NEWS

POLYMERS: STRENGTH IMPARTED BY STRUCTURE*

By Vyacheslav Batrakov

The faculty members of the Chemistry Department at the Moscow Lomonosov State University in cooperation with specialists from research and production association Khimvolokno of the USSR Ministry of Chemical Industry have carried out a research work on liquid crystal polymers, their structure, and physical and chemical properties.

There is no need to talk about the importance for various industries of polymers and polymer materials which sometimes have a set of absolutely unique properties. Polymers may be flexible and elastic, strong and heat resistant, capable of withstanding the most corrosive media and having the most unusual electric and physical characteristics, such as semi- and super-conductivity. Moreover, the polymer properties may be controlled, so that seemingly incompatible qualities can be combined at will in one material.

Strength is what is most often valued in materials used in technology: the stronger the material, the lighter, more compact and reliable the structure. Some polymer articles are frequently stronger than steel, and if, in addition, one takes into account the fact that polymers are much lighter than the metals, even magnesium and aluminium, the drop in the weight of structures using a wide range of polymers may prove quite striking.

The strength of any substance is determined by the strength of bonds between its atoms and molecules. Resisting tensiles strain in metals are very strong atomic bonds, and the same kind of bonds exist between atoms in polymer molecules. But as to the polymer molecules themselves, they interact very weakly and, as the saying goes, it snaps where it is the thinnest. Therefore, the strength of polymers may be raised if their molecular chains be stretched in one direction, and their strong atomic ties, rather than weak molecular, be brought into play. Calculations show that in this way it is possible to increase strength several hundred times over.

Indeed, the rigid chain polymers whose molecules cannot coil in disorderly balls and therefore fully resist tensile strains are not inferior in terms of strength to steel. Even ordinary polyethylene can become highly resistant if articles made of it are formed by the oriented crystallisation method which allows to stretch flexible molecules of this polymer in one direction and fix them in that state. The same principle underlies production of super-strong polymers through imparting to them liquid crystal structure.

Liquid crystals combine characteristic features of structure and properties of liquid and crystal solid. As fluids they have fluidity, but as crystals they are characterised by anisotropy, *i.e.* different physical properties in different directions. In liquid crystals, the inner orderly structure does not prevent changes in outer form, and vice versa, changes in outer form do not disturb their regular molecular structure.

Many substances whose molecules are stretched in one direction have liquid crystals properties. When these are dissolved or melted, it takes some time before their molecules lose the orderly mutual orientation they had in the solid crystal, keeping it until a certain stage in the liquid state. Hence, the idea to produce polymer articles through the liquid crystal stage. Such articles, for example, fibers and film, have greater mechanical strength owing to their orderly molecular structure.

However, high strength is not the only merit of liquid crystal polymers. Liquid crystals have one more remarkable feature which is that their structure and physical and chemical properties react quickly to the slightest external influences. For example, they change transparency and colour under quite insignificant fluctuations of temperature and in weak electric and magnetic fields. It is liquid crystals that form images in the indicators of electronic clocks, micro-calculators, and other devices, and on the screens of colour TV sets; temperature-sensitive liquid crystals are used in medicine for diagnosing hidden inflammatory processes.

Liquid crystal polymers, too, are capable of changing their properties when exposed to weak external influences. In addition, they can memorise as it were

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* Extracted from: *Soviet Features*, Vol. XXIV, No. 37, March 11, 1985; Information Department of the USSR Embassy in India, P.B. 241, 25 Barakhamba Road, New Delhi 110019.

such influences and therefore may serve for recording and storing information.

Lastly, liquid crystal polymers may be used for modelling various biological structures, such as cellular membranes, since more data have been coming in of late in support of the assumption that liquid crystals are exceptionally widespread in living nature.

Liquid crystals and polymers obtained on their basis are today the focus of attention for scientists, and find ever more practical applications. Works by Soviet scientists in this sphere, presented for the 1984 State Prize, occupy a leading position in the world.

"FREEDOM FROM CANCER PAIN" CALLED FOR BY INTERNATIONAL PAIN EXPERTS

Recommendations Made to WHO for Global Programme of Pain Management

Experts in pain therapy from 22 countries have recommended wide-ranging measures to counter the general neglect of the problem of cancer pain, while simultaneously calling for education and information programmes to promote the concept of "Freedom from Cancer Pain" as a right for caner patients.

The recommendations, made to the World Health Organisation (WHO) following a four-day meeting on cancer pain, takes into account virtually all aspects —psychological, technical, legal and educational—of the treatment of cancer pain.

"Drugs are the mainstay of cancer pain management", the experts state. "If used correctly— the right drug in the right dose at the right time intervals — they are effective in a high percentage of patients." And they add: "The scientific foundation for the successful treatment for cancer pain now exists".

In major recommendations, the experts:

—Urge governments to ensure that legislation controlling the use of opioids (narcotic drugs) do not "prevent cancer patients with pain from getting the pain-relieving opioids that they need".

—Call for more education in pain management at both the graduate and under-graduate levels.

—Advocate information through mass media so that patients, and particularly their families, are made aware that pain is not inevitable, and almost always controllable.

—Advocate also as the basis for the management of pain WHO's "Guidelines for Relief of Cancer Pain", a part of which is a three-stage "pain-control ladder" that sets out the drugs required —aspirin, codeine and morphine— for relieving pain.

—Ask that a global network be established to help disseminate knowledge about pain and what can be done about it. Thus far 32 countries are part of the network.

—Set as goal the treatment of cancer pain, not only in specialized cancer centres, which is the case now, but in hospitals and homes.

In the case of cancers far advanced, the expert's view is that patients receive care in their home should they wish.

Furthermore, the experts state "family members be given training in the home care of cancer patients, and receive financial support", for instance paid leave from work.

Worldwide one out of ten deaths are due to cancer. According to the experts each day close to four million people are suffering from cancer pain, or are being treated for it.

The meeting was chaired by Dr Kathleen Foley, Memorial Sloan-Kettering Cancer Center, New York. The vice-chairmen were Dr Luzito de Souza, Tata Memorial Hospital, Bombay and Dr D. C. Jayasuriya, Colombo, Sri Lanka. Dr Robert Twycross, Churchill Hospital, Oxford, was rapporteur.

The meeting took place at WHO Headquarters in Geneva from 11 to 14 December 1984. (Press Release, WHO/21 dated 17 December 1984, World Health Organisation, Media Service, 1211, Geneva 27, Switzerland).

Edited and Published by Prof. M. R. A. Rao, Current Science Association, Bangalore 560 080
Phototypeset by Macmillan India Ltd., Bangalore 560 025 and
Printed at Macmillan India Press, Madras 600 041.