

## THE SOURCE OF CARBON AS A DETERMINANT IN DIASTASE-FORMATION BY *ASP. ORYZAE*

As a natural sequence to our studies on the influence of the nature of nitrogen in diastase-formation,<sup>1,2</sup> a study of the role of carbohydrates in diastase formation by *Asp. oryzae* was taken up. The literature on this subject is meagre and though a certain amount of work has been done by Saito<sup>3</sup> and by Funke,<sup>4</sup> no details are available regarding the comparative diastase forming efficiency of the various forms of carbohydrates. The following is an attempt to determine the relative efficiencies of a group of the more commonly available carbohydrates in stimulating diastase-production by *A. oryzae*.

### EXPERIMENTAL

The carbohydrates used are arabinose, xylose, galactose, glucose, mannose, lactose, maltose, sucrose, raffinose, inulin and starch. The nitrogen source for the organism was potassium nitrate. The salt mixture was composed of  $\text{KH}_2\text{PO}_4$ —2.5 gms.,  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ —0.5 gm.,  $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ —0.5 gm.,  $\text{ZnSO}_4$ —0.025 gm.,  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ —0.05 gm. (dissolved in water, enough HCl added to dissolve the precipitate and volume made up to 250 c.c.).

The composition of the media was as follows: Carbohydrate equivalent to 20 mg. carbon;  $\text{KNO}_3$  equivalent to 2 mg. nitrogen; salt solution 0.5 c.c.

Final pH adjusted to 6.5 and vol. made up to 4 c.c. in each case. The method of growing the fungus<sup>5</sup> and the determination of the diastatic activity of the extracts<sup>6</sup> are the same as described previously. The results are given below:—

TABLE I  
Total Activity of the Extracts in Lintner Units

Carbohydrate	Arabinose	Xylose	Galactose	Glucose	Mannose	Lactose
Total Activity (L.U.)	23.1	31.9	28.8	127.9	19.6	15.7
Carbohydrate	Maltose	Sucrose	Raffinose	Inulin	Starch	
Total Activity (L.U.)	282.4	53.2	45.9	6.9	280.0	

### DISCUSSION AND CONCLUSIONS

The results show that starch and its hydrolytic products, glucose and maltose, are prominent as diastase producers. The other carbohydrates are not efficient in stimulating diastase-formation, the laevorotatory inulin being the poorest. The same phenomenon of increased diastase-production by starch, maltose and glucose in the case of *Asp. niger* has been observed by Funke.<sup>7</sup> Only slight growths were

obtained in the case of arabinose, lactose, mannose and inulin; a better growth was, however, secured with raffinose, galactose and xylose as the source of carbon. Sucrose gave rise to a fairly good growth, but in the case of maltose, glucose and starch there was abundant growth.

The increased diastase production by *Asp. oryzae* with maltose and starch as carbon sources is in accordance with Yudkin's "mass action theory of enzyme formation,"<sup>8</sup> which postulates the mediation of a precursor for the elaboration of adaptative enzyme. The precursor which in the cell may be quite a negligible amount is supposed to be in equilibrium with the enzyme. The addition of the precursor, usually the substrate or its hydrolytic intermediaries will shift the equilibrium in favour of an increase in the concentration of the enzyme.

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1. Bindal, A. N., and Sreenivasaya, M., *J. Sci. and Ind. Res.*, 1945, **3**, 386. 2. Raghavendra Rao, M. R., and Sreenivasaya, M., *Ibid.*, 1946, **4**, 654. 3. Saito, K., *C.A.*, 1911, **2**, 707. 4. Funke, *Ibid.*, 1929, **28**, 4489. 5. Raghavendra Rao, M. R., and Sreenivasaya, M., *Curr. Sci.*, 1946. 6. Bindal, A. N., and Sreenivasaya, M., *J. Sci. and Ind. Res.*, 1944, **3**, 245. 7. Funke, G. L., *Zbl. Bakt.*, 1923, **59**, 162. 8. Yudkin, J., *Biol. Revs.*, 1938, **13**, 93.

## REACTIONS BETWEEN IODINE AND SODIUM SALTS OF CARBOXYLIC ACIDS IN PRESENCE OF METAL IONS AS CATALYST

### (i) Photo-reactions—

A STUDY of reactions between iodine (dissolved in KI) and sodium salts of the following carboxylic acids in light (illuminated by 1000-watt lamp) indicates that contrary to the observations of Dhar and co-workers<sup>1,2</sup> and unlike the potassium oxalate iodine reaction, these reactions proceed with negligibly low velocity at room temperatures (about 20°–40° C.) provided the reactants used are pure and precautions are taken to account for the loss of iodine by evaporation. The acids examined are: Acetic, Propionic, Butyric, Succinic, Malic, Benzoic, Phthalic, Glycollic, Lactic, Malic, Tartaric, Citric, Mandelic and Glycemic.

Further, it is found that addition of traces of certain metallic ions like Mn (II), Cr (III), Fe (III), Co (II), Uo., (II), and Ce (III) promotes reactions with salts of hydroxycarboxylic acids to varying degrees. Out of these Mn (II) and Cr (III) are most effective in all cases. The carboxylic acids containing no -OH group, however, do not react in light in the presence of added catalysts with the exception of Mn (II) which is oxidised to  $\text{MnO}_2$  and hence precipitated. The factors which influence the reaction rates are many; thus increase of  $[\text{H}]^+$  ultimately suppresses the reaction, whereas withdrawal of I<sub>2</sub> in the equil-



ibrium  $I + I_2 \rightleftharpoons I_3$ , as the amount of  $I$  present progressively increases in the course of reaction, renders kinetic interpretation difficult. Moreover, in some reactions solid iodination products appear, which effectively rules out photochemical measurements for the purposes of determining the order of reaction, quantum yield, etc. There are a number of other complications, the details of which together with a probable mechanism of reaction based on the formation of co-ordination compounds will shortly appear in the *Journal of Indian Chemical Society*.

(ii) *Dark reactions*—

As expected from the behaviour of photo-reactions, no reaction takes place in the dark between salts of non-hydroxycarboxylic acids and iodine even in the presence of catalysts excepting Mn (II) which is very slowly oxidised and precipitated as  $MnO_2$ .

The reactions with salts of hydroxycarboxylic acids (mentioned above) are very slowly catalysed in the dark by some of the metallic ions specially Mn (II) and Cr (III) and also by Co (II) in some cases. No appreciable change takes place within the first ten to twelve hours, hence it was at first thought that there was no dark reaction at all and so reported in a preliminary communication.<sup>3</sup> Detailed investigation has shown that dark reactions do take place extremely slowly, and in some cases it takes a few weeks for completion of the reaction at the room temperature. Recently Qureshi and Veeriah<sup>4</sup> have reported similar observations in the case of sodium citrate-iodine reaction pointing out the existence of what may be called an "induction period". In the cases tried in this investigation long "induction periods" have been observed in dark reactions specially with those of citrate and malate in presence of Mn (II) as catalyst. The details of the dark reactions will be the subject of a separate communication to be published in due course.

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1. Mukerji and Dhar, *J. Ind. Chem. Soc.*, 1925, **2**, 277; *J. Phys. Chem.*, 1928, **32**, 1308; *J. Ind. Chem. Soc.*, 1929, **33**, 850. 2. Bhattacharya and Dhar, *Ibid.*, 1929, **6**, 451. 3. Srivastava, *Proc. Ind. Science Congress*, 1944, Part III, Abstracts, p. 26. 4. Qureshi and Veeriah, *Curr. Sci.*, 1946, **15**, 132.

### ALUMINIUM BORATE GEL

In continuation of our previous work<sup>1</sup> on the preparation of several sols and gels, an attempt has now been made in this laboratory to prepare aluminium borate gel and this communication describes the conditions under which it can be obtained.

When a saturated solution of borax is gradually added to aluminium chloride solution, a bulky precipitate of aluminium borate occurs which dissolves on shaking, but when sufficient quantity of borax has been added, the precipitate settles down in the form of a bulky opaque jelly. By regulating the concentration of borax, transparent jellies can be obtained, and the time of setting can be extended over a period of several hours.

To 2 c.c. of a solution of aluminium chloride, containing 24.88 g. of  $Al_2O_3$  per litre, varying amounts of 20 per cent. borax solution were added. The total volume was kept 5.5 c.c. in each case. The mixtures were shaken and the time of setting and the nature of the gel were recorded.

Amount of 20% borax (c.c.)	Time of setting (hours)	Nature of jelly
3.5	Instantaneous	Opaque
2.8	5	Opalescent
2.7	10	Transparent
2.6	18	Transparent
2.5	28	Transparent

These jellies are perfectly stable and exhibit no syneresis. On vigorous shaking they assume a liquid form and the viscous liquid so obtained again sets to a jelly on standing, and this process can be repeated several times. These jellies are, therefore, thixotropic in nature.

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1. Mushran, *Curr. Sci.*, 1945, **14**, 123, 200, 233; 1946, **15**, 24. Mushran and Prakash, *J. Ind. Chem. Soc.*, 1946, **23**, 111.

### COMPOSITION OF "RAINTREE" FRUITS

*Pithecolobium saman* or the Rain Tree is widely grown around Bangalore. The tree bears pods 4-5" long and  $\frac{1}{2}$ " broad, having 6 to 8 seeds which are enveloped in a sweet edible pulp. The pods are readily eaten by cattle. The pods ripen from March to May and they are specially welcome because cattle food is not available during the dry season in plenty.

Analysis of six samples of the pods of the Rain Tree have been carried out to determine their nutritive value. The average of the results is given in the following table. Figures in column 7 were obtained by subtracting the sum of the rest of the constituents from 100.

Chemical Compositions (per cent.) of the  
Kernels, Seeds and Whole Pods

	Whole pods	Kernels	Seeds
1. Moisture	15.30	16.05	7.55
2. Ash	3.19	3.01	3.54
3. Fat	2.07	1.27	4.26
4. Proteins	12.71	10.55	28.57
5. Crude Fibre	11.43	10.77	14.05
6. Sugars	29.71	35.59	5.36
7. Carbohydrates (other than sugars and crude fibre)	25.59	22.86	36.67
8. Caloric value (100 gm. fresh material)	298.15	294.71	329.02