

Chemistry of Vegetable Physiology and Agriculture.

Influence of Aeration on the Formation of Volatile Products in Alcoholic Fermentation. E. KAYSER and A. DEMOLON (*Compt. rend.*, 1909, 148, 103—105. Compare Abstr., 1907, ii, 714; 1908, i, 317; Trillat, Abstr., 1908, ii, 615).—The authors have compared the action of the champagne yeast No. 3 with that of a yeast (the yeast of bananas No. 221) of a definitely aerobic character on malt extract (containing 15.76% of sugar) with reference to the quantities of volatile acids, esters, aldehydes, and higher alcohols formed. Comparative experiments were made (a) in long-necked flasks completely filled in order to avoid contact with the air; (b) in shallow vessels two-thirds full and exposing a large surface of liquid to the air. The results are given in tabular form. At the end of one month the quantities of sugar decomposed, and of yeast, volatile acids, esters, and aldehydes formed, by the banana yeast were considerably greater (two to five times) in the shallow vessels than in the flasks, whilst the alcohol content was found to be greater in the unexposed liquid. On the other hand, similar experiments with the champagne yeast showed that exposure to the air had very slight effect on the amounts of sugar decomposed, and yeast formed, decreased those of volatile acids and esters to less than half, doubled the amount of higher alcohols, and enormously increased the proportion of aldehydes.

At the end of six months the effect of exposure to air on the action

of the banana yeast is still to increase the amount of sugar decomposed and of yeast formed, although to a smaller extent than after one month, but to largely decrease the amounts of volatile acids and esters. Only traces of aldehyde are found in either exposed or unexposed liquids.

After six months, comparison of the exposed with the unexposed liquids fermented with the champagne yeast shows that the weights of yeast, aldehydes, and higher alcohols are greater, and that of esters is less, in the former than in the latter. Addition of mercuric chloride to the liquid fermented by the champagne yeast in a shallow vessel for six months reduces the amounts of yeast and aldehydes formed, but increases those of esters, ethyl alcohol, and higher alcohols, probably by protecting these from oxidation.

E. H.

Influence of Inorganic Salts, particularly of Stannous Chloride, on Fermentation. G. GIMEL (*Compt. rend.*, 1908, 147, 1324—1326).—Kayser and Marchand have shown that small traces of manganese favour alcoholic fermentation. The author now finds that the effect of stannous chloride on various species of yeast is even more marked, a culture containing one part in 10,000 producing 4% more alcohol than the control.

G. B.

Denitrification. MASANIELLO CINGOLANI (*Chem. Zentr.*, 1908, ii, 19, 1626; from *Staz. sperim. agrar. ital.*, 1908, 41, 530—540).—Five grams of fresh faeces (from a calf) were placed in 100 c.c. of a 0.3% solution of sodium nitrate, and two organisms which cause denitrification were isolated. Both were cocci, and they are termed *Bacillus porticensis denitrificans*- α and - β . The latter attacks nitrates, reducing them to nitrites, but it has no further action; the former reduces nitrites to ammonia and then to free nitrogen, but has no action on nitrates. Ammonia is said to be an intermediate product; when ammonium nitrate is used in place of sodium nitrate, the reaction is much accelerated.

E. J. R.

Sewage Purification. W. MAIR (*J. Hygiene*, 1909, 8, 609—654).—An experimental discussion of the methods of sewage purification, especially in relation to the part played by bacteria. In the contact beds, a considerable proportion of the organic nitrogen disappears as gas as a result of alternate nitrification and denitrification. The amount of nitrate in the effluent is a direct measure of the degree of aeration to which the sewage has been exposed in the percolating beds. If the nitrate disappears from a contact bed, it is a sign that the bed is being overworked; the denitrifying process being allowed to proceed too far. So long as nitrate is present, cultures of the *Bacillus hyponitrosus* have no putrefactive odour.

W. D. H.

Standardisation of Disinfectants. Emulsified Disinfectants. HARRIETTE CHICK and CHARLES J. MARTIN (*J. Hygiene*, 1909, 8, 654—697, 698—703. Compare Watson, *Abstr.*, 1908, ii, 976).—In any method of standardisation, it is necessary that the tests be carried out under constant conditions of temperature, culture medium,

number of bacteria per unit volume, and duration of observation. A logarithmic relation exists between concentration of the disinfectant and velocity of disinfection. In the case of metallic salts, traces of the disinfectant carried over with the test sample must be neutralised by sulphide; in the case of mercuric chloride, an excess of sulphide is necessary to decompose a compound formed between the salt and the substance of the bacterium.

Some disinfectants are more efficient against one species of bacterium, others against another. In the case of spores, metallic salts are most efficient. As a rule, virulent species are more difficult to kill than non-virulent ones. In the process of standardisation, it is therefore necessary to fix on a particular organism in the test. *Bacillus typhosus* is the best to employ, but a non-virulent strain should be selected in order to minimise danger to those engaged in the test.

The presence of 10% of blood-serum reduces the efficiency of 1% of phenol by about 12%. The effect on emulsified disinfectants is somewhat greater. The presence of finely particulate matter affects the germicidal value of emulsified disinfectants containing the higher phenols to a much greater extent than it does solutions of phenol. The removal of an emulsion of the higher phenols by bacteria, by finely divided animal charcoal, by dust, etc., obeys in all cases the same quantitative laws. Finer emulsions are more seriously reduced in value by particulate matter than coarser ones.

The removal of an emulsion of higher phenols by bacteria is in the first instance a process of adsorption; disinfectants of this class possess superior efficiency, because owing to this adsorption the bacteria rapidly become surrounded by the disinfectant in much greater concentration than exists throughout the liquid. W. D. H.

Degradation of Sugar during the Respiratory Process.

P. BOYSEN JENSEN (*Ber. Deut. bot. Ges.*, 1908, 26a, 666—667).—Alcoholic fermentation is identical with the intramolecular respiration of seeds, and the latter process is the starting point for normal respiration. In alcoholic fermentation, dihydroxyacetone is formed as an intermediate product; if hydroxylamine hydrochloride is added during fermentation, the oxime is formed in small quantity, and after the end of the fermentation, dihydroxyacetone can be isolated as its phenylmethylosazone. Dihydroxyacetone, prepared by Fenton and Jackson's method, yields, on fermentation, alcohol and carbon dioxide. Zymase consists, therefore, of two separate enzymes: *dextrase* and *dihydroxyacetonease*.

In a glycerol solution of dextrose, the second of these is inhibited, so that dihydroxyacetone is the end product. Dihydroxyacetone is also decomposed by oxydase, yielding carbon dioxide and water, but not alcohol. The fact that oxydase attacks neither sugar nor alcohol leads to the hypothesis that in the normal respiration of plants, dihydroxyacetone is the immediate precursor of the carbon dioxide and water; in intramolecular respiration, that is, in an atmosphere deprived of oxygen, it yields carbon dioxide and alcohol. The process of normal respiration can therefore be imitated by adding oxydase to

a fermenting dextrose, the degradation of the latter then taking place as follows: $C_6H_6O_6 \rightarrow OH \cdot CH_2 \cdot CO \cdot CH_2 \cdot OH \rightarrow CO_2 + H_2O$.

G. B.

The Rôle of Zymases in the Respiratory Processes of Seed-plants. S. KOSTYTSCHIEFF (*Biochem. Zeitsch.* 1908, 15, 164—195).—It has been shown by various observers that anaerobic respiration of pea-seeds is in all essential respects identical with the process of typical alcoholic fermentation. Experiments were carried out to throw further light on the mechanism of the reaction, by determining the amount of alcohol and carbon dioxide produced by pea-seeds and wheat embryos in the presence and absence of air, and in the presence of sugar, and also in the intermediate products formed from the latter by yeast fermentation. It was shown that the assumption that the alcoholic fermentation of seed-plants is independent of the oxygen respiration will not hold, in that such powerful excitants of alcoholic fermentation as pea-seeds produce, with full aeration, no alcohol. Furthermore, alcohol does not appear to be a normal intermediate product of sugar utilisation, for although pea-seeds will when aerated consume slowly the alcohol previously produced in absence of air, the consumption is not accompanied by an increased output of carbon dioxide. Wheat-seeds and embryos do not possess this capacity for alcohol consumption at all. On the other hand, dextrose causes an increased production of carbon dioxide. Solutions containing the intermediate products of fermentation (produced, for example, by the action of zymase in the presence of phosphates) cause an even larger carbon dioxide output than sugar itself. The greater part of the primary products of the zymase action appear to be immediately oxidised further without production of alcohol. The presence of the latter substance in certain seeds is to be explained on the assumption that these primary products do not all undergo immediate oxidation; in this case they are converted into carbon dioxide and alcohol, which latter must be regarded as a by-product only, of the respiratory processes.

S. B. S.

Phosphorus and the Formation of Amino-acids in Higher Plants. FRANCESCO SCURTI (*Chem. Zentr.*, 1908, ii, 16, 1370; from *Staz. sperim. agrar. ital.*, 1908, 41, 456—470).—The non-protein nitrogen compounds in plants are made up of the same substances as are found in germinating seeds and in young seedlings. Phosphorus is known to play an important part in protein formation, and the author considers that it may function in the formation of amino-acids.

E. J. R.

Occurrence and Rôle of Zinc in Plants. MAURICE JAVILLIER (*Chem. Zentr.*, 1908, ii, 1828; from *Bull. Sci. Pharm.*, 1908, 15, 559—565).—Besides certain well-defined varieties growing on soils which are rich in zinc, most plants contain appreciable quantities of this metal, which is especially found in Conifers. The growth of yeast is favoured by small quantities of zinc, although the optimum concentration of the metal is greater than in the case of *Aspergillus*.

Zinc can also act favourably on the growth of Phanerogams, for example, cereals. G. B.

The Chemical Processes of Ripening. The Ripening of Oranges. Presence of Asparagine and Glutamine in the Juice. FRANCESCO SCURTI and G. DE PLATO (*Chem. Zentr.*, 1908, ii, 16, 1370; from *Staz. sperim. agrar. ital.*, 1908, 41, 435—455).—The authors draw the following conclusions from their experiments: (1) The acidity of oranges is due to citric and malic acids, the quantity of which increases in the earlier stages, but falls off afterwards. In this respect oranges resemble other acid fruits. (2) The sugars present are dextrose, lævulose, and sucrose; the two first steadily increase during ripening, whilst the sucrose decreases. There is more lævulose than dextrose. In sweet and in bitter oranges there is more reducing sugar than sucrose, but not in common Italian oranges. No relationship could be discovered between acidity and the amount of sucrose present. (3) The total nitrogenous matter decreases, but the loss falls entirely on the proteins precipitated by basic lead acetate and not on the other nitrogen compounds, which remain constant in amount. These non-protein compounds consist chiefly of asparagine and glutamine it is significant that these two, which are constantly associated with germination and assimilation, should also be present during ripening.

E. J. R.

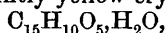
The First Stages in the Development of Perennial Plants compared with those of Annuals. GUSTAVE ANDRÉ (*Compt. rend.*, 1908, 47, 1485—1487).—During the first two years of the life of a perennial plant, the root is much more developed, relative to the shoot, than is the case in annual plants, and contains a larger proportion of phosphates than the root of the latter. G. B.

Constituents of the Fruit of *Rhamnus cathartica*. NICOLAI A. WALJASCHKO and N. KRASOWSKY (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1502—1509).—Discussion of previous work on this subject (see Tschirch and Pedersen, *Abstr.*, 1898, i, 599; Hesse, *Abstr.*, 1900, i, 40; Tschirch and Polacco, *Abstr.*, 1900, i, 681) and of the results obtained by Krasowsky (see following abstract). T. H. P.

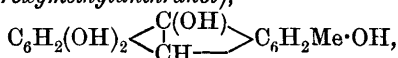
Berries of *Rhamnus cathartica* and the Methods of Separating the Substances Contained Therein. N. KRASOWSKY (*J. Russ. Phys. Chem. Soc.*, 1908, 40, 1510—1569. Compare Tschirch and Polacco, *Abstr.*, 1900, i, 681).—After describing in detail the methods used for extracting the various constituents from the berries and purifying them, the author discusses separately each of these constituents, which are as follows.

(1) Quercetin, apparently identical with that obtained from quercitrin. (2) Rhamnetin. (3) Xanthorhamnin (compare Tanret and Tanret, *Abstr.*, 1900, i, 185), which is hydrolysed by dilute sulphuric acid, giving rhamnetin, galactose, and rhamnose (2 mols.): $C_{34}H_{42}O_{20} + 3H_2O = C_{15}H_9O_7Me + C_6H_{12}O_6 + 2C_6H_{12}O_5$. The only difference between the product described by Tanret and Tanret (*loc. cit.*) and that obtained

by the author is that the former gives golden-yellow crystals, whilst the latter separates in faintly yellow crystals. (4) Emodin,



m. p. 254—255°, which is a trihydroxymethylanthraquinone, and closely resembles frangula-emodin (compare Oesterle, Abstr., 1900, i, 304). (5) *Rhamnoxanthin*, $C_{21}H_{20}O_9 \cdot H_2O$, which is reduced to methylanthracene by zinc dust in an atmosphere of hydrogen, and readily undergoes transformation into emodin when crystallised repeatedly from alcohol. *Tetra-acetylramnoxanthin*, $C_{21}H_{16}O_9Ac_4$, crystallises from acetic acid in microscopic, pale yellow needles, m. p. 146—149°. Rhamnoxanthin is a glucoside, and is resolved into emodin and methylpentose on hydrolysis with dilute hydrochloric acid: $C_{21}H_{20}O_9 + H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5$. (6) *Jesterin*, $C_{26}H_{30}O_{13} \cdot \frac{1}{2}H_2O$, m. p. 205—218°, which is a glucoside yielding emodinanthranol, hexose, and pentose on hydrolysis: $C_{26}H_{30}O_{13} + 2H_2O = C_{15}H_{12}O_4 + C_6H_{12}O_6 + C_5H_{10}O_5$. (7) *Rhamnocathartin*, $C_{27}H_{30}O_{14}$, which is hydrolysed by alkali, giving rhamnoxanthin and an unknown hexose, $C_{27}H_{30}O_{14} + H_2O = C_{21}H_{20}O_9 + C_6H_{12}O_6$, and by acid, giving emodin, rhamnose, and hexose, thus: $C_{27}H_{30}O_{14} + 2H_2O = C_{15}H_{10}O_5 + C_6H_{12}O_5 + C_6H_{12}O_6$. (8) *Emodinanthranol* (trihydroxymethylanthranol),



which separates from ethyl acetate in faintly yellow crystals, m. p. 280°; its *tetra-acetyl* derivative, $C_{15}H_8O_4Ac_4$, crystallises from alcohol in pale yellow plates, m. p. 197°. In alkaline solution, emodinanthranol is oxidised by the oxygen of the air, yielding emodin, $C_6H_2(OH)_2 \begin{array}{c} \text{CO} \\ | \\ \text{CO} \end{array} \text{---} C_6H_2Me \cdot OH$, reduction of which by means of tin and hydrochloric acid yields emodinanthranol. (9) Rhamnonigrin or a mixture of rhamnonigrins, which were not characterised. (10) Succinic acid.

The berries of *Rhamnus cathartica* contain dextrose in the free state, and galactose, rhamnose, and pentose only in the form of glucosides. T. H. P.

Chemistry of the Higher Fungi. II. *Polyporus ignarius*.

JULIUS ZELLNER (*Monatsh.*, 1908, 29, 1171—1187. Compare Abstr., 1908, ii, 216).—The constituents of *Polyporus* closely resemble those of *Trametes suaveolens* previously examined (*loc. cit.*), in accordance with the fact that these closely-related fungi are parasitic on the same host (willow). The ash (with much calcium sulphate), ergosterols, fats, resins, soluble proteins and volatile substances, dextrin-like carbohydrates (which are abundantly present), and ferments are all very similar. The constituents of the cell wall, however, are different, and, unlike *Trametes*, *Polyporus* contains mannitol and tannins, but no mycose. G. B.

Presence of Urea in Certain Higher Fungi. A. GORIS and M. MASCRÉ (*Compt. rend.*, 1908, 147, 1488—1489).—Young specimens of *Psolliota campestris* contain urea to the extent of 2.75%, and mature ones, 4.3% of their dry weight (compare Abstr., 1903, ii, 567). G. B.

Some Mannas and Related Products. ALFRED EBERT (*Chem. Zentr.*, 1908, ii, 1874—1875; from *Zeitsch. Allg. Oesterr. Apoth. Ver.*, 1908, 46, 427—429, 439—440, 447—450, 459—460, 467—470, 479—481, 491—492, 503—504, 515—516, 529—530).—This gives the proximate composition of a number of Persian and Australian mannas. The figures given below are expressed in percentages of the crude materials, except where otherwise stated.

"Trehala," derived from the larval cocoons of a beetle living on the stems and flowering heads of *Echinops persicus*, contains moisture 11.1, ash 2.6, trehalose 17.5, gum (yielding mucic acid on oxidation) 27.1, and tannin and residue 44.5; of the residue, 71% consists of a starch giving a reddish-brown colour with iodine.

"Terendschabin" is exuded from the leaves and thorns of *Alhagi maurorum*; it consists of moisture 5.2, ash 9.4, chlorophyll with some gum 0.5, sucrose 42.0, a gum (yielding oxalic acid on oxidation) 20.3, and residue 32.0.

"Bide-khecht," derived from the leaves of *Salix fragilis*, contains moisture 4.1, ash 25.4, dextrose 17.5, sucrose 50.1, matter soluble in water 13.3, and insoluble matter 19.2. The sample was adulterated with wheat-flour and gypsum.

"Gueze-elefi," from *Quercus vallonica*, contains moisture 7.5, ash 5.4, sucrose 53.2, dextrose 19.0, gum (yielding mucic acid on oxidation) 10.3, and insoluble residue 10.0.

"Schir-Khist," the manna from *Cotoneaster nummularia*, contains moisture 15.9, ash 2.2, dextrose 37.5, sucrose 12.9, gum (yielding mucic acid) 24.2, and insoluble residue 9.5.

"Eucalyptus manna," from *E. Gunnii*, var. *rubida*, contains moisture 9.7, ash 6.8, melitose 68.5, dextrose 20.9, sucrose 2.1, gum (yielding mucic acid) 3.2 and insoluble residue 4.3. A specimen from *E. pulverulenta*, S., consists of melitose 21.4, lævulose 16.2, sucrose 60.0, and insoluble residue 1.0.

Tabasheer, a siliceous deposit from bamboo culms, especially *Bambusa stricta* R., contains sucrose 4.2, gum (yielding mucic acid) 2.6, and inorganic residue about 90 (compare Ince, Abstr., 1897, ii, 278).

T. A. H.

Mode of Combination of Mineral and Organic Acids in Wine. ANTONIO QUARTAROLI (*Bied. Zentr.*, 1908, 37, 862; from *Staz. sper. agrar. ital.*, 1906, 39, 993).—The mineral acids of wine are in the form of salts unless present in very large amounts. Addition of mineral acids can be detected by determining the electrical conductivity, which is distinctly increased by adding potassium hydroxide to wine containing neither mineral nor free organic acid. When organic acids have been liberated by addition of mineral acid, the conductivity is diminished by adding potassium hydroxide. Addition of 1 gram of sulphuric acid per litre can be detected in this manner.

N. H. J. M.

Amounts of Nutrients Utilised by Sugar-beet in the First Year, and their Relation to the Amount of Sugar in the Roots. KARL ANDRLÍK and JOSEF URBAN (*Zeitsch. Zuckerind. Böhm.*, 1909, 33, 221—240. Compare Abstr., 1908, ii, 1066).—For

a yield of 400 quintals per hectare of roots, it was found that the indispensable amounts of phosphoric acid, nitrogen, and potash were 65.1, 139.8, and 168.6 kilos. respectively. The amount of phosphoric acid is thus approximately the mean of the amounts found by Hoffmann (71.4) and by Willfarth (62.0 kilos.), whilst the amount of nitrogen is lower, and that of potash higher, than those given by Hoffmann and Willfarth; the yield of sugar in Bohemia was, however, also higher than the yields obtained in Germany.

At present the most favourable relations of the different nutrients are $N=2.15$ and $K_2O=2.59$ to 1 part P_2O_5 . When, by selection, roots are obtained containing higher amounts of sugar, it will be necessary to ascertain whether these amounts still hold good.

N. H. J. M.

Influence of Some Calcium Compounds on the Manurial Value of Ammonium Sulphate and Calcium Cyanamide.

ALEXANDER STEBUTT (*Bied. Zentr.*, 1908, 37, 805—806; from *Fuhling's Landw. Zeit.*, 1907, 56, 669).—Pot experiments in which mustard was grown in loam, containing 0.09% of calcium carbonate, and manured with ammonium sulphate and calcium cyanamide in conjunction with calcium oxide, carbonate, and sulphate respectively. The conclusion is drawn that, under normal conditions, the calcium compounds are without effect on the action of the two nitrogenous manures.

N. H. J. M.

Is Dicyanodiamide Poisonous to Crops? OSCAR LOEW (*Chem. Zeit.*, 1909, 33, 21—22. Compare Abstr., 1908, ii, 775).—Pot experiments with barley in garden soil with mineral manures and with $N=0.75$ gram in the form of dicyanodiamide (1 and 2) and as ammonium sulphate (3). The soil of (1) was heated at 100° for one hour. A fourth pot was without nitrogen.

The highest amount of dry matter (43.2 grams) was obtained in the pot which had ammonium sulphate. Dicyanodiamide in heated soil gave the next highest amount (31.3 grams), then the pot which had no nitrogen (24.8 grams), and last, dicyanodiamide in non-sterilised soil. The conclusion is drawn that dicyanodiamide is directly utilised by plants under sterilised conditions, but that in unsterilised soil it is converted by microbes into substances injurious to plants.

N. H. J. M.

Phosphoric Acid with Different Citric Acid Solubility as Manure for Meadows. HANNO SVOBODA (*Chem. Zentr.*, 1908, ii, 1893; from *Zeits. Landw. Versuchswes. Oesterr.*, 1908, 11, 733—774).—Whilst the rapidity of action of phosphate manures depends on a high percentage of phosphoric acid soluble in citric acid, the value of the manure depends mainly on the amount of total phosphoric acid.

N. H. J. M.

The Causes which Determine the Replacement of Potassium of Leucite in Soils. LUIGI BERNARDINI (*Chem. Zentr.*, 1908, ii, 15, 1285; from *Staz. sperim. agrar. ital.*, 1908, 41, 304—320).—The leucite used contained when dried at 110° : SiO_2 , 56.89; Al_2O_3 + Fe_2O_3 , 24.08; K_2O , 15.63; Na_2O , 1.77; CaO , 1.11; MgO , traces.

The solubility was determined in hydrochloric acid, 5% acetic acid, water, a solution of carbon dioxide in water, and in a number of salt solutions including sodium chloride, nitrate and sulphate, ammonium chloride, nitrate, sulphate and carbonate, calcium chloride, nitrate, sulphate and dihydrogen phosphate, and magnesium chloride, nitrate and sulphate. Sodium and ammonium salts caused a good deal of potassium to go into solution; magnesium and calcium salts, on the other hand, had only a slight solvent power. The author considers that double decomposition takes place, the potassium of the leucite being replaced by sodium or ammonium. Ammonia produced in the soil by bacterial processes would therefore react with leucite, forming an insoluble ammonium leucite, whilst at the same time a soluble potassium compound is formed which is available for plants. The ammonia can no longer be washed away by rain, but may still be nitrified.

E. J. R.

Humus-Silicic Acid. HJALMAR VON FEILITZEN (*Bied. Zentr.*, 1908, 37, 793—794; from *Svenska Mosskulturforening Tidskr.*, 1907; and *Wiener landw. Zeit.*, 1907, No. 43).—The manure, which is prepared from peat, has the following composition: water, 10.12; organic matter, 46.13; N, 1.26; K₂O, 2.64; CaO, 6.44; P₂O₅ (a) soluble in boiling 24% HCl, 3.33; and (b) citrate soluble, 2.55%.

Application of the manure alone (1000 kilos. per hectare) to a poor, sandy soil increased the yield of peas, but was without effect on oats, owing to the deficiency of nitrogen in the soil. When applied in conjunction with other manures, humus-silicic acid gave similar results with peas, and very slightly increased the yield of oats.

N. H. J. M.