

D.P.H.

CHEMISTRY of (a) FLOUR

(b) OTHER FOODS

Flour, bread and starches.

- Reading: (1) "Synopsis of Hygiene." Jameson and Parkinsea.
(2) Reports referred to in (1)
(3) Treatment of Flour with Chemical Substances.
Ministry of Health Report 1927.
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Starches. - microscopical characters.

Group I Large round, sometimes oval granules with no marked concentric striae.

- e.g. Wheat - Granules chiefly large or small
Barley - Intermediate size granules occur and shape is less regular
Rye - May show a stellate hilum and some of the granules have burst.

Group II Large pyriform granules with well-marked concentric striae and hilum.

- e.g. Potato, Arrowroot.

Group III Large oval granules with faint striae and a linear hilum.

- e.g. Pea, Bean.

Group IV Small angular granules often in masses.

- e.g. Rice, Oatmeal, Maize (stellate hilum).

Group V Irregular granules, often with one rounded end, the other having a "cut off" appearance. Round central hilum.

- e.g. Tapioca, Sago.

The expert, in addition to microscopical appearance, also makes use of other methods such as the behaviour to polarized light, in the recognition of starches.

Composition of Wheat Flour.

Approximate composition of white flour:-

Carbohydrate	77.0
Protein	11.0
Fat	1.2
Ash	0.4
Water	10.4

Characteristics of other flours:-

- Oatmeal - rich in cellulose, fat and salts; fat up to 6%.
Barley - rich in cellulose and mineral matter, poor in nitrogenous matter and starch.
Rye - rich in sugar, 3.5%.
Maize - rich in fat 3.5%.
Rice - rich in starch 78.5%.

The Gluten of Flours.

The gluten on which the bread making capacity of a flour depends is a mixture of proteins, including gliadin and glutenin but small amounts of other proteins can be extracted from flour. The flour proteins are rich in tyrosine, tryptophane and glutaminic acid.

Composition of Bread.

Some of the starch is fermented to sugar and so to alcohol and carbon dioxide. Some of the soluble proteins become insoluble. In baking some of the nitrogenous substances are destroyed and some of the fat is volatilized.

The water content may vary between about 26 and 47%.
Adulteration is rare.

Calorie Value (Plimmer).

White bread (mean of 12)	1037 calories per lb.
Brown bread (mean)	1014 calories per lb.

Chemical Additions.

Read Report.

Note. Alum is not used for the sophistication of bread at the present day.

Practical Notes.

1. The Kjeldahl estimation is performed in similar fashion as has been done for milk.

Note. The value of the protein factor depends on the nature of the protein foodstuff.

Plimmer gives the following:-

Milk	6.38
Meat	6.25
Wheat	5.68

5.68
 1.4

 22.72
 22.72 - 17.85 = 4.87

2. If oxides of nitrogen have been used in bleaching the flour, nitrites will be found. However, nitrites up to 2.0 parts per million may be found normally in unbleached flour, so that a larger figure than this suggests bleaching.

3. To obtain "gluten" some of the flour is put into a muslin bag which is then held under the tap and kneaded until the wash water is no longer milky. The gluten is retained in the muslin as a sticky mass.

Perform protein tests on the gluten.

Other Foods.

Coffee and Chicory.

Ground chicory is frequently added to ground coffee and the admixture is not an offence against the Law provided the addition of a moderate amount has been declared by the vendor.

Chicory as used in this way is made from the chicory plant by drying the root, and finally powdering and roasting it. Coffee acquires its characteristic aroma only on roasting.

Tests.

	<u>Chicory</u>	<u>Coffee</u>
1.	When floated on water the powder sinks, colours the water and the precipitate is soft to feel.	Floats for a longer time. Precipitate feels hard and gritty.
2.	A ten per cent. solution has:- a s.g. of about 1024.0	a s.g. of about 1010.0
3.	Microscopic:- Square ended, thin-walled spirally marked cells.	Some long dovetailed thick-walled, pointed cells.
4.	No caffeine.	1.0% or more of caffeine.
5.	Lead acetate does not precipitate colouring matter.	Colouring matter precipitated.

Cocoa.

Composition: 50% fat
 1-2% theobromine.

Tea.

No food value.
Up to 5% of caffeine.
Adulteration is nowadays excessively rare.
The tea leaf under the microscope presents the following characters:-

Elliptical, notched apex, terminal spine, looped venation. Under surface is hairy and has oval stomata.

Vinegar.

Is the product of the alcoholic and subsequent acetous fermentation of saccharine materials. Malt vinegar is made from malt and barley; on the continent wine and in America cider, are used in the preparation of vinegar. Dilute spirit may also be employed. Various artificial vinegars such as diluted acetic and pyroligneous acids are met with.

Adulterations.

- (1) Mineral acids.
- (2) Metallic impurities dissolved by the vinegar from metal pipes or containers.
- (3) Pyroligneous acid.

- (4) Colouring agents also capsicum or ferrocyanide which may be used for fining.

Analysis.

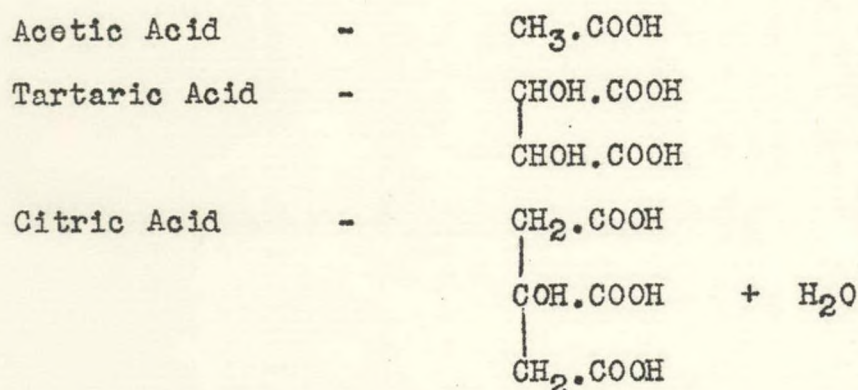
- (1) Acidity - should contain 4-7% of acetic acid (4% is taken as the standard in this country.)
- (2) Special tests may be needed for mineral acids, colouring matters and metallic impurities.

Lemon and Lime Juice.

The chief adulterants are:- Tartaric acid, mineral acids, glucose, cane sugar, coal-tar dyes and preservative.

The natural acid is citric acid.

Lemon juice should have a s.g. of 1030-1040 and should contain 7-9 grams of citric acid per 100 cc. and not more than 3% of ash.



Tests.

Acetic Acid, or Acetates.

- (1) Heat with sulphuric acid - acetic smell.
- (2) Ferric chloride gives a red colour with an acetate.
- (3) Add strong H₂SO₄ and some alcohol and heat. An ethereal smell of ethyl acetate is produced.

Tartrates.

- (1) Heat with strong sulphuric. The mixture blackens and then a smell of SO₂ is produced.
- (2) Calcium salts or lime water in excess give a white precipitate of calcium tartrate.
- (3) Mirror test - given by other substances also. Neutralize carefully with NaOH, add AgNO₃ when a ppte of silver tartrate results. Now add dilute ammonia till the ppte nearly vanishes. Place test tube in a beaker of hot water.

Citric Acid.

Add dilute CaCl_2 to a dilute citrate solution. No precipitate results but on heating a white precipitate forms due to calcium citrate which is less soluble in hot than in cold water.

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