attempts to solve them are discussed. Debye's formula seems also to be applicable, at least roughly, to solutions in polar solvents such as alcohol and water.

The free orientations of dipole molecules are even more hindered when they are located as in a crystal lattice, on account of the strong internal potential fields. Still the existence of a pronounced dispersion as in ice points to a probability for spontaneous passage of a molecule from one direction to another. J. Errara and H. Sack (p. 687) find a similar dispersion also in the crystals of magnesium and yttrium platinocyanides and attribute this to the existence of one or two very loosely bound water molecules per platinum atom. It is also observed that the orientation of the field with respect to the axes has a pronounced effect.

When an ionic lattice is placed in an electric field there is an additional polarisation due to the relative displacement of ions. This additional polarisation increases with rise in temperature while the usual volume polarisation decreases. E. Bretscher (p. 685) has calculated the resulting temperature coefficient of dielectric constant on the basis of the existing theories of interionic potential for the case of NaCl and CaF_2 crystals, and finds a discrepancy between calculated and experimental values, which is attributed to certain imperfections in the theory.

The symposium is thus seen to cover almost the whole field of the dielectric properties of matter, and when taken along with the exhaustive table of moments given as an appendix, this volume of the *Faraday Society Journal* is easily the most up-to-date guide to the subject of Dipole Moments.

M. A. GOVINDA RAU.

Industrial Possibilities of Some Research Work done in India. *

ALTHOUGH, prior to the time of the Great War, efforts at industrial developments in India were not wanting, yet, the phenomenal enthusiasm for the starting of new industries and the serious attempts to explore and exploit industrial possibilities in the country witnessed during the period 1916-18, can be directly traced to the stimulus given to industrial research by the Great War. Since then, the interest has been, more or less, kept up and energetic steps are now being taken by the Central Government to investigate market conditions and centralise research work in industries.

Original work carried out in recent years holding out industrial possibilities, can be reviewed under 5 heads:—(*a*) Researches resulting in permanent factories, (*b*) Researches resulting in factory operations still in the initial stage, (*c*) Researches resulting in factories operating on a commercial scale, but which for various reasons, have been discontinued, (*d*) Researches which have been of proved commercial interest, but which have not been fully exploited, and (*e*) Researches that await commercial consideration.

The researches pertaining to the distillation of sandalwood oil, the utilisation of local oils for soap manufacture and the manufacture of turpentine may be mentioned as examples which come under the first group. Under the second category, comes the manufacture of ceramic wares and gas mantles. Acetone with increased demand under the exigencies of War, may be cited as an instance of a temporary industrial venture. Other industries which may be mentioned in this connection are the manufacture of glue and gelatine, thymol and strawboards. The manufacture of glue deserves careful consideration; a material of a somewhat inferior quality can be produced as a cottage industry and may therefore prove of particular interest to India.

Researches of proved commercial importance but which have not been fully exploited, deserve special consideration. They concern improvements in large-scale industries already existing in India. The lac industry is a case in point. It is now faced with competitive synthetic substitutes on all sides, but possesses certain virtues which give the natural resinous product a distinctive character; the latter, therefore, cannot be easily substituted. This is particularly true in the manufacture of electrical insulators, where the decomposition products of lac which may be formed when exposed to high electrical pressures, are still non-conducting, which is not the case with similarly formed products from artificial substitutes. By imposing a strict scientific control during the various stages of the industry—production, manufacture, storage and transport, and exploiting the by-products of the factory, it should be possible to set the whole industry in order and the natural lac will undoubtedly hold its own against competition.

Another industry which offers considerable scope for improvement, is the fibre industry. In the year 1931, of the 3½ million tons of coir produced for spinning, only 1/10 million tons were used, and here is ample room for enterprising inventive genius to utilise the waste. The short fibres which can be recovered from the cotton seed appears to be quite suited for paper manufacture, and the pre-treatment of this and other cellulosic materials for paper manufacture demand careful and systematic enquiry. Fermentation or "retting" may be found cheaper than chemical treatment. Other varieties of fibres that are available in India are the *sann* hemp, linseed straw, megasse, rice straw and bamboo.

The problems of the oil industry in its many ramifications are so numerous that there is ample room for continued activity. The proposed Technological Laboratory at Nagpur to be subsidised by the Lakshminarayan bequest intends to take up the subject, and it is hoped that fresh lines of enquiry may be opened up.

The question of power alcohol has been in the minds of Indian technologists for many years, but although the country abounds in exceptionally cheap raw materials, such as mahua, cassava and artichokes whose utility as raw materials have been tested, the production of alcohol has not proceeded much beyond the laboratory trials. Papaya has been shown to

* Abstract of a course of two lectures delivered by Dr. Gilbert J. Fowler, D.Sc., F.I.C., under the auspices of the Society of Biological Chemists, India, on the 22nd and 26th October 1934.

contain more fermentable sugar per acre than any other crop in India, and holds out vast possibilities for industrial exploitation.

Another source of natural wealth which requires only energy and persistence to be utilised with great benefit to the food supply of the mass of the population, is human and animal wastes including activated sludge which can be employed as a starter for composting town and farm refuse thus yielding a valuable fertiliser.

Other industries whose progress can be ensured by systematic laboratory investigations are the dyeing industry, wood distillation, chromium products, refining of crude saltpetre, preparation of papain and manufacture of vinegar.

A large proportion of the literature that has accumulated, concerns those problems, which await commercial consideration. To mention only a few, a good deal of work has been carried out on cereals and cereal products, and in the fruit and vegetable industry including its by-products, such as, papain, pectin, tartaric and citric acids, beverages and condiments. With the exception of rose water and sandal oil, little effort has been made to develop the possibilities of perfumes from Indian flowers and scented grasses. The economic handling of the enormous quantities of molasses from sugar factories, and its utilisation, presents numerous problems awaiting solution.

The argument that, provided raw materials could be exported with profit, it would be unnecessary to spend money in setting up factories to utilise the raw materials and convert them into useful commodities, is illusory since it disregards the importance of the circulation of wealth. There is a considerable field in India, to-day, for small industries requiring comparatively little capital, and no opportunity should be lost to exploit them. The large-scale industries require not only considerable capital, but also courage and vision. A country which has produced Jamsetjee Tata may hope for other captains of industry.

"Ultimately all wealth must come from land since men cannot live without food. In India, it cannot be doubted that every effort should be directed towards a more intensive agriculture. ....Improved agriculture should render possible a higher standard of life in the countless villages of India, and with this higher standard a greatly increased demand for the products of mechanical industry."

B. N. S.

Science Notes.

Acetyl Group in Lignin.—Mr. Pulin Behari Sarkar of the Dacca University writes: "The fact that wood and other lignified materials when distilled with dilute mineral acids afford acetic acid, has caused several investigators to assume that lignin contains acetyl groups. This is still an unsettled fact, as no lignin preparation until now has been found to give acetic acid under similar conditions. According to Jonas (*Papier Fabrikant.*, 1928, **26**, 221) the acetyl group is split off from lignin by very strong HCl during isolation even in the cold. He includes therefore an acetyl group in his modification of Schrauth's formula. Heuser (*Paper Trade Jour.*, 1930, **83**, **75**) also considers the acetyl group as characteristic of lignin.

"Raw jute but not lignin, even when separated with 42 %HCl under the mildest conditions, gave acetic acid on distillation with dilute H_2SO_4, or on being first boiled with KOH and then steam distilled after acidification with H_2SO_4. Acetic acid was estimated in raw jute and jute delignified with ClO_2 without any previous boiling with 1 % alkali. It has been found that raw jute gave 6·26 % acetic acid while delignified jute gave 7·54 %. As jute contains 15·43 % of lignin, 100 g. of raw jute means 84·57 g. of delignified jute. Again, since 100 g. of delignified jute gave 7·54 g. of acetic acid, 84·57 g. of it would give 6·37 g. of the acid. Actually, raw jute gave 6·25 % acetic acid, which fact therefore proves in an indirect way the absence of acetyl group in lignin."

* * *

Absence of Aldehydo-group in Lignin.—Mr. Pulin Behari Sarkar of the Dacca University writes: "In a former communication (*Curr. Sci.*, 1934, **2**, 406) it has been pointed out by the author that the reducing action of lignin is due to the two OH groups attached to the benzene ring in the ortho-position. Further proof has now been obtained for this from the results of methylation.

Lignin isolated by 42 % HCl at room temperature has been separated into two fractions by dilute NaOH. The soluble portion which reduces Fehling's solution very readily, has been methylated with dimethyl sulphate and 45 % KOH at a temperature below 25° (Urban, *Cellulose Chemie.*, 1926, **7**, 73). After a single treatment the reducing property diminished considerably and after the second, it disappeared altogether. The colour changed from deep black to light brown and the product no longer dissolved in alkali. As only the OH groups are attacked by dimethyl sulphate in presence of alkali, the absence of reducing property in methylated lignin therefore proves conclusively that lignin contains no aldehydo-group.

It may be mentioned here that the loose combination of dimethyl sulphate with the CHO group as in the case of sugars, breaks up easily on warming with dilute acids or alkalis."

* * *

Harvesting Sugarcane.—Mr. Y. K. Raghunatha Rao, Chemist, Mandya Sugar Factory, writes: "To know when a sugarcane crop is ripe for harvesting it has been the practice to cut down several stalks, send them to the factory for pressing out in a handmill and analyse the juice. Lately the method is the inexpensive and simple one of noting the 'Brix' or density of the juice from the cane in the field with a hand refractometer, the point of sampling being about the middle of the stalk. The pith is bored out from an internode of the cane with a 'Gempol' knife and pressed to give a drop or two of the juice, whose Brix is noted. A variant of the method is to collect the juice drops from all the stalks in four selected stools and observe the brix of the mixed sample.[1]

[1] *I. S. J.*, 1933, pp. 37, 274, 359; 1934, pp. 235, 240, 320.