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***Research Paper :***

# IR, X-ray and ultrasonic velocity of uranyl (II) stearate

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## ABSTRACT

The infrared and X-ray diffraction techniques have been used to study the structure of uranyl (II) stearate in solid state, whereas the structural changes of the metal soap in the solvent-mixture of 50% dimethylformamide and 50% benzene(V/V) at 40°C have been studied by the ultrasonic method. The appearance of two absorption bands at 1570 and 1440 $cm^{-1}$ which may be assigned to as $\upsilon_{as}$ $COO^-$ and $\upsilon_s$ $COO^-$ modes of carboxylate group of uranyl stearate indicate the ionic nature of this group in the soap. The XRD analysis reveals that uranyl soap has a single layer structure as proposed by **v**old and Hattiangdi for disoaps. Ultrasonic velocity measurement is employed to obtain various acoustic parameters and the critical micelle concentration, CMC($5.55\times10^{-4}$ mol. $dm^{-3}$) for the soap solutions. The values of ultrasonic velocity and acoustic impedance are found to decrease while adiabatic compressibility and intermolecular free length increase with increasing soap concentration.

**Key words :** Metal Soap, critical micelle concentration, infrared, X-ray, ultrasonic velocity, acoustic parameters

While major developments have taken place in the study of alkali, alkaline earth and transition metal soaps, the studies on actinide soaps have remained almost untouched with the result that only a few references (1-5) are available in this relatively unexplored field. The physicochemical characteristics and structure of these soaps depend on the method and conditions of preparation. The information about the structure and properties of these soaps is of great significance for their use in industries under varying conditions. Therefore, the present investigation is aimed at the physicochemical characteristics of urany1(II) stearate both in solid state and in solutions.

## MATERIALS AND METHODS

Merck/BDH reagent grade chemicals were used. Stearic acid was purified by distillation under reduced pressure, The m.p. of the purified acid was 128°C. Urany1 distearate was prepared by the direct metathesis of potassium stearate with urany1 nitrate at 50-55°C under vigorous stirring. The precipitated soap was digested, filtered, washed with distilled water-ether and dried. The metal soap thus obtained was crystallized twice from benzene-dimethylformamide and dried under vacuum for atleast 48 h before use. The purity was checked up by the elemental analysis and determining the m.p. (118°C).

The infrared absorption spectra of stearic acid, potassium stearate and urany1 stearate were obtained with a Perkin-Elmer "577 Model" grating spectrophotometer in the region of 4000-400 $cm^{-1}$ using potassium bromide disc method. The X-ray diffraction patterns for the metal soap were obtained over the range of diffraction angle, $2\theta=3\text{-}65^0$ with Philips "PW-1730" X-ray diffractometer using Cu-$k_\infty$ radiations filtered by a nickel-foil. The XRD curves were recorded under the applied voltage of 40 kV-20μA using scanning speed of $1^0$ $min^{-1}$ and chart speed of 1 cm $min^{-1}$. The wavelength of the radiation was taken as 1.542 $A^0$. The ultrasonic velocity measurements of the solutions of uranyl soap were recorded on a single frequency (1 MHz) ultrasonic interferometer "Model F-81", Mittal Enterprises, New Delhi. The density measurements ($\pm$ 0.0001) were made with the help of pyknometer. All the measurements were carried out at a constant temperature ($40.0 \pm 0.05^0$C) in a thermostat.

## RESULTS AND DISCUSSION

The results obtained from the present investigation are below :

### *Ir Spectrum:*

The infrared spectrum of urany1 stearate is depicted in Fig. 1. The characteristic absorption bands of caroboxyl group of fatty acid (2650, 1700, 940, 690 and 550 $cm^{-1}$) are found completely absent in the spectra of both potassium (2960, 2920, 2850, 1430, 1380, 1325-1190, 1110, 720 and 530 $cm^{-1}$) and urany1 (2960, 2920, 2850, 1570, 1470, 1440, 1415, 1370, 1350-1170, 1120, 720, 520 and 440 $cm^{-1}$) stearates; whereas the absorption maxima characteristic of the aliphatic portion of stearic acid (2960,