

I am indebted to Dr. K. Rangadhama Rao for the specimen of germanium.  
Central College,  
Bangalore.  
January 10, 1945.

S. RAMACHANDRA RAO.

\* All susceptibility values are given in  $10^{-6}$  unit.  
(*Ann. der Phys.*, 1912, 37, 657. *Angus, Proc. Roy. Soc.* 1932, 136, 569.)

#### A NEW METHOD OF DESIGNING PACKED COLUMNS

PACKED columns have been designed using almost exclusively overall transfer coefficients and overall H.T.U.s rather than individual film coefficients and individual H.T.U.s. Since the overall transfer coefficients and overall H.T.U.s are defined (for distillation) as follows:—

$$\frac{1}{K_G a} = \frac{1}{k_G a} + \frac{m}{k_L a}$$

$$\frac{1}{K_L a} = \frac{1}{k_L a} + \frac{1}{m k_G a}$$

$$H.T.U_{OG} = H.T.U_G + H.T.U_L \frac{mG}{L}$$

$$H.T.U_{OL} = H.T.U_L + H.T.U_G \frac{L}{mG}$$

where  $G$  = the rate of flow of the vapours in  
 $\frac{\text{lb. moles}}{\text{hr.} \times \text{sq. ft.}}$

$L$  = the rate of flow of the overflow in  
 $\frac{\text{lb. moles}}{\text{hr.} \times \text{sq. ft.}}$

$m$  = the slope of the equilibrium curve. their use for design purposes can only be justified when they are constant. For example this happens to be so (1) when the resistance of one of the films predominates over that of the other, so that the resistance of the second can be neglected, (2) when the value of " $m$ " remains constant. When both the films are controlling, and the vapour-liquid equilibrium curve is not a straight line, then  $K_G a$ ,  $K_L a$ ,  $H.T.U_{OG}$  &  $H.T.U_{OL}$  are functions of the slope  $m$ ; and since  $m$  is a variable they cannot be used for design purposes. They are, nevertheless, used (incorrectly) as no alternative method of approach has been presented to the Chemical Engineer.

If the reasonable assumption be made that the slope of the equilibrium curve is constant over small distances:—

$$m = \frac{dy_i}{dx_i} = \frac{dy^*}{dx^*} = \frac{dy}{dx}$$

where  $y_i$  and  $x_i$  are the interfacial compositions in any differential section of a packed column.

$y^*$  is the composition of the vapour in equilibrium with liquid of composition  $x$  present in the differential section.

$x^*$  is the composition of the liquid in equilibrium with vapour of composition  $y$  present in the same section

then equations can be derived by means of which the height of any packed column can be computed:—

$$h = \frac{G}{k_G a} \int_{y_F}^{y_D} \frac{dy}{(y^* - y)} + \frac{L}{k_L a} \int_{y_F^*}^{y_D^*} \frac{dy^*}{(y^* - y)} \quad (1)$$

$\leftarrow N_{G_1} \rightarrow$                        $\leftarrow N_{G_2} \rightarrow$

$$h = \frac{G}{k_G a} \int_{x_F}^{x_D} \frac{dx}{(x - x^*)} + \frac{L}{k_L a} \int_{x_F^*}^{x_D^*} \frac{dx^*}{(x - x^*)} \quad (2)$$

$\leftarrow N_{L_1} \rightarrow$                        $\leftarrow N_{L_2} \rightarrow$

The integrals  $N_{G_1}$ ,  $N_{G_2}$ ,  $N_{L_1}$  &  $N_{L_2}$  can be evaluated graphically. However, if both  $k_G a$  &  $k_L a$  are unknown, the height can be expressed either in terms of  $k_G a$  or  $k_L a$ . This is done by solving the above as simultaneous equations.

$$h = \frac{G}{k_G a} \left[ \frac{N_{G_1} N_{L_1} - N_{G_2} N_{L_2}}{N_{L_1} - N_{G_2}} \right]$$

$$= \frac{L}{k_L a} \left[ \frac{N_{G_1} N_{L_1} - N_{G_2} N_{L_2}}{N_{G_1} - N_{L_2}} \right] \quad (3)$$

Full details of the derivation and applications of the above equations will be published elsewhere.

My thanks are due to Dr. M. A. Govinda Rau, at present Reader in the Alagappa Chettiar College of Technology, University of Madras, for the help that he has given me in this investigation.

Chemical Engineering Section,  
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November 29, 1944.

J. SIMON.

#### A NEW ANTI-SNAKE-VENOM SERUM

THE anti-snake-venom serum in use in India at present is effective only against the venoms of cobra and Russell's viper. Lamb (1903, 1904, 1905) when he prepared this bivalent serum showed that it did not neutralise the venoms of any snakes other than the two (cobra and Russell's viper) against which it was prepared. The only improvement introduced in recent years has been the concentration of the anti-snake-venom serum (Maitra *et al.*, 1933, and Greval, 1934). Thus we have lacked a remedy against the bite of krait and the saw-scaled viper—two snakes as common as cobra and Russell's viper.

We have been working on the preparation of a polyvalent anti-snake-venom serum which would be effective against the poison of all the four common poisonous snakes of India—cobra, Russell's viper, common krait, and saw-scaled viper. In this we have succeeded and have taken up its manufacture at the Haffkine Institute.

We have also worked out a method for assaying our polyvalent anti-snake-venom serum on the lines of Ipsen's method (1938) sponsored by the League of Nations Permanent Commission on Biological Standardisation. We have assayed four batches of our polyvalent serum and find that 1 ml. of our serum neutralises not less than the following quantities of dried venoms, when the serum along with the venom is injected intravenously into white mice: cobra 0.6 mg.; common krait 0.45 mg.; Russell's viper 0.6 mg.; and saw-scaled viper 0.45 mg.

We are arranging to issue our polyvalent serum in lyophilised form, i.e., preserved by drying from the frozen state. In this form the serum does not require to be stored in a refrigerator. It may be stored in any cool dark place and may even be carried in a haversack

on one's back if an occasion demands it. Even when stored at room temperature, it is expected, it will keep its full potency for ten years or so.

The new polyvalent anti-snake-venom serum thus meets the long-felt need for a serum, effective against all the common poisonous snakes of India, and which can be made available at rural dispensaries and other out-of-the-way places where it is needed and has not so far reached.

Haffkine Institute,  
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January 11, 1945.

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D. C. LAHRI.  
S. S. SORHEY.

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### THERMAL REACTIONS OF IRON PYRITES

These studies were carried out with several samples of iron pyrites some of which were collected in the field while others were obtained in the laboratory by separation and concentration from its mineral associates. The pyrites of the samples employed, viz., the FeS<sub>2</sub> contents ranged from 90 to 99.9 per cent. Complete analysis of the samples were also done and the nature and extent of the impurities ascertained.

Some important features of the thermal reactions of iron pyrites under various conditions are the following:

(1) Absorption of oxygen with consequent increase in weight (about 10 per cent.) of the sample and conversion of the combined sulphur into water-soluble sulphate. (2) Liberation of elementary sulphur to the extent of about 25 per cent. of the sulphur content of the pyrites. (3) Formation of the normal as well as of a basic ferric sulphate. (4) Evolution of sulphuric anhydride in appreciable amounts.

The studies were all carried out in all-glass apparatus adopting standard methods of analysis.

Full details concerning the mechanism of the various reactions and also of their industrial utilisation will soon be presented.

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January 18, 1945. H. S. OGAL.  
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### INFLUENCE OF CARBOHYDRATE TO NITROGEN RATIO ON THE FORMATION OF DIASTASE BY *ASPERGILLUS ORYZAE*

Our previous work has shown that the formation of diastase by *Aspergillus oryzae* is influenced by the character and complexity of the nitrogen employed in the culture medium. Further

studies have revealed that the carbohydrate-nitrogen ratio appears to constitute an essential factor in the elaboration of the enzyme. It is generally recognised that starch stimulates the production of the enzyme, but no quantitative data is available in literature. The present study has been undertaken to determine the effect of the addition of varying amounts of starch to a given quantity of nitrogen, on the formation of diastase by *Aspergillus oryzae*.

The method of culturing the fungus, of making the enzyme extract and of determining the

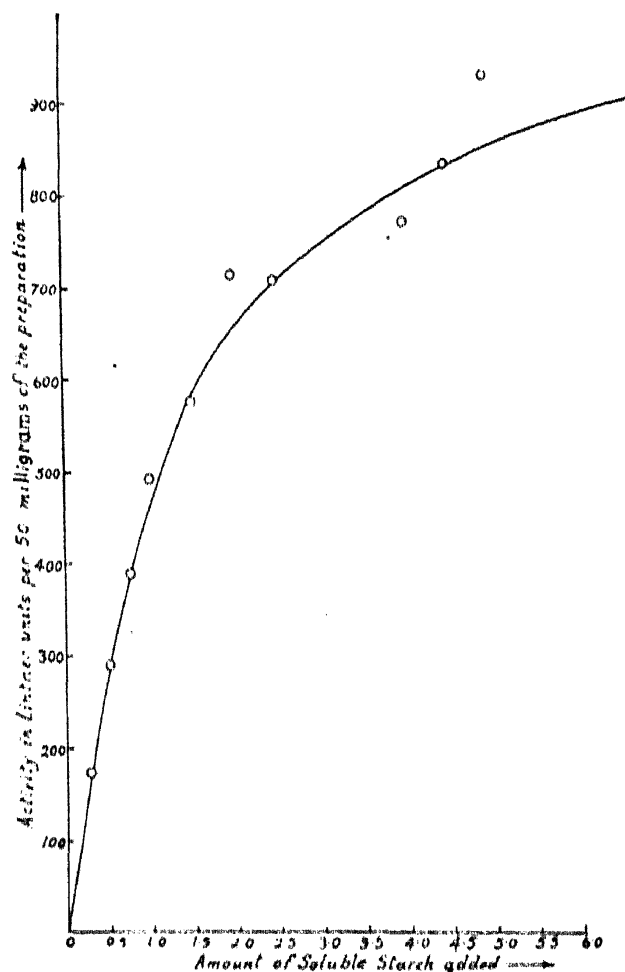


FIG. 1

diastatic activity, are similar to those described in our earlier communications. Finely shredded and acid-digested and purified asbestos was used to provide an inert mat for the growth of the fungus. The basal nutrient solution was composed of:—Peptone (Difco) 60 gms.; potassium dihydrogen phosphate 1 gm.; potassium citrate 1 gm.; magnesium sulphate, 7H<sub>2</sub>O 1 gm.; ferrous sulphate 0.01 gm.; zinc sulphate 0.01 gm.; calcium chloride 0.5 gm.; water 1 litre.

The medium was constituted as follows:—A given weight (5 gm.) of the asbestos was placed in 250 c.c. conical flasks, moistened with 12.5 c.c. of the nutrient solution (corresponding to 290 mgms. of nitrogen) and treated with graded amounts of soluble starch. The mass was intimately mixed, autoclaved at 20 lbs. for 30 minutes on two successive days. The flasks were then inoculated with a suspension of the spores of the fungus, incubated at 30° C. for three days, the resulting moldy