



MINISTRY OF ECONOMIC AFFAIRS.

Bangkok, Siam.

DEPARTMENT OF SCIENCE.

8TH. REPORT.

FROM APRIL 1st. 1934 TO MARCH 31st. 1936

B.E. 2477 AND 2478.

Bangkok, January 1938.

Price 50 satangs



Ministry of Economic Affairs.

May 19th B.E. 2481

To His Excellency Phya Bahol Balabayuha Sena,
President of the Council.

Sir,

I have the honour to lay before Your Excellency the Eighth Report of the Director-General of the Department of Science on the work of this Department for the years B.E. 2477 and 2478.

I have the honour to be, Sir,

Your obedient servant,

BORIBHANDH YUDHAKITCH

Minister of Economic Affairs.



Department of Science,
Ministry of Economic Affairs.

April 8th B.E. 2481.

To

His Excellency Phra Boribhand Yudhakitch,
Minister of Economic Affairs,

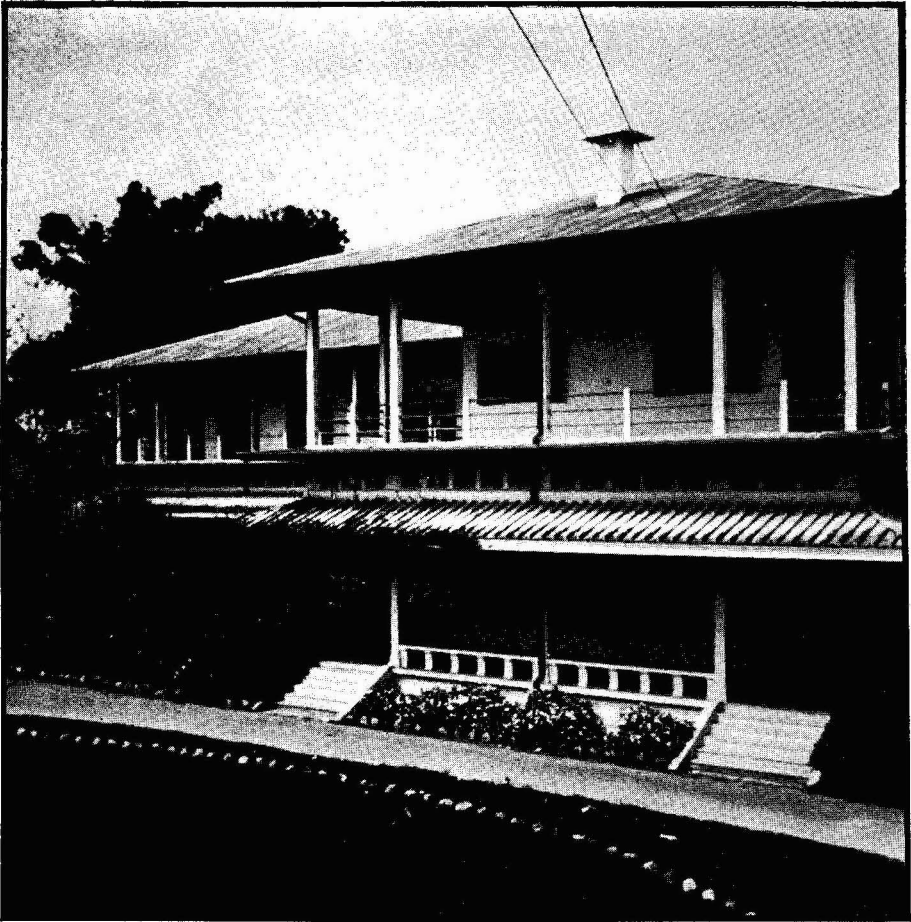
Your Excellency,

I have the honour to lay before Your Excellency the Eighth Report of my Department covering the work carried on in the years B.E. 2477 and 2478.

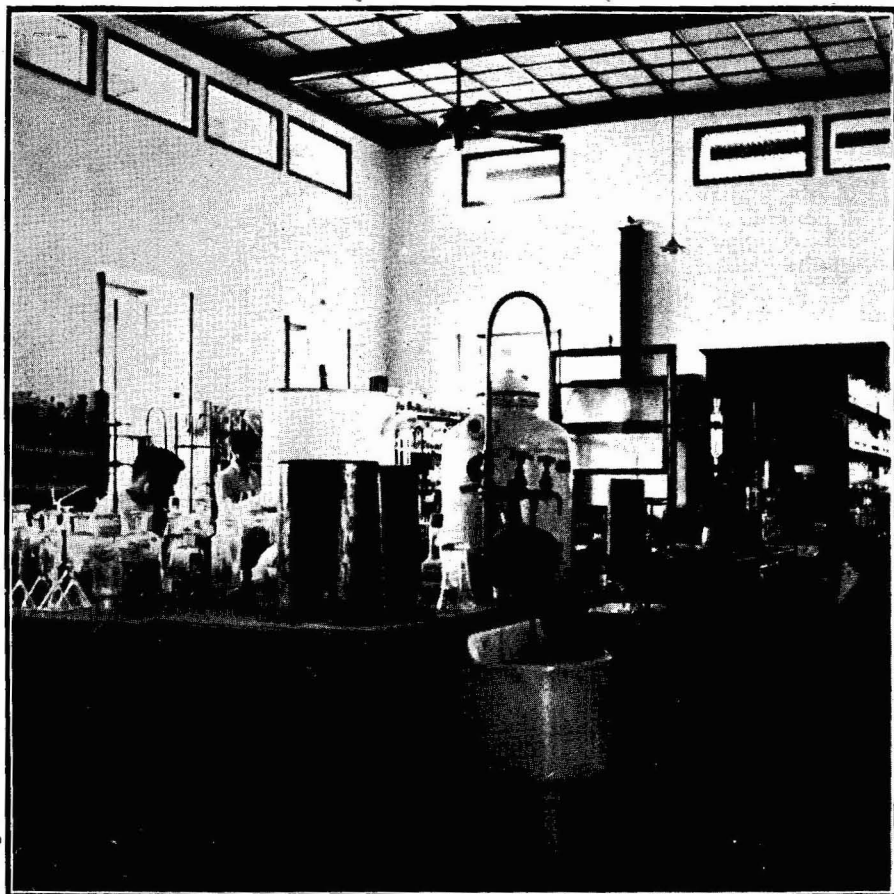
I have the honour to be, Sir,
Your obedient servant,

TOA LABANUKROM

Director-General.



Department of Science.
(main building)



Division of Chemistry.
(main analytical laboratory)

8th. REPORT
OF
THE DEPARTMENT OF SCIENCE
(MINISTRY OF ECONOMIC AFFAIRS)

From April 1st. 1934 to March 31st. 1936

B.E. 2477 and 2478

Senior Professional Staff.

Director-General. Nai Toa Labanukrom, Ph. D. (Berne)

Chemists. { C. J. House, B.Sc. (London), A.R.C.S., F.I.C.
Phra Krasapna Bibhag.
Luang Vichien Dhatukarn, L. ès Sc., I. C.
(Poitiers)

Departmental organisation and staff.

DIVISION OF CHEMISTRY.

Head of Division. Luang Vichien Dhatukarn, L. ès Sc.,
I. C. (Poitiers)

Section of Inorganic Chemistry.

Asst. Chemist. Nai Samroeng Vimuktanandana, B. S.
(Chem.) (Silliman)

Lieut. Van Lohpinit, Dip. Phar.
(Chulalongkorn University)

Assistants. Nai Tong Kham Milintalek, Dip. Phar.
(Chulalongkorn University)

Section of Organic Chemistry.

Asst. Chemist. Nai Chalaem Bhumiratana, Sc. B.
Chem. (Sto. Tomas)

Section of Water Analysis.

Asst. Chemist. Khun San Kosiyabastr.

Section of Metallurgy.

Asst. Chemist. Nai Banbota Suddhikam, B.S. (Chem.)
(Silliman)

Section of Opium dross control.

Asst. Chemist. Nai Udom Kraisorakul.
Nai Ua Rasmidatta, Dip. Phar (Chula-
longkorn University)

Assistants.

Nai Vongse Naewbanij, A. A. (Sto.
Tomas)

Section of General Analysis.

Asst. Chemist. (vacant)

DIVISION OF TECHNOLOGY

In charge Nai Toa Labanukrom, Ph. D. (Berne)

Section of Medicinal Products.

Asst. Chemist. Nai Kliau Bunnag, B. S. Phar. (U.P.)

Asst. Chemist. Nai Taw Thaeyoo.

Section for research into forest products.

Asst. Chemist. Nai Pue Rochanapurananda, B. S.
(Chem.) (U.P.)

Asst. Chemist. Nai Robert Saisanit.

Section for General research.

Asst. Chemist. (vacant)

DIVISION OF AGRICULTURAL SCIENCE

Head of Division Nai Sangar Sharasuvana, C. D. A.
(*acting*) Hons. (Seale-Hayne)

Section of Agricultural Chemistry.

Asst. Chemist. Nai Sangar Sharasuvana.

Asst. Chemist. Nai Thongchai Punyasingha, B. S.
Agr. (U. P.)

Section of Soil Analysis.

Chemist. Magdaleno M. Cero, B. S. Agr. (U.P.)

Asst. Chemist. Nai Sroung Charuprakara.

Section of Fertilizers and Insecticides.

Asst. Chemist. Nai Aree Supol, B. Sc. (Calcutta)

Assistant. Nai Bunsuep Alobho, Dip. Sc. (Chulalongkorn University)

OFFICE OF THE SECRETARY OF THE
DEPARTMENT.

Head of Division Phra Krasapna Bibhag.

Correspondence and Library Section.

Head of Section. Khun Chamras Rasayana.

Assistant. Nai Phong Manidisth.

Stores Section.

Head of Section. Khun Piya Bannasarn (until Jan. 1st.
1936)

Head of Section. Nai Siri Chuvidya, B. S. C. (F. E. U.).

The Director-General visited Europe during 1935 and was absent from June 13th. to October 13th. 1935.

Mr. C. J. House was absent on leave in Europe from June 14th. 1934, until January 19th. 1935.

Mr. Magdaleno M. Cero joined the staff as Chemist, Soil analysis section, on October 1st. 1935.

Introductory.

During the two years covered by this report there has been a very notable increase in all branches of work and the staff has been augmented to cope with this by recruitment of a number of suitably qualified Siamese, trained either in the Philippine Islands or at Chulalongkorn University, as Assistant Chemists.

The laboratory and office accommodation also proved insufficient to meet this expansion of work and plans were made in 1935 to increase the size of the building by adding an upper storey to the original Government Laboratory block.

The total number of samples of all kinds examined was 35,628 as compared with 13,872 during the previous period.

The increase is largely due to a further increase in opium gross control (31,889 samples compared with 10,327 formerly).

326 samples of bronze from the Mint were also examinations of a routine nature and the deduction of these from the total given shows the number of general samples to be 3,413 as compared with 2,169 for B.E. 2475 and 2476.

The fees received amounted to Baht 24,264.27 summarised as follows:—

Analytical work for the public,	Baht	4,614.90
Sales of preparations,	„	19,649.37

This compares with a total of Baht 14,142 for the last period, of which Baht 2,999 represented analytical fees.

Acknowledgement.

The Department gratefully acknowledges help received from Professor J.F. Thorpe of the Imperial College

of Science and Technology London, in investigating the odorous principle of Mai Chanchamot and expresses appreciation of the continued interest of Dr. H.R. Ing of University College, London in researches upon the alkaloids of mitragyne speciosa.

Pharmaceutical Development.

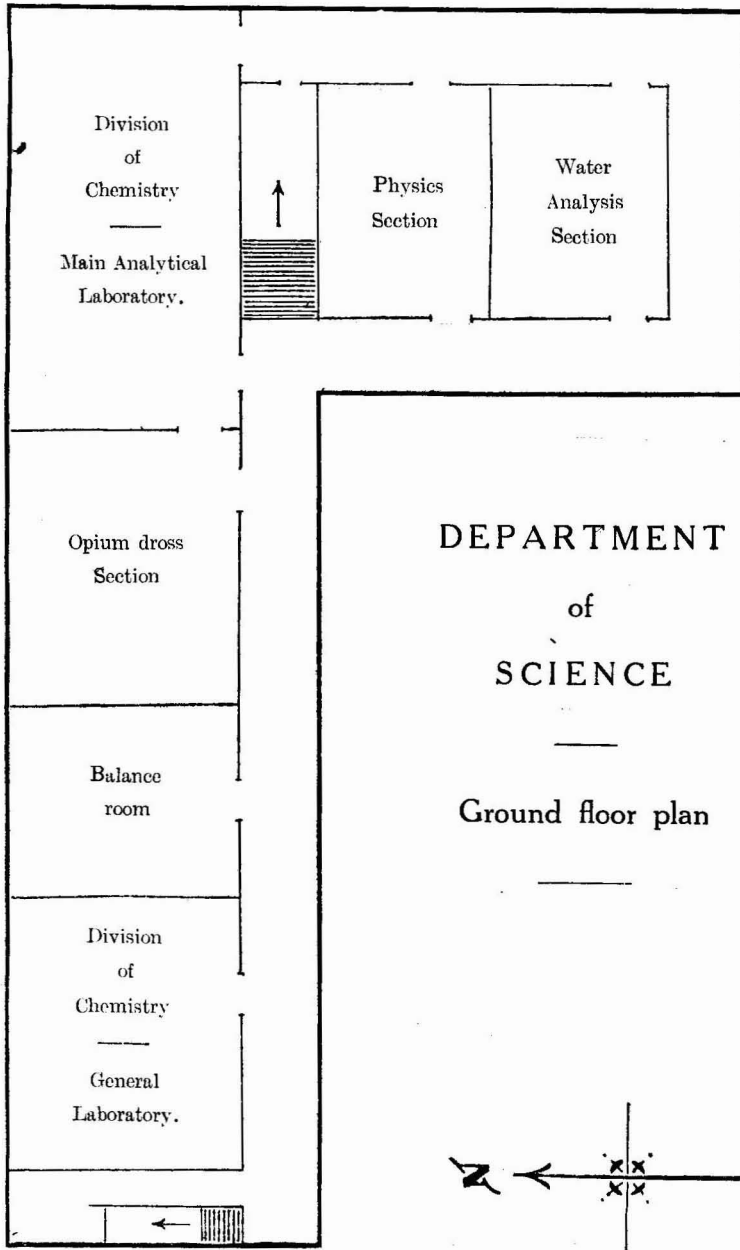
In January 1935 the Minister of Economic Affairs convened a committee to consider a scheme for Pharmaceutical development submitted to the Government by Lieut. Van Lohpinit, Tambol representative of Tambol Ban Loh, Changvad Dhonburi.

The committee consisted of medical men, pharmacists and chemists and included the following officials from the Department of Science: Nai Toa Labanukrom (Chairman), Phra Krasapna Bibhag, Luang Vichien Dhatukarn, Nai Kliau Bunnag, Khun Chamras Rasayana (secretary) and Mr. C.J. House.

Lieut. Van put forward a comprehensive scheme for the formation of a pharmaceutical manufactory on a large scale to be conducted by the Government under the control of the Department of Science in order to supply drugs to the Government Medical Depot and to the Defence services.

The committee held two meetings, the second of which was presided over by H. S. H. Prince Vimvatit Voravarn, Under-Secretary, Ministry of Economic Affairs as Nai Toa Labanukrom had already left for Europe.

It was found that scheme submitted by Lieut. Van Lohpinit went very considerably beyond any reasonable requirement of the Government at that time as the quantities



Division
of
Chemistry
—
Main Analytical
Laboratory.



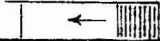
Physics
Section

Water
Analysis
Section

Opium dross
Section

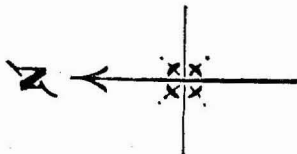
Balance
room

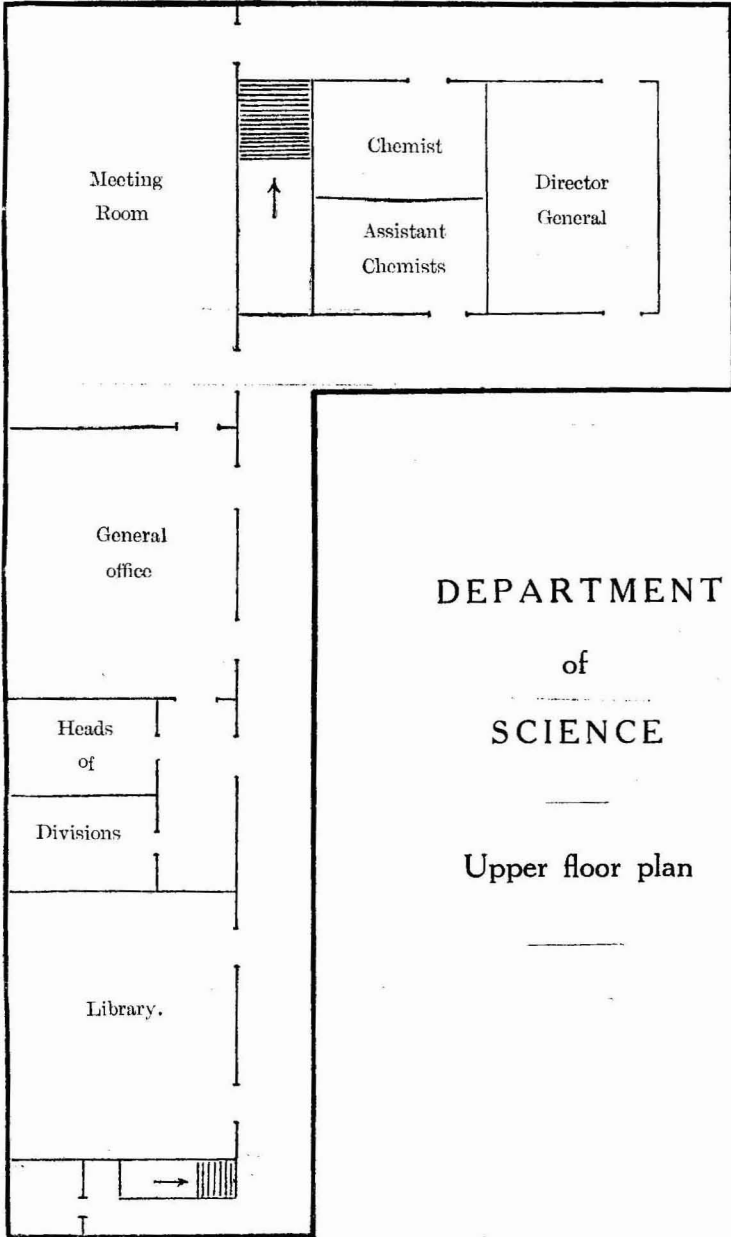
Division
of
Chemistry
—
General
Laboratory.



DEPARTMENT
of
SCIENCE

Ground floor plan





of galenical drugs used officially is not large and the Government Medical Depot is already making such preparations as tinctures and ointments. The scheme was modified to make provision for research into indigenous drugs as well as the manufacture of certain specific drugs otherwise difficult to obtain and the Budget law for B. E. 2479 contained an appropriation of Baht 15,000 for the erection of a building. A site was selected a little to the east of the existing buildings and the plans were being prepared at the end of B. E. 2478.

Additions to building.

The increase of work during recent years had proved the accommodation both of laboratories and offices to be inadequate and early in 1935 it was decided to add an upper storey to the existing Government Laboratory building erected in 1918. The commencement of the work was delayed until November 1935 and the alterations occupied seven months, being divided into three sections each of which had to be completed separately before the next section was proceeded with, so that the work of the Department might be interfered with as little as possible. Eleven steel girders were introduced to support the new upper floor and the former heavy roof of tiles was replaced by a roof of much lighter construction consisting of sheets of asbestos composition. The accommodation on the upper floor duplicates that of the lower floor and has been allocated in the manner shown in the plans. The new floor was formally opened on August 15th. 1936 when a chapter of seven priests chanted sacred stanzas and were presented with food on the following day.

Petroleum survey.

Nai Kliau Bunnag accompanied the official expedition of the Swiss geologists Drs. Heim and Hirschi as chemical officer.

The expedition carried out a survey of the potential resources of the country in petroleum under the auspices of the Ministry of Defence from January to March 1935.

Notes and Reports on Materials of Interest.

(I) Drugs for the treatment of Leprosy.

There has been an increasing demand for mixed ethyl esters of the oil of *Hydnocarpus anthelmintica* and 444 litres were issued as compared with 240 litres in the previous two years.

This is mostly exported abroad in the form of the Iodised esters. This work was transferred to the Technical Laboratory in B. E. 2478 when the rooms temporarily used as offices were vacated on completion of the additions to the main building.

The oil was obtained from the Siam Medicinal oil works as usual.

Analytical constants for the esters are as follows:—

Acid value as oleic acid	0.23
Specific gravity 30°/4°C.	0.895
Refractive index 30°C.	1.454
Saponification value	197.0
Iodine value	81.7

(2) Kratom (*Mitragyne speciosa*)

This subject has continued to interest people in Siam as the opinion is sometimes expressed that the habit of chewing these leaves is harmful and ought to be suppressed by legislation. The physiological action was fully discussed in the 6th. report and there is nothing further to report on this aspect.

The Department has continued to keep in touch with Dr. H. R. Ing of University College, London who is working on the problem of isolating alkaloids other than mitragynine which are believed to exist in these leaves. Dr. Ing has been working on alcoholic extract prepared in the technical laboratory of the Department and has found that the method of purifying the Mitragynine alkaloid by crystallisation of the pierate from hot acetic acid leads to a continuous degradation of this alkaloid to amorphous products resulting in small yields; no other alkaloid has yet been isolated in a crystalline form. There is also doubt as to whether ethyl alcohol, used to extract the leaves, is entirely without action on these alkaloids and therefore arrangement are being made to send to him a quantity of the dried leaves without preliminary extraction here.

(3) Mai Chanchamot.

This is the perfumed wood derived from decayed trees of *Mansonia gagei*. A crystalline odorous principle was isolated as described in the 7th. report and was in the hands of Professor J. F. Thorpe of the Imperial College of Science and Technology who has now sent a preliminary report upon

it. The work was carried out by Dr. R.P. Linstead who states that the crystalline substance submitted was found to be a pure substance of melting point 139°C , practically colourless and having a strong sandal-wood odour.

The most probable formula appears to be $\text{C}_{15}\text{H}_{18}\text{O}_3$ and one of the oxygen atoms is located as a methoxy (or methyl ester) group. The other oxygen atoms are in some comparatively unreactive group and a stable lactone ring is suggested, while a methoxy-coumarin structure is a distinct possibility which would agree with the powerful odour. Further work on the oxidation products is being carried out which should give the key to the structure.

(4) **Gelidium.**

A sample of sea-weed of gelidium species from Songkla was investigated to ascertain if a more merchantable product could be prepared. The present material is used as a foodstuff accessory to prepare jellies and "sen mi" เส้นหมี่ which is a Chinese delicacy. It is prepared by a process of washing and bleaching in the sun along the sea coasts of the Gulf of Siam but the local product is often of dark colour and has an unpleasant smell which detracts from its commercial value. Experimentally the jelly was treated with sulphur dioxide and also with animal charcoal followed by filtration. The later process was found to yield the best product which closely resembled jelly prepared from commercial agar agar. This could be dried down into thin blocks for storage although the drying process causes deterioration in colour.

Japanese agar is concentrated by freezing the jelly during the winter season, a method which cannot be applied in Siam.

(5) Act to control the quality of pepper for export.

In response to a request from the Assembly representatives for Changvads Chandaburi and Trad, a committee was formed early in 1935 to find means of protecting the quality of Siamese pepper in the world's export markets. Nai Pue Rochanapuranda represented this Department on the committee and by their recommendation a law was passed in April 1936 making it an offence to attempt to export adulterated pepper or pepper having an excessive moisture content.

A Ministerial decree later fixed the statutory limit of moisture at 15% and also laid down directions for its determination. In the Customs laboratory the Schopper moisture tester is to be used at a temperature of 110°C. but in samples which exceed or closely approach the statutory limit the testing office is directed to send a sample to the Department of Science for more accurate determination. In such cases a correction for volatile matter other than moisture lost at 110°C. would be applied.

The Act was not in force during the period of this report and therefore the only samples received were of an experimental nature.

(6) Sand for glass-making.

16 samples were submitted through the Ministry of Economic Affairs from Songkla. The results for better qualities are as follow:—

Lab. No.	Origin	Coarse	Medium	Fine	Iron as Fe ₂ O ₃ %
M. 972	Ta Mung ทุ่งหวัง	3.0	31.0	66.0	0.13
974	" "	13.0	37.6	49.4	0.22
976	Pang Nga บางพังงา	48.8	37.3	13.9	0.27
977	Sakorn บางสะกอ	5.2	45.0	49.8	0.30
978	Tapa บางทพา	92.5	5.5	2.0	0.37
982	—	89.2	6.0	4.8	0.26
983	Bo plap บ่อปลับ	2.0	45.5	52.5	0.26
984	Tung Wang ทุ่งหวัง	44.1	36.4	19.5	0.00
985	" "	1.3	8.2	90.5	0.08
986	Cha Ting Phra จันทิงพระ	46.9	18.5	34.6	0.14

N. B. Coarse sand will not pass 0.5 m.m. sieve.
Medium sand will not pass 50 mesh sieve.

It was considered that only sand as samples M. 984 and M. 985 would be of any value for making white glass. A show-case illustrating the use of sand in the manufacture of glass was exhibited at the Constitution Day fair in 1935 and 1936.

There is a demand for fine white sand for export to Japan but so far the sources mentioned above have not been exploited.

(7) Charcoal.

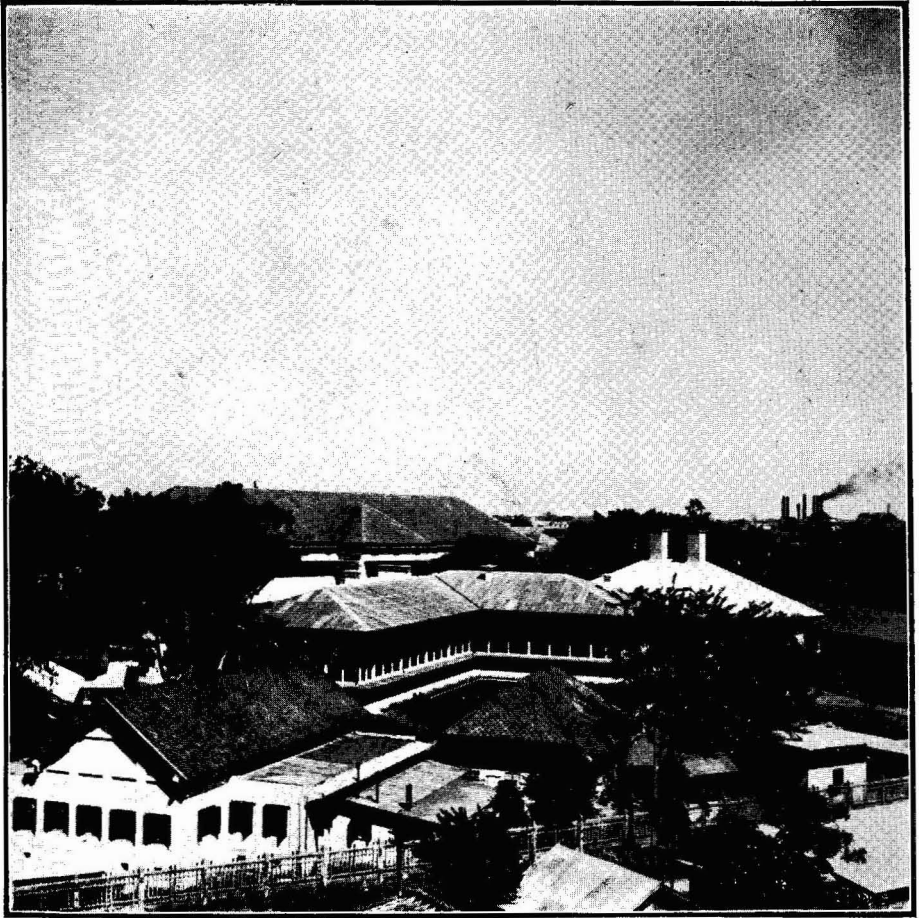
The Forest Department submitted 34 samples of Siamese charcoal for evaluation. 10 samples had been prepared in an iron retort (marked * in the list) and the remainder in the usual kiln made in the country.

The results are appended classified according to the approximate botanical source of the wood.

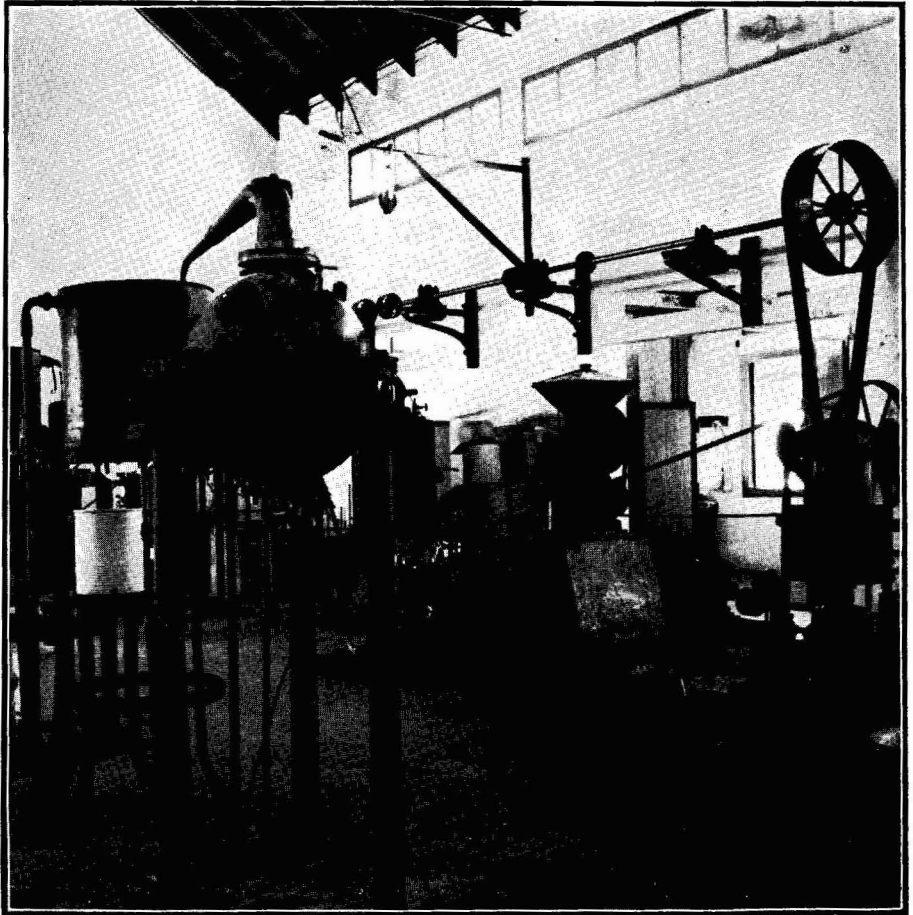
Evaluation of Siamese Charcoal.

Botanical name	Siamese name	Moisture	Ash	Gross calorific power	
				as determined	Calculated on the dry sample
<i>Acacia catechu</i>	Mai sisiet *	6.8	2.0	6567	7046
<i>Albizzia lebbokoides</i>	Mai kang	6.3	4.5	6478	6914
<i>Bambusa arundinacea</i>	Mai pai pa	6.6	6.0	6999	7493
<i>Bruguiera</i> sp.	Mai prasak	5.4	2.0	6426	6793
<i>Bruguiera cylindrica</i>	Mai rang kratae	5.7	2.1	6318	6700
<i>Butea frondosa</i>	Mai tong kwao	8.1	5.6	6607	7189
<i>Cassia siamea</i>	Mai ki lek *	6.0	4.3	6713	7141
<i>Combretum quadrangulare</i>	Mai sakae	6.8	5.9	6555	7033
<i>Cotylelobium lanceolatum</i>	Mai kiem	9.2	2.3	7088	7806
<i>Cratoxylon prunifolium</i>	Mai taew *	6.7	2.2	7557	8099
<i>Dipterocarpus tubinatus</i>	Mai yang	3.3	1.2	6055	6261
<i>Dipterocarpus tuberculatus</i>	Mai pluang *	5.9	1.6	6956	7392
<i>Erythrophloem</i> sp.	Mai sark	9.6	1.2	7059	7808
<i>Erythrophloem</i> sp.	„ „ *	6.3	0.3	7613	8125
<i>Garuga pinnata</i>	Mai takram	8.0	6.1	6488	7052
<i>Irvingia malayana</i>	Mai krabok	5.9	5.2	6715	7136
<i>Irvingia malayana</i>	Mai krabok *	6.5	7.0	6745	7213
<i>Lagerstroemia calyculata</i>	Mai tabaek *	6.1	6.2	7038	7495
<i>Leucaena glauca</i>	Mai kratin	7.9	3.4	6501	7059
<i>Odina wodier</i>	Mai oi chang	8.1	6.1	6686	7275

Botanical name	Siamese name	Moisture	Ash	Gross calorific power	
				As determined	Calculated on the dry sample
<i>Pentacme siamensis</i>	Mai rang	5.9	3.2	6525	6934
<i>Rhizophora candelaria</i>	Mai kong kang	5.4	2.0	6600	6977
<i>Rhizophora conjugata</i>	Mai kong kang	6.0	3.0	6354	6760
<i>Rhizophora mucronata</i>	bai lek				
<i>Rhizophora mucronata</i>	Mai kong kang	6.1	2.7	6530	6954
<i>Rhizophora mucronata</i>	bai yai				
<i>Schleichera trijuga</i>	Mai lan	5.5	2.1	6350	6719
<i>Shorea obtusa</i>	Mai takraw *	5.6	2.8	7330	7765
<i>Tamarindus indica</i>	Mai teng	7.3	3.1	6851	7390
<i>Terminalia tomentosa</i>	Mai makam *	5.4	4.1	7242	7655
<i>Thyrsostachys siamensis</i>	Mai rok fa *	5.1	15.5	6373	6715
<i>Vitex sp.</i>	Mai ruak	5.2	8.6	6512	6869
<i>Vitex limonifolia</i>	Mai sawong hin	6.5	2.3	7095	7588
<i>Vitex sp.</i>	Mai sawong teen nok	6.7	1.7	7303	7827
<i>Vitex sp.</i>	Mai kai nao hin	9.2	4.8	6692	7370
<i>Vitex sp.</i>	Mai kai nao nam	8.1	6.0	6462	7041



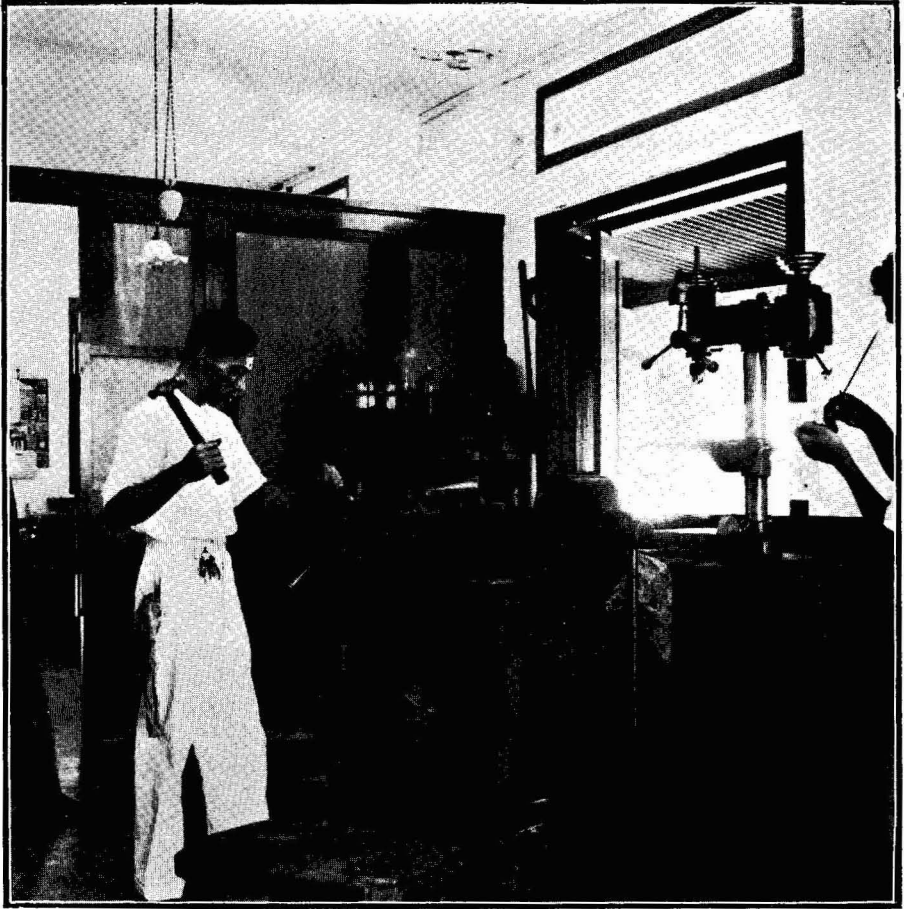
Department of Science.
(Division of Technology in fore-ground)



Division of Technology.



Division of Technology.
(manufacture of hydnocarpus ethyl esters)



Division of Technology.
(fitters' shop)

Division of Technology.

1,373 litres of Vitamin B. extract were prepared and issued compared with 467 litres during the previous period.

The reduction in demand commented upon in the last report proved to be only temporary and the output now recorded is the highest so far attained. The distribution is in part through the Government dispensaries and in part directly to the public and has been assisted by a reduction in price made possible by the lower price of locally manufactured alcohol.

As stated under the heading of Leprosy drugs the manufacture of ethyl esters is now carried out in this division and further extension was being planned at the end of B. E. 2478.



Bangkok Water Supply.

The tables which follow show that the purity of the city supply is well and continuously maintained.

The reduction in the iron content is very noticeable in recent years and is effected at the expense of a very small increase in the temporary hardness.

Bangkok

TAP

B. E.

Date	Total Solids	Dissolved Solids	Total hardness	Per- manent hardness	Tem- porary hardness
1934 April	17.0	17.0	10.0	nil	10.0
May	18.6	18.6	11.0	0.2	10.8
June	18.2	18.2	10.5	1.0	9.5
July	17.4	17.4	10.0	1.4	8.6
August	14.0	14.0	9.0	2.8	6.2
September	12.8	12.8	7.0	2.1	4.9
October	13.4	13.4	6.0	2.8	3.2
November	11.7	11.7	8.0	3.8	4.2
December	12.2	12.2	6.5	1.4	5.1
1935 January	15.7	15.7	9.5	1.2	8.3
February	15.5	15.5	11.0	1.8	9.2
March	16.9	16.9	12.5	2.6	9.9
Average for the year	15.3	15.3	9.25	1.75	7.5

Water Supply**WATER**

2477

Chlorides as Chlorine	Oxy- gen con- sumed	Saline ammonia	Albumi- noid ammonia	Nitrites as nitrogen	Nitrates as nitrogen	Loss on igni- tion	Iron
1.8	0.16	0.001	0.005	nil	0.020	1.5	nil
2.4	0.13	nil	0.003	nil	0.025	2.5	nil
2.2	0.17	nil	0.004	nil	0.035	1.5	nil
1.6	0.19	0.002	0.008	nil	0.030	3.3	nil
1.0	0.18	0.001	0.007	nil	0.018	1.2	0.01
0.8	0.15	nil	0.007	nil	0.023	2.3	0.01
1.0	0.25	0.002	0.008	nil	0.011	1.9	nil
0.9	0.25	nil	0.006	nil	0.008	1.7	nil
0.8	0.26	0.001	0.019	nil	0.007	1.3	0.01
1.3	0.24	0.001	0.006	nil	0.017	1.3	nil
1.3	0.19	0.001	0.006	nil	0.027	0.8	nil
1.7	0.15	0.001	0.005	nil	0.020	1.2	nil
1.4	0.19	0.0008	0.007	nil	0.020	1.7	0.0025

Bangkok Water

TAP

B.E.

Date	Total Solids	Dis-solved Solids	Total hardness	Perma-nent hardness	Tem-porary hardness
1935 April	17.9	17.9	12.5	2.8	9.7
May	19.4	19.4	13.5	4.0	9.5
June	18.8	18.8	13.0	4.5	8.5
July	16.0	16.0	12.0	6.4	5.6
August	13.6	13.6	10.0	5.7	4.3
September	11.5	11.5	8.0	2.4	5.6
October	13.1	13.1	7.0	5.8	1.2
November	8.3	8.3	6.5	4.9	1.6
December	9.5	9.5	6.0	1.7	4.3
1936 January	10.6	10.6	8.0	2.9	5.1
Febuary	14.6	14.6	10.0	1.7	8.3
March	16.5	16.5	10.0	2.1	7.9
Average for the year	14.15	14.15	9.7	3.74	5.96

Supply
WATER
2478

Chlorides as Chlorine	Oxygen con- sumed	Saline ammonia	Albumi- noid ammonia	Nitrites as nitrogen	Nitrates as nitrogen	Loss on ignition	Iron
2.3	0.14	nil	0.004	nil	0.020	1.2	nil
2.4	0.14	0.001	0.006	nil	0.015	2.2	nil
2.0	0.26	0.001	0.007	nil	0.029	1.5	nil
1.1	0.19	0.001	0.007	nil	0.019	1.0	nil
0.8	0.22	0.001	0.006	nil	0.018	0.9	nil
0.6	0.15	0.002	0.015	nil	0.015	0.9	nil
0.8	0.17	0.002	0.009	nil	0.008	1.0	nil
0.6	0.26	0.001	0.007	nil	0.008	0.6	0.01
0.5	0.25	0.002	0.011	nil	0.013	0.8	nil
0.5	0.30	0.002	0.010	nil	0.015	0.6	nil
1.3	0.18	0.002	0.014	nil	0.016	0.9	nil
1.4	0.18	0.001	0.008	nil	0.015	1.3	nil
1.2	0.20	0.0013	0.0086	nil	0.016	1.07	0.0008

Notes on Special Branches of Work.

(I) Toxicology.

54 cases of suspected poisoning were submitted during the two years under review as compared with 90 during the previous period. The actual number of exhibits examined was 79. This work has again fallen to the level at which it had remained for a number of years.

Poisons were found in 30 cases (55.5%) and the proportion of positive findings has exceeded 50% for the first time since this Laboratory was instituted.

Human viscera were submitted in 6 cases.

The poisons found were as follows:—

Datura	8 cases.
Arsenic	6 „
Strychnine	4 „
Sodium cyanide	3 „
Hydrochloric acid	2 „
Sulphuric acid	1 „
Mercury	1 „
Phenol	1 „
Zinc	1 „
Chloroform	1 „
Pak wan	1 „
Illicium religiosum	1 „
Senna leaves	1 „
Total	<u>31</u> cases. (in 30 causes)

Notes on poisoning cases.

There were fewer cases of Arsenic poisoning than in former years but the number of Datura cases remains as usual.

The eight cases of Datura poisoning were all concerned with robbery and all the victims recovered. Two of the exhibits containing strychnine were found upon suspected burglars by whom it is generally used to get rid of watchful dogs. One of these suspected persons was found to be well-provided with a Datura preparation for human beings and a strychnine preparation with bread and fat for any dogs that might hinder his purpose.

Sulphuric acid.

Sulphuric acid of 60% strength was used by a mother to destroy an unwanted child only 17 days old. The stomach was not damaged and only contained the equivalent of 8.6 mgms. of pure acid. Medical evidence indicated that the oesophagus was blocked by the effect of the strong acid on the mucous membrane and death was probably due to suffocation caused by changes in the throat.

Pak wan. (*Meliantha suavis*)

One case was reported from Kanburi district in which eight people were killed by eating the leaf-shoots as food. The chemical nature of this poison still awaits investigation but it is intended to undertake research in the Pharmacology section in the new Pharmacy building when it is opened.

Owing to the very variable toxic properties of this plant, tests on animals must precede any chemical investigation.

Japanese star-anise. (*Illicium religiosum*)

In March 1935 the Bangkok police reported that a Chinese had died after eating some star-anise fruits which are known in Siam only by their Chinese (Tae chiew) name "Poey Kak" (lit. five ways, referring to the five pointed star of the fruit) An investigation in the market showed that two varieties of Star-anise were offered for sale in certain Chinese drug shops. The normal variety, *Illicium verum* was distinguished by its anise-like fragrance but the other variety had a balsamic odour and a peculiar salty taste.

In outward appearance these fruits resembled the true species very closely and it was suspected that they were fruits of the Japanese Star-anise, *illicium religiosum* Siebe et Zuccarini, which is known to be poisonous. As no specimens of these fruits were available in Siam a certified sample was obtained through the Sankyo Co. Ltd. of Tokyo by courtesy of Dr. Yasuhiko Asahina and the Botanical Garden of Tokyo Imperial University to all of whom grateful acknowledgement is made. The Japanese name is Skimmi and the poisonous properties are very variable.

A critical pharmacognostical study was then made from which it was concluded that the inferior market species was indeed Japanese star anise although somewhat bolder specimens than those received from Japan.* The main points noted were as follows:—

* The sample of fruits of *Illicium religiosum* from Tokyo was stated to have been collected unduly late in the season.

	I. verum	Suspected material	I. religiosum
Size	3.0-3.5 cm.	2.5-3.0 cm.	2.0-2.5 cm.
Odour	anise-like	feeble-balsamic	aromatic-balsamic
Taste	sweet-spicy	salty	salty and aromatic
Carpels	well developed not wrinkled	less bold, much wrinkled	poorly developed and wrinkled
Beak of carpel	horizontal	variable many upward pointing beaks	acute and pointing upwards
Ventral suture	usually closed or nearly	usually open	some open, some closed
Peduncle	curved	straight	straight
Seeds, length	10 mm.	9-10 mm.	9 mm.

Chemical work on the false species was confined to preparation of an extract soluble in alcohol and water, after clearing with lead acetate. On concentration in vacuo a crystalline material was obtained which gave negative reactions for alkaloids and glucosides. This possessed the same salty taste as the original fruits. This material has been set aside for pharmacological investigation when opportunity offers.

Zinc.

A specimen of salt from Ubol concerning which complaint had been made was found to contain 0.07% of Zinc.

This was derived from galvanised iron vessels used for the evaporation of brines from local sources.

(2) Examination of stains for human blood.

The police and public health authorities submitted 82 exhibits in 71 cases in which a positive finding was reported in 13 cases.

(3) Harmful habit-forming drug law.

The police and opium monopoly officers submitted 176 samples suspected to contain principles prohibited under this law but only 60 were found to contain anything contrary to law, while 3 contained Novocaine which is not prohibited.

The results are summarised as follows:—

Submitted by	Morphine	Opium	Cocaine	Negative	Total
Police Department	36	1	—	20	57
Min. of Interior	1	—	—	—	1
Excise & Opium Dept.	9	8	—	96	113
Dept. of Public Health	4	—	1	—	5
Totals	50	9	1	116	176

Compared with previous years this work is much reduced, particularly in respect to seizures of white powders by the police which were formerly of daily occurrence but became very rare during the year B.E. 2478. The samples sent by the opium authorities are mostly locally prepared medicines suspected to contain harmful habit-forming drugs. They do not include suspected illicit opium which is dealt with later in the report.

The Customs submitted 118 imports under this heading of which three contained morphine, two opium and one codeine.

By a law promulgated in May 1935 (B. E. 2478), the drug Ganja (Cannabis indica) was brought under control as with other harmful habit-forming drugs; formerly it had been freely offered for sale in all markets.

(4) Suspected illicit opium.

Of 54 samples of suspected illicit opium only 7 were found to contain opium. Evidently defendants seldom dispute the opinions of the opium authorities unless they have very good reason to believe that the seized material is innocent.

(5) Police Department.

Samples submitted under the headings of poisons, blood stains and harmful habit-forming drugs have already been dealt with under their respective sections.

Guns.

45 exhibits concerning firearms were submitted as compared with 55 in the previous period.

In 33 cases it was possible to state definitely that the gun had been fired but without giving any but the slightest indication of the probable date of firing. Two illustrations of curious guns received in the course of this work are shown opposite:—

Fig. 1. is a typical home-made gun of the country districts; it is loaded from the muzzle and the firing action consists of a piece of deer's horn which when the trigger is pulled, snaps down upon a percussion cap connected with the charge through a small hole in the breech.

Fig. 2. is a walking-stick gun adapted for firing large calibre revolver cartridges. It was well-made with silver fittings and when the breech was closed gave no indication of its possibilities as a weapon.

Counterfeit coins.

Early in 1935 the police raided an illicit mint engaged in manufacturing Indian rupees at Chiengmai. These coins are still current in northern markets owing to the proximity of the Shan states.

Coins of two reigns were represented in the seizure and were both of good silver although not sufficiently correct in composition to escape detection when assayed.

Rupee coins	Weight	Fineness of silver
Counterfeit date 1907	11.7 g.	956
„ „ 1916	14.7 g.	887
Statutory limits	11.61–11.71 g.	914.6–918.5

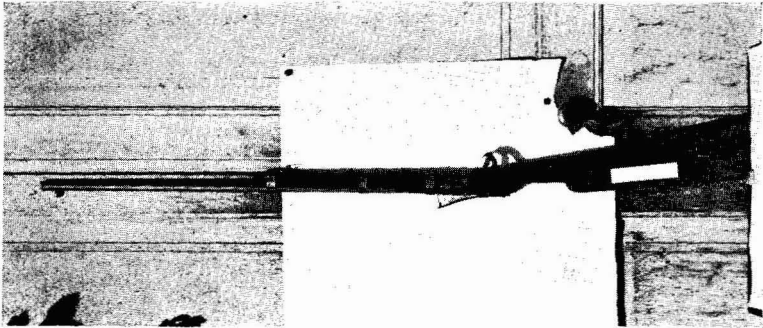
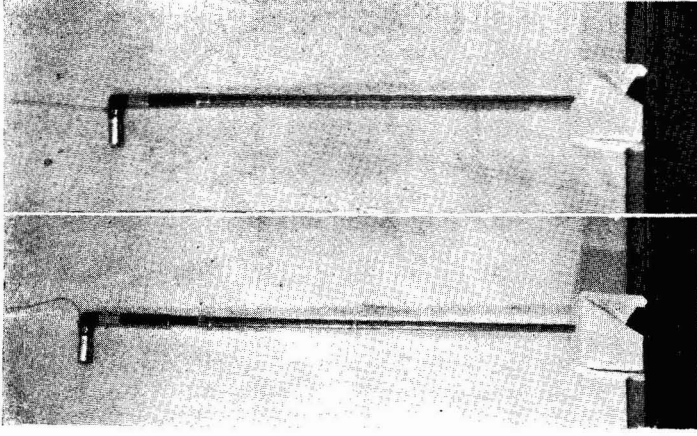


Fig. 1.



open

closed

Fig. 2.

The results indicate the importance of the assay office in a modern mint.

In the only case of counterfeiting the nickel subsidiary coinage, the false coins were made of iron and were nickel-plated thus producing very good imitations of the genuine coins.

Gold ornaments.

A complaint was received from a Southern province of an itinerant Chinese merchant who went about offering to clean gold jewellery. One customer detected that her gold chains had lost weight in the process and on examination they were found to be seriously corroded. Aqua regia appears to have been the agent used to dissolve the gold.

(6) The Skimmed Milk Act B. E. 2470.

222 samples of tinned or dried milk were submitted compared with 205 during the previous period. This work has now remained constant in amount for some years.

200 samples were submitted by the Customs Department, 11 by the Department of Public Health, 10 by the Public and 1 by the Police.

Of these ten samples, all representing different brands, were found to be deficient in milk-fat and were reported as being skimmed milk within the terms of the Act. Five of these defective samples were only sample tins submitted by merchants desiring information prior to importation and one sample was of local manufacture and of an experimental nature. Thus only four brands actually contravened the law.

As the standards for the various types of milk are only to be found in a Ministerial order published in the gazette of 1928 which is now out of print the minimum standards are given here for convenience of reference.

	Milk-fat	Total milk solids	Sum of fat + total milk solids
	%	%	
Milk, natural of sterilized . .	3.25	11.75	—
Evaporated milk, unsweetened .	7.80	25.50	33.70
Condensed milk, sweetened . .	8.00	28.00	—
Dried milk . .	26.00	—	(Moisture limit 5%)

(7) Opium dross control.

During this period the Department of Science undertook the whole work of opium dross inspection instead of restricting the samples examined to those selected by the opium officers. Thus the work increased three-fold and was carried out by sorting out adulterated samples by a rapid test and only these samples were assayed for morphine by the former method.

(8) Customs tariff classification.

The Customs Department now sends more samples than any other department, excluding opium dross from the Excise and Opium Department, the total for this period being 1,105 as compared with 446 during the previous period.

625 of these samples were submitted to ensure that imports were correctly classified according to description under the revised Customs tariff act. These samples are classified as follows:—

Customs Import.

Lubricating oil	323
Diesel and fuel oils	210
Edible oil	1
Piece goods	35
Artificial silk	9
Plated or gilt goods	9
Turpentine or turpentine substitute	7
Fertilizers	8
Drugs	4
Chemicals	5
Dye	2
Gas mantle	1
Brake fluid	1
Antimony	1
Gold leaf	1
Disinfectants	5
Peat moss	1
Molasses	1
Wax	1

625

The most numerous class of samples was that of lubricating oils which are examined for admixture with vegetable or animal oils and the next is that of diesel and fuels oils which had to be differentiated from kerosene.

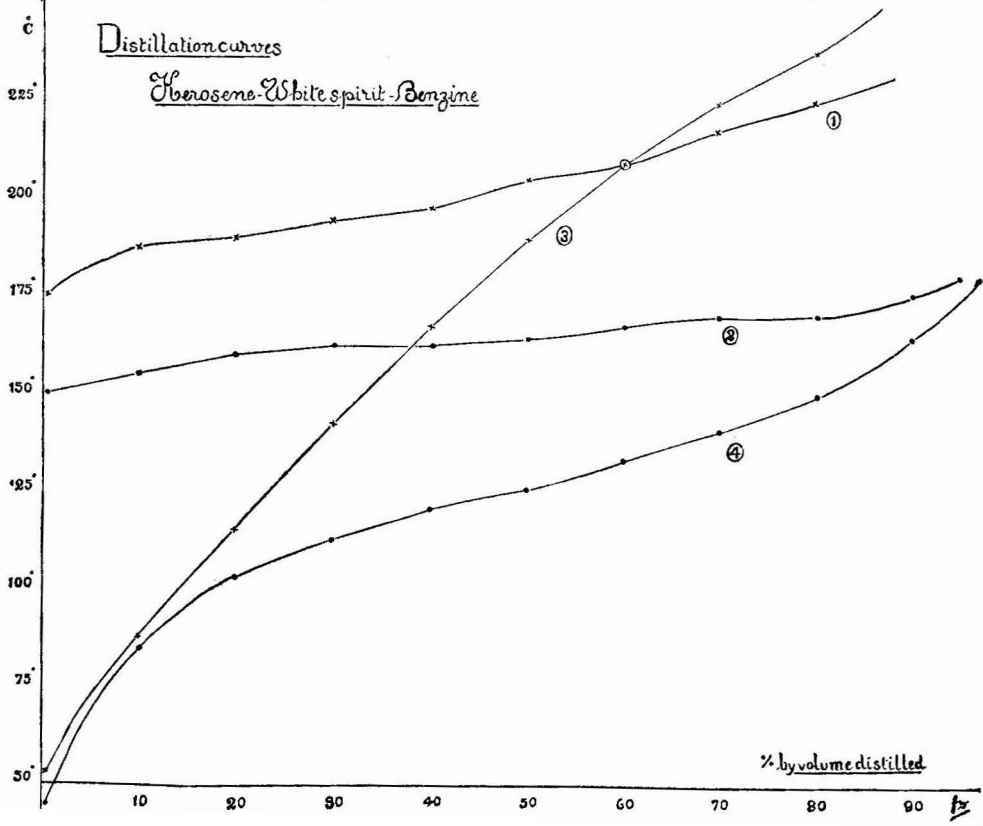
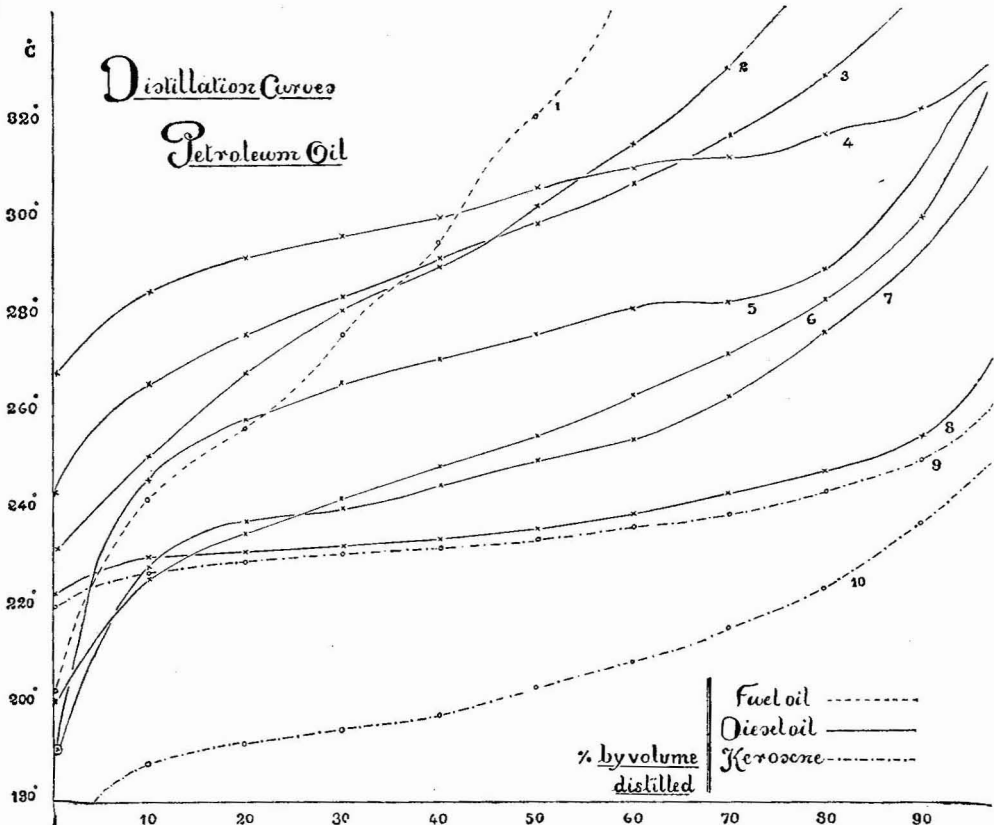
Diesel oil and Kerosene.

Kerosene had formerly been distinguished from heavier oils by means of its flash-point as oils having flash-point above 66°C. were considered to be diesel oils according to the limit under the Liquid Fuel Act for non-dangerous liquid fuels.

In July 1935 the police discovered a kerosene factory in operation near Hualampong station and seized a quantity of material with a view to prosecution under the Liquid Fuel Act. The raw material was found to be a dark coloured petroleum distillate distilling between 220° and 260° C. having s.g. 30°C/ 30°C. 0.829 and flash-point 87°C. which passed the Customs as diesel oil. There was evidence that sulphuric acid and caustic alkali were used to decolorise the distillate. The product resembled kerosene but was considerably less volatile having flash point 85°C. and the whole distilling between 220° and 250°C. as compared with flash point 58°C. of the recognised brands.

As both materials seized were above the flash point 66°C. they had to be classified as non-dangerous liquid fuels and the quantities found on the premises were less than the minimum amount of this class of fuel requiring a licence by law. Thus there was no basis for any prosecution.

In order to protect the Customs revenue it was necessary to formulate some standard for diesel oils and a comprehensive study of the petroleum oils imported was made,



The results are summarised as follows:—

Ref.no.	Lab.no.	Trade name	S G. 30°C/30°C	Flash- point	Distillation range (90%)
1	N. 356	Fuel oil	0.910	87°C	202° - 382°C
2	N. 282	Diesel oil	0.866	110°C	234° - 360°C
3	N. 307	Solar oil	0.846	110°C	242° - 366°C
4	0.822	Automotive diesel	0.830	130°C	268° - 322°C
5	N. 131	Semi- distillate	0.848	75°C	190° - 289°C
6	N. 340	Diesel oil	0.847	72°C	201° - 300°C
7	S. 770	(used for distillation)	0.852	80°C	190° - 277°C
8	N. 210	(used for distillation)	0.829	87°C	222° - 265°C
9	N. 206	(Sold as kerosene)	0.829	85°C	220° - 258°C
10	L. 687	Kerosene genuine	0.806	58°C	176° - 248°C

The distillation curves for these samples are given opposite. Sample No. 8 is the material seized by the police in the case already referred to and sample No. 9 is the kerosene produced from it. Such kerosene is much heavier than the usual brands sold in the market and burns smokily in lamps.

It was recommended that the Customs Department should send all samples for test if declared as diesel oil and found by the Customs to have density less than 0.84. Such samples having less than 50% distilling below 250°C. were to be considered as kerosene.

This standard was adopted by the Customs Department and published as a tariff notification. Although this hindered the business of distilling inferior kerosene in Bangkok it did not stop it entirely. Petroleum fractions of density greater than 0.84 were imported and evaded the distillation test; sample No. 7 is an example of this type, having exactly 50% distilling below 250°C.

To prevent this loss of revenue it will be necessary either to control the local distillation of kerosene by excise laws or to rate all light diesel oil such as No. 5 onwards as kerosene. No decision has yet been made on this matter.

Mineral turpentine.

As the Customs department desired to differentiate mineral turpentine from kerosene, samples were examined in the same way as for diesel oils

Ref.no.	Lab.no.	Description	S. G. 30°C/30°C	Flash-point	Distillation range
1	L. 687	Kerosene	0.806	58°C	176°-248°C
2	R. 151	Mineral turpentine	0.805	38°C	150°-175°C
3	O. 835	- do -	0.765	below 23°C	52°-260°C
4	P. 63	Benzine	0.738	below 23°C	45°-179°C

Sample No. 2 is representative of the usual type of white spirit used by painters being a specific petroleum fraction, and with flash-point high enough to escape the regulation for "dangerous liquid fuels." The specification recommended and adopted was that spirit having flash point below 23°C. should be classed as benzine for Customs purposes, but if above that limit and having density less than 0.790, they should be classed as mineral turpentine if more than 40% distilled below 175°C. In all petroleum distillation tests the appropriate standard I. P. T. apparatus is used.

(9) Rural Economic Survey.

A second Rural Economic Survey was conducted in the country throughout the year B.E. 2476 by Mr. J.M. Andrews of Harvard University; Nai Sangar Sharasuvana was a member of the survey party representing this department. A number of samples of foodstuffs etc. were submitted for analysis as in the case of the 1st. survey of Professor Zimmerman but the results were not recorded in the report of the survey. In order that the results may be preserved a summary of the results is now given.

Rice.

57 samples of rice and paddy were examined covering nearly the whole of Siam. The table which follows gives the average figures obtained for different varieties and from different districts. The results are calculated to a standard 12.0% moisture.

Analysis of Rice.

Type	Mois- ture	Fat	Pro- tein N x 6.25	Ash	Crude fibre	Carbohy- drates (by dif- ference)
	%	%	%	%	%	%
Glutinous Rice						
North-eastern provinces	12.0	1.0	8.4	0.7	0.4	77.5
Northern provinces	12.0	0.6	7.3	0.7	0.4	79.0
Ex paddy (husks removed)	12.0	2.1	7.9	1.1	0.8	76.1
Ordinary rice (Kao Chao)						
Ex paddy (husks removed)	12.0	2.0	8.1	1.1	0.8	76.0
Northern provinces	12.0	0.4	8.1	0.7	0.6	78.2
Dhanyaburi (central plain)	12.0	0.2	6.8	0.5	0.5	80.0
Unpolished rice (Kao Klong)						
Southern provinces	12.0	1.7	8.4	1.1	0.8	76.0
Unpolished rice from various prisons						
Kukandr	12.0	0.8	8.6	0.4	0.5	77.7
Korat	12.0	1.1	7.5	0.9	0.5	78.0
Pitsanuloke	12.0	1.6	7.5	1.4	0.7	76.8
Ayuthia	12.0	1.3	7.9	1.5	1.0	76.3
Saraburi	12.0	1.5	8.2	1.2	0.8	76.3
Songkla	12.0	2.2	8.0	1.2	0.8	75.8
Chiengmai	12.0	0.4	8.1	0.7	0.6	78.2

Salt.

Source	Moisture	In-soluble	Sodium chloride	Magnesium chloride	Sodium sulphate	Calcium sulphate
	%	%	%	%	%	%
Samud Sakol (sea-salt)	7.86	0.33	89.15	0.77	0.63	0.75
Khonkaen (inland)	3.2	0.40	94.1	0.40	0.8	1.0
Loey (inland)	0.1	0.20	98.4	0.02	1.1	0.4

Fermented Fish. Pla ra from Khonkaen.

	Bones & scales	Water	Fat	Protein N x 6.25	Ash less salt	Salt
	%	%	%	%	%	%
No. 1	16.9	43.7	6.1	14.0	2.9	15.2
No. 2	6.3	68.8	4.5	14.1	1.6	4.7
No. 3	6.7	56.5	2.0	12.9	1.5	19.4

Sample No. 1 was stated to be derived from Pla tapien, a species of carp.

Fish sauce. Nam pla.

One sample contained 20.3% of salt and 10.2% of solid matter other than salt.

(10) Kapi.

Kapi is a fermented fish paste, preserved with salt, largely used as a condiment in Siam, Burma and French Indo-China. The Chemical Examiner of Burma had reported that the Burmese product, called *Seinsa ngapi*, was often considerably adulterated with rice-bran and therefore the Department decided to investigate the nature of the Siamese kapi more closely than in the past.

Samples were procured by the Ministry of Interior from all the more important coastal districts and local markets. Of 47 samples examined only 8 were found to be adulterated with starch. All the adulterated samples came from various Bangkok markets ; the country samples were not adulterated at all. Adulterated samples contained more fat than genuine kapi, indicating that rice-bran is probably the adulterant used. Kapi in the local market is often coloured with synthetic dyestuffs usually very imperfectly incorporated into the mass. A detailed account of these investigations has been published in the Bulletin of the Department.

(11) Swimming-pool water.

Weekly samples of water are submitted by the Royal Bangkok Sports Club from their large modern swimming-pool which has been in operation since February 1933. The water is not tested for purity but only for alkalinity as experience has shown that a strict control of this condition is necessary in order to keep the water clear and bright.

The method adopted is titration with standard acid using methyl orange as indicator and the most satisfactory limits are equivalent to 60 and 80 milligrammes of soda crystals ($\text{Na}_2\text{CO}_3, 10\text{H}_2\text{O}$) per litre of water.



Opium dross section



Agricultural Science Division.

Division of Agricultural Science.

Soils.

During the two years most of the investigations have dealt with soils from various experimental stations and experimental fields. The majority of the soils examined were in conjunction with the economic survey under Mr. J. M. Andrews and the soil survey under the supervision of Dr. Robert Pendleton of the Department of Agriculture and Fisheries. Soil samples were also sent for examinations from various departments such as Prison Department, Quarter Master General's Department, Irrigation Department and the Public and Municipal works Department.

Foods and Feeding Stuffs.

Several kinds of vegetable such as *Ipomea aquatica*, *Phaseolus radiatus*, *Lactuca sativa*, *Brassica Sp.*, *Neptunia oleracea*, *Ipomea batatus*, *Cucurbita moschata*, *Nymphaea lotus*, *Piperonia pellucida*, *Cyperus rotundus*, *Dryopteris protifera* and *Carica papaya* were analysed to find their food values for human consumption.

Examinations were made on various kinds of vegetables and grasses for their feeding values for live stock. The data thus obtained will be useful for future reference.

Insecticides.

A few examinations were made on insecticides such as Nicotine dust and extract, Lead arsenate and *Derris elliptica*, *Derris elliptica* has attracted world-wide attention because of its remarkable power of killing insects.

Miscellaneous.

Other materials examined were Dried buffalo's blood, Papain, Dung manure, Water, Peat moss, Denatured Rum and Wood Ash.

Soil Survey.

To render the scientific study of soils properly available for the service of the agriculturist, more is required than the examination of single samples of soil, representing, at the best, only the land dealt with by one person. Over any wide district, not only would such work become expensive and practically endless, and liable also to many sources of error through local and accidental variations of the soil on the spot from which the sample was drawn, but each analysis would lose the greater part of its value if it could not be co-ordinated and brought into line with others drawn from soils of the same type. A general soil survey of a district, so as to be able to lay down a plan of the distribution of the various soil types, should be the basis upon which the interpretation of the analysis of any particular soil of any particular field is to be found. Only by comparison with the type can the analysis of any particular soil be properly interpreted.

The aim of making a soil survey is to study in detail the superficial formation of the soil. Classification is based upon the physical texture and indicated by such conventional terms as sands, clay, loams and marls. At the same time, a map must be drawn so as to indicate boundaries of various soil types in the area under survey.

Complicated cases may arise from time to time and the typical soil and subsoil will be selected for detailed examination and analysis in the laboratory. Therefore field workers and laboratory workers must work hand in hand if anything like success is to be attained. When this great task is accomplished Siam will be in possession of a series of "Soil maps" and then every farmer should possess the exact knowledge of the soil which is fundamental to all farming operations.

Work has been commenced at the experimental stations where history of the soils and the crops grown are better known, in order to gain a general knowledge of Siamese soils. The survey will gradually extend itself into important areas and Changwads and finally into the least known districts.

Mr. M. Cero has completed soil mapping of three stations, namely Haad Yai, Singora; Mai Jo, Chiengmai; and None Wat, Korat.

The soil survey scheme was commenced in the middle of the year B. E. 2478 and officials who went out to work in the Changwads were as follows:

1. M. Cero, Haad Yai, Singora, October 8th. to October 22nd. 1935.
2. Sroung Charuprakara, Haad Yai, Singora, October 8th. to October 22nd. 1935.
3. M. Cero, Chiengmai, December 8th. 1935, to January 24th. 1936.
4. Aree Supol, Chiengmai, December 8th. to December 23rd. 1935.
5. M. Cero, None Wat, Korat, March 10th. to March 29th. 1936.

Appendix

1. PREPARATIONS.

A. Drugs for the treatment of leprosy.

Description	Quantity litres	Issued to
Mixed ethyl esters of Hydnocarpus anthelmintica	20.25	Department of Public Health. Naval Medical Service. Chiengmai Leper Asylum. Siriraj Hospital. Public.
do.	0.05	
do.	0.25	
do.	0.10	
do.	122.96	
Total	443.61	
Oil of Hydnocarpus anthel- minica.	12.50	Department of Public Health. Chiengmai Leper Asylum. Siamese Red Cross Society. Siriraj Hospital. Public.
do.	507.50	
do.	5.00	
do.	0.50	
do.	188.18	
Total	713.68	
Oil of Hydnocarpus anthel- minica with 4% Creosote.	72.25	Department of Public Health. Chiengmai Leper Asylum. Public. Songkhla Hospital.
do.	0.25	
do.	86.55	
do.	1.00	
Total	160.05	

B. Vitamin B extract.

	Quantity litres	Issued to
	766.85	Public.
	333.50	Department of Public Health.
	187.50	Chulalongkorn Hospital.
	78.00	Police Department.
	4.00	Naval Medical Service.
	1.50	Vajira Hospital.
	1.50	Army Medical Service.
	0.10	Royal State Railways.
Total	1372.95	

II. ANALYSIS

No. of Samples	Description
MINISTRY OF INTERIOR	
1	Coal
3	Ink
50	Kapi
1	Medicine
5	Metal
2	Pepper
1	Suspected poison
1	Viscera
64	Total
MINISTRY OF DEFENCE	
1	Aluminium
2	Benzine
4	Castor oil
1	Cotton-seed oil
3	Copper
1	Copper phosphide
3	Fertilizer
1	Fuel oil
2	Gold braid
8	Hay
5	Lubricants
8	Metal
8	Mineral

II. ANALYSIS (Continued)

No. of Samples	Description
MINISTRY OF DEFENCE (Contd.)	
2	Pollen
22	Tin
4	Water
43	Wolfram
118	Total.
DEPARTMENT OF PUBLIC HEALTH	
2	Alcohol
1	Cocaine
5	Drugs for examination under the harmful habit forming drugs law.
5	Exhibit for blood stains
39	Material suspected to contain poison
11	Milk
13	Morphine
1	Quinine
1	Salt
1	Star anise fruit
1	Turpentine
1	Viscera for poison
73	Water
141	Water supply, Bangkok.
51	Water supply, Bangkwang.
1	Yeast
347	Total.

II. ANALYSIS (Continued)

No. of Samples	Description
EXCISE AND OPIUM DEPARTMENT	
2	Bottle-capping mixture
1	Liquors from spirit factory
113	Material re harmful habit forming drugs law
11	Medicinal wines
241	Metals
31889	Opium dross, routine samples
28	Opium dross, special assays
60	Raw opium
2	Sugar
49	Suspected illicit opium
3	Vinegar
32,399	Total.
POLICE DEPARTMENT	
77	Articles for examination for human blood stains.
8	Counterfeit coins
57	Drugs for examination under harmful habit forming drugs law.
46	Fire-arms and cartridges
6	Fuel oil and kerosene
1	Gold chain
6	Metals
1	Milk

II. ANALYSIS (Continued)

No. of Samples	Description
POLICE DEPARTMENT (Contd.)	
1	Mineral
24	Poison (drugs)
11	„ (food)
4	„ (Viscera)
3	Shellac
3	Water
248	Total.
CUSTOMS DEPARTMENT	
15	Import for alcohol determination
118	Import for examination under harmful habit forming drugs law
625	Import for examination for tariff classification.
200	Milk
43	Pepper
10	Pyridine
50	Samshoo
4	Tobacco Flavouring.
39	Wood Naphtha
1,104	Total.

II. ANALYSIS (Continued)

No. of Samples	Description
DEPARTMENT OF MUNICIPAL AFFAIRS	
1	Benzine
1	Brick
1	Distilled water
2	Metals
1	Oil
5	Road-metal
24	Water
35	Total.
BANGKOK WATER WORKS	
6	Bangkok water supply
16	Lime
2	Limestone
2	Sodium carbonate
14	Sulphate of alumina
11	Water
51	Total.
ROYAL STATE RAILWAYS	
2	Asphalt
1	Calcium carbide
1	Cast Iron
7	Castor oil

II. ANALYSIS (Continued)

No. of Samples	Description
ROYAL STATE RAILWAYS (Contd.)	
2	Caustic soda
1	Copper sulphate
1	Diesel oil
2	Firewood
1	Linseed
3	Muntz metals
4	Nitric acid
6	Paints
1	Soil
2	Tar
5	Water for boiler purposes
7	White zinc
46	Total.
MINISTRY OF ECONOMIC AFFAIRS	
1	Alum
2	China clay
1	Metal
1	Mineral
81	Rural Economic survey, Foods.
4	Salt
11	Sand for glass-making
1	Wolfram
102	Total.

II. ANALYSIS (Continued)

No. of Samples	Description
ROYAL IRRIGATION DEPARTMENT	
1	Copper
1	Metal
1	Piston ring
1	Tin
11	Water
15	Total.
DEPARTMENT OF AGRICULTURE AND FISHERIES	
1	Castor oil
1	Castor oil seed
1	Cocoanut oil
2	Cotton seed
7	Derris root
1	Dried buffalo blood
2	Ginger
6	Papain
2	Pepper
1	Pine cones
8	Resin
1	Rice
4	Salt
1	Sugar cane
1	Tobacco
1	Water
40	Total.

II. ANALYSIS (Continued)

No. of Samples	Description
FINANCE DEPARTMENT	
326	Bronze
6	Nitre
35	Nitric acid
8	Silver
7	Tin
9	Zinc
391	Total.
OTHER DEPARTMENTS	
<i>Criminal Court.</i>	
5	Suspected illicit opium
<i>Department of Commerce</i>	
1	Mineral
2	Pepper
7	Sand for glass-making
4	Sugar
<i>National Store Department</i>	
1	Gum
33	Ink
1	Polishing powder
<i>Post & Telegraph Department</i>	
2	Cable

II. ANALYSIS (Continued)

No. of Samples	Description
OTHER DEPARTMENTS (Contd.)	
<i>The Royal Survey Department</i>	
5	Alum
1	Chan ta maew (resin)
10	Kaolin
1	Salt
<i>The Forest Department</i>	
1	Crude turpentine
13	Charcoal
<i>Siriraj Hospital</i>	
7	Drugs tested for Purity
<i>Ministry of Finance</i>	
1	Tablets
<i>Lands & Mines Department</i>	
1	Clay
2	Metal
7	Mineral
2	Stone
25	Wolfram

II. ANALYSIS (Continued)

No. of Samples	Description
PUBLIC	
<i>(Firms and private individuals)</i>	
2	Beer
2	Benzine
2	Castor oil
4	Chlorate of Potash
7	Coal
8	Copra cake
226	Damaged cargo
9	Fuel oil
2	Ink
2	Linseed oil
1	Mai chan
12	Metals
1	Methylated spirit
10	Milk
22	Mineral
16	Moisture determinations
2	Paddy
34	Papain

II. ANALYSIS (Continued)

No. of Samples	Description
PUBLIC (Contd.)	
<i>(Firms and private individuals)</i>	
3	Poisons, suspected
1	Potassium Nitrate
1	Resin
8	Road metal
3	Salt
2	Santonin tablets
7	Sticklac
1	Strychnos seeds
1	Sulphate of ammonia
2	Sulphuric acid
107	Swimming pool water
1	Tobacco
2	Tonic wine
8	Water
2	Wax
27	Wolfram
538	Total.

Division of Agricultural Science

No. of Samples	Description
DEPARTMENT OF AGRICULTURE AND FISHERIES	
2	Nicotine dust and extract
3	Tobacco
60	Soils
1	Lead arsenate
1	Dried Buffalo's blood
8	Papain
2	Dung manure
11	Derris root
1	Castor seeds
1	Salted fish
5	Vegetables
QUARTER MASTER GENERAL'S DEPARTMENT	
30	Soils
10	Grasses
3	Bone meals

Division of Agricultural Science (Continued)

No. of Samples	Description
ROYAL IRRIGATION DEPARTMENT	
5	Water
1	Dyestuff
2	Soils
DEPARTMENT OF SCIENCE	
21	Vegetables
3	Wood ash
OTHER DEPARTMENTS	
112	Soils
1	Tobacco
2	Peat moss
14	Shrimp paste (Kapi)
PUBLIC AND PRIVATE INDIVIDUALS	
34	Papain
1	Denatured Rum

PUBLICATIONS.

The following pamphlets in the Siamese language were published by the Department in December 1935 (2478) and copies are available gratis to persons interested.

- (1) Improvements in salt manufacture, by Pue Rochanapuranda, A.A., B.S. (Chem). and Aree Suphol, B.Sc.
- (2) Advice about methods of curing Ginger (Zingiber officinale), by Pue Rochanapuranda, A.A., B.S. (chem).
- (3) Turpentine and rosin, by Klio Bunnag, B.S. Phar.
- (4) Jelly from Siamese sea-weed, by Klio Bunnag, B.S. Phar.
- (5) Papain, by Sangar Sharasuvana, C.D.A. (Hons).
- (6) Sand for glass-making, by C.J. House, B.Sc., A.R.C.S., F.I.C.

Copies of past biennial reports, numbered 1 to 7 are also available in either Siamese or English language at a cost of 50 satangs per copy.

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