantee a 10% increase in output. The cost incurred by the use of part patent was $3,000 and of the full patent $12,000. It had been decided worthwhile to obtain the rights of the part patent. With the old process using a 15 brix wash 70-80 hours were required for fermentation, 15 hours being required for distillation for a maximum distillation of 1,100 litres of alcohol. With the use of Dr. Arroyo's part patent process with the same 15 brix wash time of fermentation was reduced to 24 hours. The amount distilled rose to between 1,300 litres and 1,500 litres of alcohol in the same 15 hours. There was thus a decreased consumption of steam and an increase in production. There was a total increase of 15% production on the season's operations, which more than paid for the part patent in one season. He had asked Dr. Arroyo if he had any objection to his mentioning the process when he was in Jamaica and he had been perfectly willing for him to do so. He had pointed out to Dr. Arroyo that Jamaican factories made special flavoured rum. Dr. Arroyo had said he had some 26 types of yeast which could produce any flavour rum that was desired. Dr. Arroyo used a system of pure yeast cultures and accurate temperature control by means of a well controlled cooling system.

Cleanliness was an essential part of the process. The process included the sterilisation of the molasses, pure yeast culture being added to the prepared wash. Fermentation was effected at controlled temperatures throughout the 24 hour period required for complete fermentation. Mr. Dalley had informed Dr. Arroyo that the factories in Jamaica used dunder rather than Ammonium Sulphate and Sulphuric Acid but the latter stated that his process could be modified to include the use of the dunder and that he could guarantee from 10% to 20% increased output depending on the efficiency of any particular factory's operations. Mr. Dalley offered to communicate with Dr. Arroyo if any of the members of the Sugar Manufacturers Association were interested. He considered it a very good investment and considered that in some of the larger estates in Jamaica it would pay them to purchase the full patent.

In reply to a question by Mr. Floro, **Mr. Dalley** stated that the temperature of fermentation was not allowed to exceed 34°C. Fermentation was done in closed vats. His factory had four 8000-litre vats which were more than adequate with the Arroyo process. His factory manufactured 95% alcohol only.

There was discussion as to whether, in a factory producing three or four different flavoured rums, there would not be inter-contamination of yeasts but **Mr. Dalley** felt that if the process were carefully controlled such contamination would not occur.

In reply to a question by Mr. Cuthill, **Mr. Dalley** explained that the yeast was supplied from Puerto Rico in test tubes. Dr. Arroyo sent his own chemist to the factory to prepare the yeast for inoculation of the vats. The yeast built up through five stages until sufficient was available to impregnate an 8,000 litre tank. The process had improved the quality of the alcohol and greatly reduced the flavour and odour of the alcohol. The only alterations required in the factory were to the cooling system and in the five-stage yeast system.

Mr. Smedmore asked if Mr. Dalley had mentioned to Dr. Arroyo that bacteria play an important part in the manufacture of Jamaica rum.

Mr. Dalley replied that Dr. Arroyo guaranteed to produce individual flavours in rum—even that of Jamaica "German-flavour" rum. Dr. Arroyo also felt that the pot stills in Jamaica would be no hindrance to his process. Mr. Dalley on request amplified his remarks on keeping the factories clean stating that the distllery, including piping and drains, had to be washed out thoroughly daily. All tanks were painted and no "foaming-over" or gutters were allowed. Another thing Dr. Arroyo had emphasised was that there should be no sediment left in the vats or stills—such sediment giving a bad flavour to the rum. The last 3" in the bottom of the vats or stills after each fermentation were run to waste. This apparent waste however had been fully justified in the type of alcohol obtained.

On a question from Mr. Graham, **Mr. Dalley** explained that Dr. Arroyo had increased the brix of their wash from 15 to 22. By the new system using 15 brix wash the production of alcohol was increased from 1,100 to 1,500 litres in the same time of distillation. By using a 22° brix wash, production of alcohol increased to 1,700 litres per vat. Increase of brix to 22° was expected to yield a corresponding increased production per vat. If many factories in Jamaica decided to adopt the process, he considered that Dr. Arroyo would probably open an office in Kingston for the production of yeast to supply those who had purchased the patent.

THE ROUTINE TESTING OF SAMPLES OF SUGAR FOR EXPORT.

J. G. DAVIES, Sugar Technologist, Sugar Research Office,
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Mr. Springer took the chair and mentioned that the paper on the above subject had already been circulated and ought to prove very interesting.

1. The suggested methods set out below are the result of an attempt to simplify the Custom Regulations of 1931 and of 1937 of the Treasury Department, Bureau of Customs, Washington, and of the points discussed by Browne