

Solubility of Aromatic Hydrocarbons in Water and Aqueous Solutions of Sugars

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Summary 'Sugaring out' and sugaring in' phenomena are observed on the solubility of aromatic hydrocarbons in water and aqueous solutions of sugars.

BENZENE and other aromatic hydrocarbons are of interest in the study of the solubility of nonelectrolytes in water,^{1,2} and show interesting solubility characteristics.¹ We here report measurement of the solubility of aromatic hydrocarbons in water and sugars solutions using the method of

Bohon and Claussen.¹ Figures 1—3 illustrate the solubilities of benzene, biphenyl, and phenanthrene, respectively in water, and in aqueous solutions of glucose, fructose, and sucrose between 0 and 35 °C. Figure 1 shows that the addition of sugars to water decreases the solubility of benzene; the decrease in solubility follows the order: glucose < fructose < sucrose < water. This observation of decreased solubility in sugar solution is analogous to the

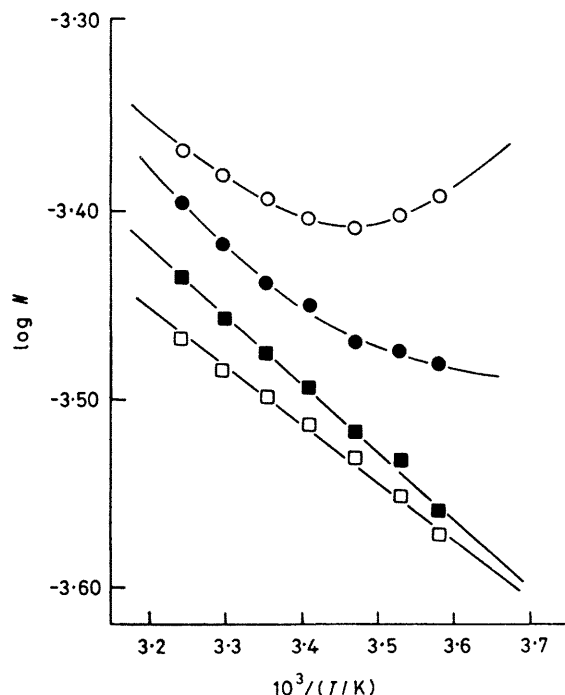


FIGURE 1. Solubility of benzene [log mole fraction (N)] in water and aqueous sugars vs. reciprocal absolute temperature. ○: water; ●: 1 mol l⁻¹ sucrose; ■: 2 mol l⁻¹ fructose; □: 2 mol l⁻¹ glucose.

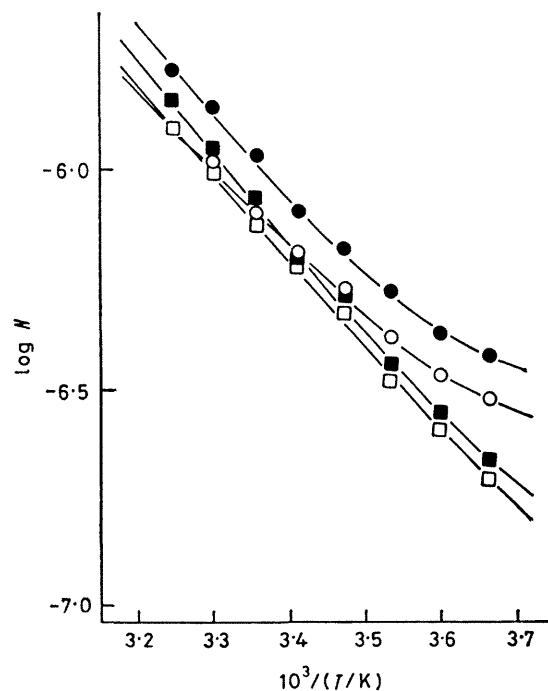


FIGURE 2. Solubility of biphenyl [log mole fraction (N)] in water and aqueous sugars vs. reciprocal absolute temperature. ○: water; □: 2 mol l⁻¹ glucose; ■: 2 mol l⁻¹ fructose; ●: 1 mol l⁻¹ sucrose.

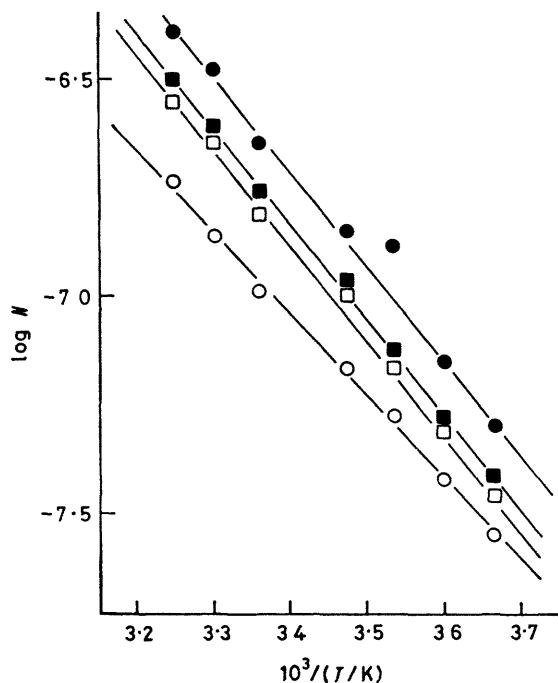


FIGURE 3 Solubility of phenanthrene [log mole fraction (N)] in water and aqueous sugars vs reciprocal absolute temperature. \circ water, \square 2 mol l^{-1} glucose, \blacksquare 2 mol l^{-1} fructose, \bullet 1 mol l^{-1} sucrose

'sugaring out' phenomenon described by Lakshmi and Nandi³ Figure 2 shows that the addition of glucose to water also decreases the solubility of biphenyl. However, the addition of fructose increases the solubility of biphenyl at higher temperatures (between 25 and 35 °C), and the addition of sucrose leads to a greater increase in solubility at all temperatures studied. The increase in solubility at 25 °C follows the order sucrose > water ~ fructose > glucose. Figure 3 shows that the addition of sugars increases the solubility of phenanthrene at all temperature measured and this increase follows the order sucrose > fructose > glucose > water. Thus, benzene showed decreased solubility ('sugaring out') in all the sugar solutions studied, while phenanthrene showed increased solubility ('sugaring in'), biphenyl showed intermediate behaviour, its solubility being increased in some cases and decreased in others. These results show that the solubility of aromatic hydrocarbons in sugar solutions depends not only on the sugar used but also on the size of the aromatic hydrocarbon. Thus, we cannot interpret the solution behaviour of aromatic hydrocarbons in sugar solutions only in terms of a 'sugaring out' effect.³

(Received, 12th September 1979, Com 973.)

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