

moment can set itself in any direction independent of the other, and the resulting moment of the molecule will be  $\sqrt{2} m$  irrespective of the number of links above a certain limit. This has been experimentally observed.<sup>47</sup> Recently Kuhn<sup>48</sup> has calculated the shape of such molecules to be that of a bean the ratio of whose axes are 6 : 2.3 : 1. Further the electron interference measure-

ments with 1,5-dichloropentane<sup>49</sup> show that in this case the distance between the end chlorine atoms cannot be defined.

Much of the above review shows how general is the phenomenon of intra-molecular rotation and how our ideas about it are still very qualitative. There is certainly ample scope for precise and quantitative investigations in this field.

### Study of Plant Tissue Fluids.\*

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#### CHEMICAL INVESTIGATIONS.

A CHEMICAL study of the plant sap usually consists of a proximate analysis of the more important constituents, like total solids, total ash, total and amino nitrogens, sugars and ash constituents particularly P, K and Ca. In special cases, a determination of some definite constituent pertinent to the investigation, is carried out. In a study of the nature of rust resistance in wheat, Newton and Anderson<sup>114</sup> have determined the phenol content in the press juice of wheat plants varying in rust resistance. Link and others<sup>115</sup> have determined protocatechuric acid in the pigmented variety of onions, which is reputed to resist the fungus disease known as the onion smudge. Power and Chesnut<sup>116</sup> have examined the odorous constituents of the cotton plant, ammonia and trimethyl amine as the possible attractants of the boll-worm. Those varieties of cotton whose content of these constituents is low, are the ones more resistant to the attack of the boll-worm.

For most of the routine estimations, the centrifuged sap can be directly employed but for the estimation of certain constituents like sugars, phenols, a suitable method of clarification has to be adopted, with a view to eliminate substances interfering with the reaction. Immiscible solvents like ether or chloroform can be employed for extracting

the constituent from the sap; sometimes a preliminary separation of the associated impurities by precipitating them out with a miscible solvent like alcohol or acetone facilitates subsequent processes of purification. This is elegantly achieved by absorbing the sap on a filter pad or pulp<sup>117</sup> and extracting the impregnated mass with alcohol or acetone.

There are other physical methods of fractionating the sap into groups of constituents, which are helpful in the isolation of certain constituents; ultra-filtration, for example, will effect a separation of the sap roughly into two portions, the filtrate containing mostly the crystalloidal constituents of the tissue fluid. The advantage of such a fractionation lies in the fact that both the ultra-filtrate and the residue are obtained in a "pure" state without any admixture of adsorbents, solvents or salts. Electro-ultra-filtration also can be employed with advantage in many instances, to ensure a greater rapidity of separation. The application of such colloid chemical technique has not been extensively employed in a study of the plant tissue fluids.

A line of investigation which has received little attention is the assay of the tissue fluids from the viewpoint of its dynamic nature. It is determined by the presence of the reactive groups on the one hand, and the agents catalysing certain reactions on the other. The reactive groups, aldehydic, ketonic, amino, sulphhydryl, hydroxyl, phenolic, carboxyl, can easily be estimated chemically while the existence of the biochemical catalysts present in the fluid is

<sup>47</sup> L. Ebert and K. Höjendahl, *Z. Physikal. Ch.* (B), 1932, 15, 74.

<sup>48</sup> W. Kuhn, *Koll. Z.*, 1934, 68, 2.

\* Continued from *Curr. Sci.* 1934, 3, 58.

<sup>114</sup> Newton and Anderson, *Can. J. Res.*, 1929, 1, 85.

<sup>115</sup> Link et al., *J. Biol. Chem.*, 1929, 81, 309.

<sup>116</sup> Power and Chesnut, *J. Amer. Chem. Soc.*, 1925, 47, 1751.

<sup>49</sup> R. Wierl, *Ann. der Phys.*, 1931, 8, 521.

<sup>117</sup> Sreenivasaya and Sastri, *J.C.S., abst.*, 1931, A, 1342.

revealed through a study of the enzyme make up of the sap.<sup>118 119</sup>

#### COLLOID CHEMICAL INVESTIGATIONS.

Colloid chemical studies of plant tissue fluids open out a new field of investigation. The most comprehensive investigation which has been conducted is in connection with the study of drought resistance<sup>52</sup> and winter hardiness<sup>6, 53, 54, 55</sup> in plants. Particular

attention should be drawn to the systematic work of Gortner, Newton and others in the field. Newton<sup>120</sup> has studied the gold number of colloids in plant tissue fluids in the course of dialysis. The question of hydration of colloids in plant juices is a problem which has aroused wide interest in the field of plant physiology and this important and extensive subject should be dealt with in a separate review.

### The Origin of the Santra Orange.

By S. S. Bhat, M.Ag.

THE *Santra* orange is perhaps the most important table variety of citrus in India, its cultivation being chiefly concentrated in the Central Provinces and parts of Western India—more than 10,000 acres being under its cultivation in these tracts. It is a loose-skinned orange of the Tangarin type, and was for a long time accepted in this country as *Citrus aurantium*. The description of King orange (*Citrus nobilis*) of California seems to agree well with that of *Santra*. As there are other types of loose-skinned oranges like *Ladu* and *Kavla* growing in this country and closely related to *Santra*, it is difficult to say which of them is exactly the King orange. After a careful study of the various systems of classification of citrus fruits offered by different authors, Cheema and Bhat<sup>1</sup> have assigned to *Santra* the place and name of *Citrus nobilis*, Lour. var. *deliciosa* Swingle.

Like the other varieties of citrus, the *Santra* seems to have originated somewhere in Southern and Cochin China. Citrus varieties are even at present found in a wild state also at the foot of the Himalayas in the north-eastern part of India.<sup>2</sup> There are references to these fruits in the ancient Sanskrit literature. The very word *Santra* might have been derived from the Sanskrit word *sam* (सम्) meaning 'well', and *tri* (त्रि) meaning, 'to float', the whole word '*Santra*' meaning one that floats well. The fruit floats very well indeed in water. The

fruits were possibly observed coming to the southern parts floating in rivers from the wilds at the foot of the Himalayas. Hence the name *Santra* or the floating fruit seems to have been given to it in the earliest times as soon as it came to the notice of the ancient Sanskrit-knowing Aryans. The other word *Narangi*, which is another popular name of this fruit, is perhaps similarly derived. *Narangi* is a corruption of the word "*Nagaranga*" (नगरंग). *Naga* means red lead in Sanskrit. *Arangama* or *aranga* means one that becomes visible. Both these words on joining form the word *nagaranga*, and mean one that has the red lead colour and that becomes visible or floats. Both the words *santra* and *nagaranga* or *narangi* are descriptive. The application of descriptive words to objects in Sanskrit is almost universally traditional as in Latin. Further, names of oranges in the original Khasi languages are words like *Usoh niamtra*, *Usoh sim*, *Usoh mianger*, etc. These words do not seem to bear any relation to the word *santra*. However, it is perhaps possible to derive the word *santra* from the word *Usoh niamtra*. If the first letters of these two syllables 'U' and 'ni' are dropped, what remains comes to be 'soh' and 'amtra'. Now joining these two latter syllables, a word like '*sohamtra*', '*sontra*' or '*santra*' may be formed. Excepting this very doubtful likelihood, it seems, therefore, more probable that the word *santra* must have been a name given to the fruit by the Sanskrit-knowing Aryans. Bonavia suggests the derivation of the word *santra* from the word *Shans*, who were rulers in Assam about the beginning of the Christian era. This

<sup>118</sup> Sastri and Sreenivasaya, *Enzymes of the sandal leaf in health and disease* (unpublished).

<sup>119</sup> Votchel, C.A., 1924, 18, 2359.

<sup>1</sup> Cheema, G. S., and Bhat, S. S., "A Study of the Citrus varieties of the Bombay Presidency", *Curr. Sci.*, 1934, 2, 8, 298-304.

<sup>2</sup> Bonavia, E., "The cultivated oranges and lemons of India and Ceylon."

<sup>120</sup> Newton and Martin, *Can. J. Res.*, 1930, 3, 386.