

ULTRASONIC VELOCITY AND OTHER PARAMETERS IN SULPHURIC ACID-SODIUM HYDROXIDE SOLUTIONS

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Ultrasonic velocity, adiabatic compressibility and refractive index have been determined in aqueous sulphuric acid-sodium hydroxide mixtures at different concentrations. Variation of these parameters with composition of the mixture was studied with a view to fix the end points of neutralization.

Recently it has been reported by Ramanathan & Raman¹ that from the measurements of ultrasonic velocity and other parameters in hydrochloric acid-sodium hydroxide mixtures, the end point of neutralisation could be fixed. In view of this observation, the method is extended to study sulphuric acid-sodium hydroxide mixtures. As sulphuric acid is dibasic, the neutralization takes place in two stages; first the replacement of one of the hydrogen atoms to form the acid salt Sodium hydrogen sulphate ($NaHSO_4$) followed by the replacement of the other Hydrogen atom to form the normal salt, sodium sulphate (Na_2SO_4). Hence we expect to get two points of inflexion by ultrasonic studies.

The mixtures studied were aqueous solutions of sulphuric acid and sodium hydroxide of concentrations 0.5, 1.0, 2.0 and 3.0 *N*. Chemicals used were of analar quality. Acid and alkali solutions of the same normality were mixed in fixed ratios. Measurements were made after cooling the solution to room temperature of 32.5°C. Ultrasonic velocities were measured by Debye-Sears' light diffraction method² at a frequency of 2.980 mc/sec. The experimental details are given elsewhere¹.

Variation of ultrasonic velocity, adiabatic compressibility, density and refractive index with composition of the mixture is shown in Fig. 1-4.

Ultrasonic velocity increases with the addition of alkali. The curve for all concentrations consists of two breaks corresponding to the neutralization points. But the variation in the different regions is linear. It is found that the slope of the line in the region between

the first and the second neutralization points is always greater than that of the line on either side of it (Fig. 1). As concentration increases the second break is less marked though the first one remains distinct. By this method it is possible to determine the end points within an error of ± 1 per cent. Below 0.5 *N* the two breaks are not distinct.

The variation of adiabatic compressibility with the addition of alkali is not linear. The curve has two breaks corresponding to the two endpoints. However the second break is not marked at all concentrations (Fig. 2).

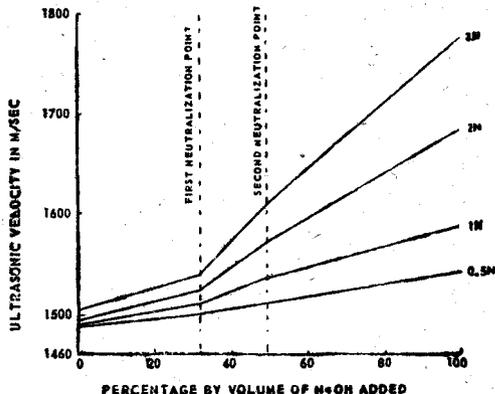


Fig. 1—Variation of ultrasonic velocity with composition in H_2SO_4 - $NaOH$ mixtures.

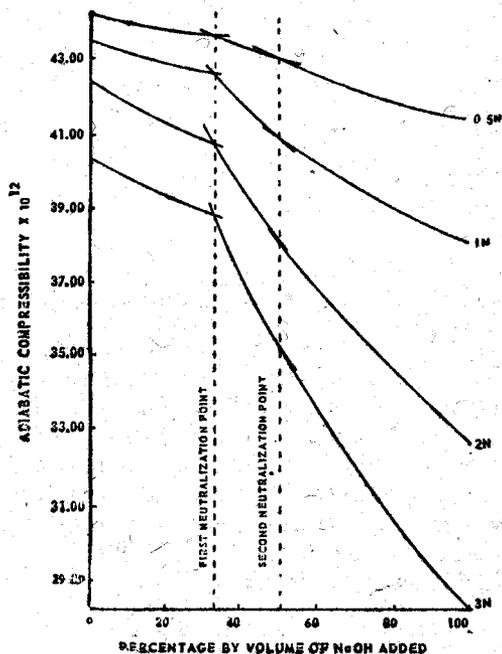


Fig. 2—Variation of adiabatic compressibility with composition in H_2SO_4-NaOH mixtures.

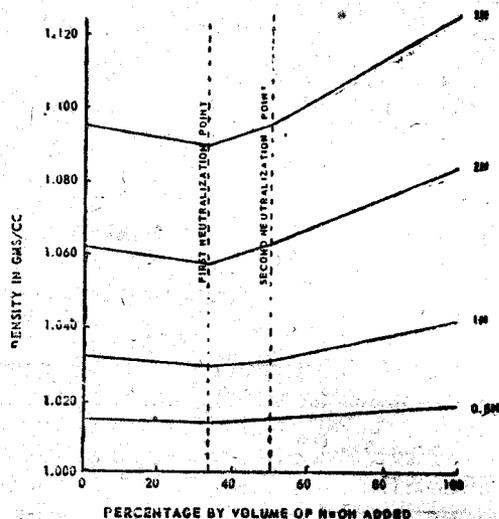


Fig. 3—Variation of density with composition in H_2SO_4-NaOH mixtures.

Unlike the ultrasonic velocity, density and refractive index decrease linearly with the addition of alkali, reaching a minimum at the first end point and then increase upto the second end point where a break in the curve appears once again. In refractive index curves the end points are well defined at all concentrations (Fig. 3 & 4).

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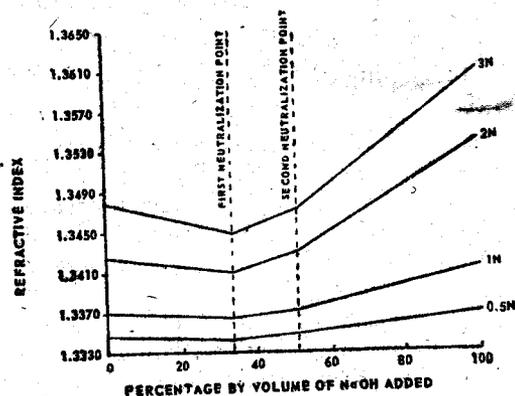


Fig. 4—Variation of refractive index with composition in H_2SO_4-NaOH mixtures.

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