an optimum temperature of 30° C. and a thermal death-point at about 60° C. It requires a hydrogen-ion concentration of 7·2-7·4 and is a strict anaerobe. The optimum salinity at which the organism is most active is 6 per cent.; organic sources of nitrogen are preferred; of the sources of carbon studied, only sodium lactate was effective. The organism reduces sulphates in concentrations upto 6 per cent. The viability of the culture is enhanced by fixing the sulphuretted hydrogen released during the reaction with the aid of iron salts.

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CHEMICAL EQUILIBRIUM IN STYRENE FORMATION FROM ETHYL-BENZENE AT LOW PRESSURES

THE chemical equilibrium in the dehydrogenation of ethyl-benzene to styrene has been successfully studied in a specially devised apparatus at the low pressures of 10 to 40 mm. of mercury and in the temperature range of 360-500° C. A catalyst, composed of the oxides of chromium and aluminium promoted by metallic copper, was used. This catalyst, prepared by a special method has been found to possess remarkable activity. Even at atmospheric pressure and upto the temperature limit of 580° C. it gave practically equilibrium yields of styrene from ethyl-benzene.

Using the equation $K_p = \frac{p\alpha^2}{1-\alpha^2}$ where α is the degree of dissociation of ethyl-benzene and p the total pressure in atmosphere, the equilibrium constant of the reaction has been calculated.

$$C_6H_5CH_2 \cdot CH_3\ (g) \rightleftarrows C_6H_5CH = CH_2\ (g) + H_2$$

From the value of K_p, the free energy of the reaction has been evaluated, using the relation :

$$\Delta F_T = -RT l_n K_p.$$

The following table gives the values of k_p and ΔE_T for five different temperatures:—

No.	Temp. °C.	Temp. °K.	K_p	ΔF_T (cals.)
1	360	633	0·00047	9636
2	395	668	0·00160	8545
3	430	703	0·00495	7414
4	460	733	0·01200	6442
5	495	768	0·03100	5299

Using graphical method, the mean value of the heat of reaction (temperature range 360-500° C.) has been found :

$$\Delta H_T = 29{,}840 \text{ cals.}$$

The free energy as a linear function of temperature is expressed by the equation :

$$\Delta F_T = 27{,}379 - 32 \cdot 65\ T.$$

Th temperature of neutral equilibrium is :

$$T_0 = 565\,°C.$$

Employing the specific heat equation,

$$\Delta c_p = 8 \cdot 52 - 0 \cdot 01405\ T + 0 \cdot 000{,}00566\ T^2$$

evaluated from the values of the specific heats for ethyl-benzene and styrene given by Daniel R. Stull,[1] the following standard free energy equation for the reaction has been obtained :

$$\Delta F_T = 27{,}097 - 8 \cdot 52\ T\ lnT + 0 \cdot 007025\ T^2 - 0 \cdot 000{,}00094\ T^3 + 23 \cdot 38T$$

The values of the heat of reaction, free energy and entropy change at standard state are :

$$\Delta H_{298} = 29{,}062 \text{ cals.}; \ \Delta F_{298} = 20{,}229 \text{ cals.}; \ \Delta S_{298} = 29 \cdot 64 \text{ E.U.}$$

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1. Daniel R. Stull, *Ind. Eng. Chem.*, 1943, **35**, 1303.

ROLE OF WATER-SOLUBLE PHOSPHORIC ACID AS AN ASPECT OF SEWAGE IRRIGATION

SEWAGE is a fairly rich source of phosphoric acid and nearly one-third of it is in water-soluble form. During sewage irrigation the crop gets readily available phosphoric acid throughout its growth period. This may play a significant role in crop-nutrition as was shown by the senior author[2] in the case of Ragi (*Eleusine coracana*). The phosphoric acid of sewage was shown to be as much responsible for the higher crop yields of Ragi as the nitrogen of sewage and it was also observed that the phosphorous content of Ragi definitely increased due to sewage irrigation. Similar experiments with wheat are now reported.

Using the local black cotton soil, pot experiments with wheat were laid out to study the effect of irrigating the crop with (1) water containing 2 p.p.m. of water-soluble P_2O_5 from superphosphate, (2) water containing 2·5 p.p.m. of soluble nitrogen as ammonium sulphate, and (3) water containing a combination of the above. The last is supposed to represent sewage irrigation. (4) A control of ordinary irrigation was also run. Each treatment was replicated four times. The amount of P_2O_5 and N corresponding to 250 lbs. and 300 lbs. respectively per acre were given in 30 irrigations of 4 gallons each per pot. The yields