

*Acta Cryst.* (1967). **23**, 666

**Preliminary X-ray data for two new forms of hen egg-white lysozyme.** By DAVID J. HAAS\*, *The Royal Institution, 21 Albemarle Street, London W.1, England*

(Received 13 February 1967)

Crystallographic data are recorded for new crystalline forms of lysozyme nitrate and chloride.

This note is to add two new crystalline forms of hen egg-white lysozyme to those already recorded by Steinrauf (1959). Both crystalline forms are grown from a mixture of solvents at a pH value near the isoelectric point of lysozyme.

#### *Lysozyme nitrate*

To a 10% acetone solution, lysozyme chloride (2.5%) was added. Enough sodium bicarbonate was used to bring the pH to 8.4. The solution was then saturated with sodium nitrate and left for several weeks. Hexagonal prisms with pointed ends grew to 1 mm in length and 0.3 mm in width. They floated in the mother liquor, and from this their density was obtained.

X-ray photographs showed the space group to be  $P6_12$ ; few reflexions occurred beyond 3 Å resolution in the  $h0l$  and  $hk0$  zones. From volume considerations, there appear to be 12 molecules as dimers in the unit cell with approximately 50% solvent by volume. Table 1 lists the lattice constants for the crystal.

#### *Lysozyme chloride*

To water (10 ml) containing lysozyme chloride (0.25 g), enough sodium bicarbonate was added to bring the pH to 8.4. Ethanol (6 ml) was slowly added; if this solution

is seeded with orthorhombic crystals (obtained previously), they grow very slowly over a period of weeks. The original batch of orthorhombic crystals was obtained by slowly adding ethanol over a period of weeks to a bath containing a 2.5% lysozyme solution in a dialysis bag (pH 8.4 by sodium bicarbonate). The final alcohol concentration in the bath was about 55%.

The crystals grow as elongated diamond-shaped plates with the  $b$  axis normal to the flat face. X-ray photographs indicated that the space group is  $P2_12_12_1$ . In addition, 23° precession photographs showed strong scattering out to the limit of the photograph. From volume considerations, one obtains 8 molecules as dimers in the unit cell with about the same solvent content as the triclinic and monoclinic forms (Table 1).

These crystals show only small lattice constant changes and still give reflexions to 2 Å resolution when placed in an atmosphere of 94% relative humidity. At this humidity presumably all free water has been removed from the crystals, and thus one may be able to perform low-temperature studies on them.

I wish to thank Dr D. C. Phillips and the lysozyme group for their assistance. I am the recipient of a National Institutes of Health Postdoctoral Fellowship to the Royal Institution.

#### References

STEINRAUF, L. K. (1959). *Acta Cryst.* **12**, 77.

\* Present address: Department of Chemistry, The Weizmann Institute, Rehovoth, Israel.

Table 1. *Crystallographic data*

Crystal form	$a$ (Å)	$b$ (Å)	$c$ (Å)	Space group	Molecules per cell	Volume of asymmetric unit (Å <sup>3</sup> )	Density (g.cm <sup>-3</sup> )
Lysozyme nitrate	87.01	—	70.40	$P6_12$	12	$2 \times 38500$	1.197
Lysozyme chloride	58.58	68.40	54.25	$P2_12_12_1$	8	$2 \times 27200$	—

*Acta Cryst.* (1967). **23**, 666

**Elastische und thermoelastische Konstanten von Benzil  $C_6H_5COCOC_6H_5$ , gemessen mit dem Schaefer-Bergmann-Verfahren.** Von S. HAUSSÜHL, *Institut für Kristallographie der Universität zu Köln, Deutschland.*

(Eingegangen am 23. März 1967)

All elastic and thermoelastic constants of benzil were measured by the Schaefer-Bergmann method (diffraction of light by ultrasonic waves). There are large discrepancies between these elastic constants and those determined by Chakraborty & Sen from thermal diffuse scattering of X-rays.

Der Vergleich elastischer Konstanten, die einerseits mit dem von Wooster und Mitarbeitern entwickelten Verfahren (siehe Wooster, 1962) aus der diffusen Streuung von Röntgenstrahlen ermittelt, andererseits mit präziseren Ultraschall-Verfahren gemessen wurden, ergab im Falle

von Hexamethylentetramin (Ramachandran & Wooster, 1951; Haussühl, 1958) und von Benzalazin (Joshi & Kashyap, 1964; Haussühl, 1965) grosse Diskrepanzen. Die Gründe hierfür sind im einzelnen noch nicht bekannt. Vor allem besteht noch keine Sicherheit dar-