

1874.

NEW ZEALAND.

COLONIAL LABORATORY REPORTS.

(SPECIAL REPORT ON ADULTERATIONS.)

Presented to both Houses of the General Assembly by command of His Excellency.

No. 1.

MEMORANDUM by Dr. HECTOR for the Hon. the PREMIER.

IN reply to your inquiry, I have the honor to remark,—

1. The subject of the *Adulteration of Food* has three aspects—

(1.) Fraud.

(2.) As affecting public health.

(3.) As a disturbing element in financial and commercial arrangements.

2. To discover adulteration is a simple application of chemical analysis. To prove adulteration, and trace it to an individual, with the view of repressing it by punishment, requires a thoroughly organized system of medical police.

3. In this colony articles must be examined for adulteration effected before importation, either by the original manufacturer, or by exporters using forged brands; also, for adulterations effected by retailers; and lastly, adulterations of articles of local manufacture.

The following is a list of some of the articles sold in this colony which are often adulterated before importation:—Tea, coffee, cocoa, breadstuffs, oatmeal, arrowroot, sago, anchovies, mustard, peppers, curry powder, spices generally, vinegar, sauces, pickles, isinglass, confectionery (sugar), wine, beer, porter, brandy, white lead, litharge, linseed meal, sperm oil, olive oil, woollen goods, candles. The adulterations of all the above have been fully investigated at home, and the application of the results there obtained to the goods in this colony will be quite easy, provided it is not desired to take legal proceedings, as it will be unnecessary to prove where the adulteration was effected. Small samples may be purchased and examined by competent analysts. Such examinations have been frequently performed in the Colonial Laboratory, and do not involve any great expense. The adulterations effected by retailers in the colony are chiefly those of wines and spirits—especially brandy—and also beers in some districts, especially on the “diggings.” The colonial-made beer is constantly examined in the Laboratory for the Customs Department, and in no instance has any adulteration been yet found. There would probably be no object in investigating the adulterations effected by retail dealers, except with the view of repression. This is already provided for by Act.

Wellington, 25th April, 1874.

JAMES HECTOR.

No. 2.

Dr. HECTOR to the Hon. the PREMIER.

SIR,—

The Colonial Laboratory, Wellington, 17th July, 1874.

I have the honor to enclose a schedule of the results of the analyses of various articles of commerce which have been examined in the Laboratory in accordance with your instructions of the 27th April last, with the view of ascertaining whether they are free from adulteration and of good weight.

In the column headed “Adulterated,” only those articles have been included which there is reason to believe have been intentionally adulterated, as in many cases impurities exist either naturally or in accordance with ordinary trade rules.

The series of analyses directed in your memorandum is not yet completed, but further reports of results will be made from time to time. A very large series of samples of the liquors sold on the gold fields have been received through the Hon. the Commissioner of Customs, the examination of which will occupy the Analyst's time for several months.

I have, &c.,

JAMES HECTOR.

The Hon. the Premier.

SCHEDULE OF ARTICLES EXAMINED; with the RESULTS.

NAME OF ARTICLE.	Number of Samples.	Adulterated.	No Adulterations found.	Gross Weight.	Error on Net Weight + 0 —
				lb. oz. dr.	
Tea—black	8	8	...	...	Good weight.
" green	7	7	...	...	Good weight.
Coffee	3	...	3	1 0 10½	—3 oz. 8 drs. on lb tin.
"	...	...	...	1 0 9	—3 oz. 7½ drs. on lb tin.
"	...	...	...	1 4 8	+8 drs. on lb tin.
Cocoa	5	...	3 Van Houten's	0 11 15½	+6½ drs. on 8 oz. tin.
"	...	...	2 Epps	...	Good weight.
Flour (wheat)	3	...	3	...	Good weight.
Oatmeal	3	...	3	...	Good weight.
Jams	12	...	12	4 English	—6 drs. on lb tin.
"	...	...	...	8 Colonial	—1 oz. on lb tin.
Bottled Fruit	3	...	3	...	
Pickles	4	...	4	...	
Vinegar	...	...	...	...	
Isinglass	2	1	1	...	
Mustard	7	5	...	...	Good weight.
"	...	...	1 Colman's	1 10 5	+4½ drs. on lb tin.
"	...	...	1 Keeno's	0 6 8½	—6 grs. on ¼-lb tin.
Curry	1	...	1	...	
Anchovy Sauce	1	...	1	...	
Anchovy Paste	1	...	1	...	
Harvey's Sauce	1	...	1	...	
Worcester Sauce	1	...	1	...	
Sugar	8	...	8	...	Good weight.
Candles	2	...	1 Brandon's	1 0 7	—4 drs.
"	...	...	1 Price's	1 0 4	—4½ drs.
Snuff	3	3	...	...	Good weight.
Boots	3	...	3	...	...
Brandy	5	...	5	...	...
Geneva	4	...	4	...	...
Whisky	2	...	2	...	...
Rum	5	1	4	...	...
Wine—Port	4	4	...	...	...
" Sherry	4	4	...	...	...
Textile Fabrics—					
Silk	4	...	4	...	...
Damask	2	...	2	...	...
Cashmere	2	...	2	...	...
Twill	2	...	2	...	...
Flannels	2	...	2	...	...
Broad Cloth	2	...	2	...	...
Llama	2	...	2	...	...
French Merino—coloured	1	...	1	...	...
" uncoloured	1	...	1	...	...
Tweeds, Nelson	2	...	2	...	...
" Imported	4	...	4	...	...
Tartans	3	...	3	...	...
Alpaca	1	...	1	...	...

SUMMARY.

Total number of samples examined	...	...	...	...	129
Number found to be unadulterated	...	...	...	97	} 129
Number found to be adulterated	...	...	...	32	

No. 3.

Dr. HECTOR to the Hon. the PREMIER.

SIR,—

Colonial Laboratory, Wellington, 24th July, 1874.

I have the honor to forward, for your information, the details of Mr. Skey's analytical examination of the articles mentioned in the schedule enclosed with my letter of the 17th instant.

I have, &c.,

The Hon. the Premier, &c.

JAMES HECTOR.

TEA.—Fifteen samples of tea have been examined, and were all ascertained to be adulterated. Seven of these are black and the others green teas.

Black Teas.—The black teas are faced with graphite or iron oxides, and in one case manganese ore (*wad*). This last is an adulterant not hitherto observed in tea. All these substances are quite innocuous. I think that iron oxides generally accompany the graphite here, and are sometimes combined as tannate of iron.

The ash in every case has been estimated, and it has not in any case been notably high; 7 per cent. being the highest yield of inorganic matter against about $5\frac{1}{2}$, which is the quantity contained in the fresh leaves of the tea plant.

Green Teas.—The green teas were all faced with some mineral compound. These were usually ferrocyanide of iron (Prussian blue) and a yellow-coloured lead compound (probably chromate of lead). In one case comparatively a large quantity of Prussian blue was found, no less than 2.44 per cent., as calculated upon the amount of iron present, which I have every reason to believe is wholly combined in this form. This tea differed from the other tea in having a bluish-green colour, while the others are of a dull-green colour; but all the green teas are in a compressed form, as if they underwent manipulation in their manufacture. There is only a trace of lead compounds in this bluish-green tea, a circumstance which helps to explain its bluish colour. In these dull-green teas, at any rate, the proportion of Prussian blue is not so large as to exercise any immediate injurious effect upon the health of those using teas of this description; but as lead compounds are poisonous and can accumulate in the system, these green teas are undoubtedly dangerous to partake of habitually.

Only a small proportion of leaves not of the tea plant were found in these samples.

Coffee.—I have not been able to accomplish much in respect to the coffees;—this partly from lack of microscopic examination, partly from the extreme variability allowed by law, and required to suit different tastes. However, I have not been able to detect anything unwholesome in them, or any earthy substance added for weight or colour. The following are the weights of coffee found in three tins of this, from three houses in this city:—

lb.	oz.	dwt.
0	12	8
0	12	8
1	0	8

Cocoa.—The only cocoa of undoubted quality I have been able to collect for testing is that known as Van Houten's; it is sold in tins of different sizes. The eight-ounce tins I have always found to be of full weight,—the net weight of the cocoa being generally about $\frac{1}{4}$ ounce over the eight ounces. The other cocoas I have examined are what they profess to be—mixtures of cocoa with starch and sugar.

FARINACEOUS SUBSTANCES.

Flour.—Our wheat flours are frequently infested with the *Acarus farinae*, but I have not been able to detect any admixture of them with the flour of other grain.

Oatmeal.—All the oatmeals I have examined are unadulterated, while our starches are of fair quality.

Jams.—Several brands and varieties of jams in tins have been examined, especially for presence of metallic substance; and it has been ascertained that in the majority of cases iron and tin were present (in the fruits), and this to a greater extent in those jams of an acid nature, as gooseberry and currant. As would be expected, the older these jams the more of these metals was dissolved therein. In no case, however, were these metals found in sufficient quantity to exercise any injurious effect upon those partaking of it in such amount as it is ever likely they would.

The only English brand of jams I examined was quite as pure as any of the others, and of better quality. Generally, the tins of jams now in the market weigh gross more than the avoirdupois pound, but do not contain a pound of jam. I would not like to strike an average weight for each brand examined, as my weighings are not sufficiently numerous to give any numbers which I could get out for this of any real value; but I believe that the English jams sold by James Keiller and Sons will mostly give 6,800 to 6,900 grains of jam, and the other jams not more than 6,500 grains. The English jams examined are of two brands, and the others from Hobart Town.

I may state, none of the tins had anything attached stating weight, but I believe retail buyers as a rule suppose they contain one pound of jam.

Bottled Fruit.—Three samples of bottled fruit, especially selected as those most likely to contain a metallic substance, were carefully examined for such, but with negative results.

Pickles.—Several of our pickles were examined, especially for copper and lead, but in no case was either of these metals found.

Vinegars.—Five vinegars have been tested in regard to their strength and freedom from substances of a noxious character. The result of this is detailed in Table I. attached, from an inspection of which it will be seen that in all cases the vinegar is of good strength, the acetic acid (the amount of which determines their value) ranging from nearly 5 per cent. to a little over 9 per cent. by weight. All are quite free from substances of a deleterious nature. No. 4, however, contains a little chloride of sodium (common salt). In regard to the sulphuric acid, it will be seen that in none of the samples is it present in nearly so great a quantity as that which is allowed by Act of English Parliament: one part to 1,000 of vinegar.

No. I.
RESULTS OF ANALYSIS OF VINEGARS.

No.	Variety.	Specific Gravity at 60° Fahr.	Solid Matters.	Acetic Acid monohydrated.	Sulphuric Acid.	Hydrochloric Acid.
			Per cent.	Per cent.	Per cent.	Per cent.
1	Common Brown Vinegar	1·0092	·89	6·72	·010	Traces.
2	" "	1·0087	1·10	6·54	·041	"
3	" "	1·0135	·97	9·15	·046	"
4	" "	1·0141	1·04	9·24	·006	·23
5	White Vinegar	1·0062	Traces.	4·91	Traces.	·23

Isinglass.—One sample of isinglass I found pure ; it was not branded.
A sample of Nelson patent isinglass gave 28·44 per cent. of water, and 1·78 per cent. of white ash.
As pure isinglass gives but ·90 per cent., and gelatine 4 per cent., it appears, at the best, this sample is made up as follows :—

Isinglass	...	...	...	...	...	71·61
Gelatine	...	...	...	...	...	28·39
						100·

This was, however, a good strong article, and is in good repute, though much inferior to the pure isinglass.

Mustard.—In all, seven samples of this have been examined, five of which were adulterated, the presence of turmeric being plainly evidenced to chemical tests. Other adulterants were not sought for, as they would be certain to be present, the turmeric being added, no doubt, to cover and supply the colorific deficiency of other adulterants. These samples were not branded, but were supplied from bulk.

The remaining samples (2) were found pure ; they are Colman's and Keene's respectively, and were purchased in pound tins, with brand attached.

As to weight : Keene's sample was stated to be in ½-lb. weight, to which the net weight of mustard nearly approximated. Colman's mustard had no weight attached, but was sold for a pound tin. In these as in other cases, where only one or two samples were weighed, I could not make any general deduction from them.

Sauces.—Anchovy sauce, with Crosse and Blackwell's brand, was ascertained to be free from anything of a noxious nature, and to be of very good quality ; it was further determined that the amount of ferruginous matter present is not more than that which they announce as being used in the preparation of this sauce for the purpose of communicating to it an inviting appearance. The same can be said of their anchovy paste.

Harvey's sauce (J. T. Morton) also appears of excellent quality ; and the same appears true in the case of Worcester sauce—at least, nothing could be found in either of these substances of a deleterious nature. This last sauce has Lea and Perrin's name attached.

Sugar.—Our principal varieties of sugar have been examined, and the result shown that they are quite free from anything of a noxious character. The only impurities which could be found were portions of bagging, as also of sugar-cane, together with a little dust and grape sugar. With the exception of the last article, I found nothing but which might have got admixed with them in the process of their manufacture, and altogether the amount of such was exceedingly small. In regard, however, to the grape sugar, I frequently found this high. It is certainly an impurity, but whether it is an adulteration depends perhaps upon whether it is added for this purpose.

The following results are the highest I have obtained for the several qualities of sugar there cited :—

				Water.	Grape Sugar or Glucose.
Brown	...	...	...	2·86	4·57
Crystallized	...	...	...	0·89	8·70
Crushed Loaf	...	...	...	0·31	3·87

It should be stated all our commercial sugars have been ascertained to contain traces or more of this substance (grape sugar). As the presence of this sugar in quantity may indicate the use of starch in manufacture of these sugars, it may be advisable to go further into this matter.

Candles.—Only two brands of candles have been examined, both of which are of English make, the only ones I can find for sale here of foreign manufacture ; these are Brandon's best Neva Stearine and Price's. They have been tested photometrically, with results as given below, and from which it will be perceived Brandon's possess a little more illuminating power—weight for weight—and also for

equal time. At the same time, however, it should be stated their fusing point is slightly lower, and, again, their wicks are not so evenly placed, and are sometimes badly made. The low fusing point of these candles causes them to "gutter" in the slightest draught of air.

Brand of Candle.	Illuminating Power for equal time.	Illuminating Power for equal weights.	Weight in grains consumed per hour.
Brandon ...	100	100	138
Price	92	88·7	143

Snuff.—The time at my disposal has not been sufficient to allow me to go as far into the chemical examination of our snuffs as I should like, nor yet as far as I think there is occasion for, so I have only partially examined three samples. From the result, it appears their water and solid matters are nearly uniform in quantity, and that they have been adulterated with a little ferruginous earth. As common salt is allowed by law to be added to snuff to any extent, it was not estimated.

Number.		Water per cent.	Mixed Matter per cent.
1	Dry	26·42	26·40
2	Dry	26·04	24·66
3	Moist	31·06	21·17

No. 1 contained 3·1 per cent. of silica. No. 3, analyzed for copper and lead, gave negative results.

Boots.—Three pairs were examined for paper, or other material, added for fraudulent purposes. Nothing of such a nature was found. However, some time since it came under my notice that paper is added in certain very light boots and slippers, but I believe a knowledge of this fact is not held back by sellers.

Spirits.—Sixteen samples of spirits have been thoroughly tested as to strength and freedom from noxious adulterants. These have been all obtained from publicans in quantities of one bottle each.

In all cases where a brand was attached to samples, I found it pure and of very fair strength; while in the two or three cases where a noxious substance was present, the spirit was freshly taken from bulk (in cask).

I have prepared a table showing my results upon them (Table II.)

Brandy.—Six brandies, five of which are of different brands, upon examination show a very singular uniformity. The brands are Hennessy's, Martell's, Associated Company's Vineyard No. 1, and Bisquit. They contain, roughly, 50 per cent. of alcohol, which is about as high as these liquors are ever sold at.

The quantity of solid matter is also very uniform; and I could discern no notable difference in their quality.

I should state that the precise and relative merits of good liquors (wine or spirits) cannot be ascertained by any purely chemical means at present known, and therefore I have not sought to compare them as to this.

The Genevas (4) are of good quality; the only impurity I was able to detect was sulphuric acid, in the case of No. 3; but as this was in combination, I do not think it had been added to the liquor purposely.

The range of alcohol is from 41·3 to 58 per cent., while the solid matters were tasteless, except in the case of that variety known as "Old Tom;" the solid matter in this was principally sugar (2·4 per cent. upon liquor), and this substance is added in good faith to consumers.

Whisky.—Only two samples of whisky have been examined—one that known as Dunville's, of Belfast, the other not branded; both are of excellent quality.

Rum.—Five samples of rum were tested. With none were brands attached: as a rule they had just been taken fresh from cask. They are all strong rums—in one case 62 per cent. of alcohol is present. In regard to noxious matter, I found copper in two of them, but as traces only; and in another I found tobacco in very appreciable quantity. The copper might, and in all probability has, got into the rum accidentally, dissolved off from some copper vessel used in the process of manufacture. With the exception of two or three rums, it will be seen all the spirits are of very good quality.

For further particulars, see Table II.

No. II.
SPIRITS.

VARIETY.	Brand.	Physical Character.	Specific Gravity.	Alcohol, per cent.	Percentage under or over proof (Sykes).	Solid Matters, per cent.	Remarks upon the nature of Solid Matters.
BRANDY ...	Hennessy's Cognac	Clear, pale	·935	50·5	10·3 U.P.	1·24	Sweet, feebly acid; has an astringent taste.
"	"	"	·9341	50·6	10·4 "	1·20	
"	Martell's Cognac	Clear, little dark	·9347	50·4	10·4 "	1·30	
"	A.V. No. 1	Clear, pale	·9332	50·1	11·7 "	1·21	
"	Bisquit	"	·9336	50·1	11·7 "	1·22	
GENEVA ...	...	Clear, nearly colourless	·949	41·3	26·7 "	Traces	Undeterminable; sulphuric acid absent; nearly tasteless.
"	...	Clear, nearly colourless	·917	58·0	3·6 O.P.	Traces	Undeterminable; sulphuric acid absent; nearly tasteless.
"	...	Clear, nearly colourless	·9407	46·0	18·1 U.P.	Traces	Undeterminable; traces of sulphuric acid.
"	Old Tom	Clear, nearly colourless	·950	42·2	25· "	2·91	Chiefly sugar (2·4 per cent.); only trace of sulphuric acid.
WHISKY ...	Dunville, Belfast	Pale straw colour	·912	60·8	8· O.P.	·16	No sulphuric acid.
"	Not branded	Very pale	·938	53·1	6· "	·24	No sulphuric acid.
RUM ...	Not branded	Clear, dark colour	·943	48·3	14·8 U.P.	1·51	Slightly acid; very saccharine; contains traces of sulphuric acid.
"	"	Dark, not clear	·941	48·0	14·9 "	1·52	Contains tobacco and treacle.
"	"	Clear, very dark	·948	44·0	21·6 "	1·07	Copper traces; treacly.
"	"	"	·908	66·0	18·0 O.P.	·69	No sulphuric acid.
"	"	"	·937	49·0	13·1 U.P.	1·45	Copper traces; acid; treacly.

The per cent. U.P. or O.P. by Sykes's hydrometer is calculated, and this only approximately, as my tables are for this very short.

Wines.—Eight wines, four port and four sherry, have been carefully examined, and in none of them could I detect anything of a noxious nature.

Port.—Three of the ports gave the reaction of elderberry wine to the test of M. Jacob, while the other did not give the proper reaction of grape wine to same test. They were, besides, saccharine to a greater degree than is compatible with the true flavour of this kind of wine.

In regard to amount of alcohol present, it is seen by Table III. attached, that in the case of three of them, it is high, in one instance amounting to 26·1 per cent., the others being about 20 per cent. It is therefore certain three out of the four ports here cited have been what is technically known as *branded*, and this to a large extent.

Sherries.—The sherries were dark-coloured, feebly acid, and sweeter than is proper for such wines; but the exact amount of sugar has not been ascertained. The alcohol is high in the case of No. 3 and 4 samples. These wines are clearly made up of brandy and caramel, with flavouring matters. It should be stated that these samples are all bottle samples obtained from public-houses, as in order to be able to test the best wines it would be necessary to buy in quantities of two gallons.

No. III.
WINES.

VARIETY.	General Physical Characters.	Specific Gravity.	Alcohol, per cent.	Per cent. U. P. (Sykes).	Solid Matters, per cent.	Nature of Solid Matters.
Port ...	Clear dark colour, acid	1·008	26·1	53·0	4·11	Innocuous.
" ...	" " "	1·006	16·1	70·1	5·22	Innocuous.
" Page	Turbid ...	1·003	20·6	62·5	3·93	Innocuous.
" ...	Clear ...	1·008	20·0	63·4	5·75	Innocuous.
Sherry ...	Clear, acid ...	·988	18·1	66·7	2·61	Innocuous. Taste and smell of burnt sugar.
" ...	" " ...	·992	16·1	70·1	2·52	Ditto ditto.
" ...	" " ...	·987	24·2	57·6	3·19	Ditto ditto.
" ...	" " ...	·984	20·6	62·5	3·11	Ditto ditto.

Fabrics.—Twenty-eight silk and woollen goods have been examined as to purity, and in every case they were ascertained to be pure. The particular goods thus examined are stated in schedule.

Six other fabrics, sold on the understanding, I believe, that they are only partly wool, have been analyzed quantitatively, and with results as annexed. The colouring matters are weighed with the fibres.

No. I.—*Winsey*.—*Character* : Very harsh and strong, thick, wears well, warp of cotton, weft of wool (shoddy), staple 1 to 2 inches.

Wool per cent.	...	...	...	...	...	...	66·98
Cotton „	...	...	...	...	...	...	33·02

100·

No. II.—*Winsey*.—*Character* : Thin, harsh, strong. Dark and purple parts of weft was of wool, the rest cotton.

Wool per cent.	...	...	...	...	...	...	52·1
Cotton „	...	...	...	...	...	...	47·9

100·

No. III.—*Winsey*.—*Character* : Soft, smooth, thin. Warp of cotton, weft of wool.

Wool per cent.	...	...	...	...	...	...	69·4
Cotton „	...	...	...	...	...	...	30·6

100·

No. IV.—*Shally*.—Firm and harsh to the touch, variously coloured. Warp is composed of 45 per cent. cotton, 5·5 per cent. wool. Weft is all wool, and amounts to 49·5 per cent.

No. V.—*Shally*.—Same character as above. Warp is black and white cotton. Weft is wool.

No. VI.—Lustrous and strong. Warp of white silk, alternating with narrow stripes of black cotton. Weft is of wool. Colour purple.

WILLIAM SKEY,
Analyst.

By Authority; GEORGE DINSBURY, Government Printer, Wellington.—1873.

Price 6d.

