THE OLD NEW CARBON

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It is well-known fact, that organic chemistry is a science studying carbon and its derivatives. Carbon's characteristics are deeply and rather wide explored. Carbon and its derivatives are used in industry, medicine and many other types of human activities. But nature still keeps a lot of secret and does not stop to surprise scientists.

Emergence process of new causative agents of dangerous diseases, including protected from antibiotics (most of them or even all of them) is well-discussed in scientific circles. Requirements in new effective and safe medicines come just after such increase, which could be cause of epidemics or even pandemics.

One of the course of the new medicine's development, which is necessary to be highlighted is research in new biologically active substances. Taking into account, that carbon is an accepted champion in amount of possible modifications and potential compounds, this element is a perspective "launch site" for every pharmaceutical researches. Moreover, the carbon's structure is rather suitable for such role: carbon's atoms compiled into spheres with surface consists from 20 hexagons and 12 pentagons. The discovery of fullerenes greatly expanded the number of known carbon allotropes, which until recently were limited to graphite, graphene, diamond, and amorphous carbon such as soot and charcoal.

In 1970, R. W. Henson (Atomic Energy Research Establishment) proposed the structure and made a model of Fullerene. Unfortunately, the evidence for this new form of carbon was very weak and was not accepted by scientific circles. Harold Kroto from University of Sussex and team of scientists from Rice University were the scientists who was interested in carbon. The first fullerene molecule to be discovered by their hard and exhaustive research in 1985. For his researches in the area of carbon (extracted from space dust) in 1985, Kroto and his American colleges were presented with the Nobel prize of 1996 in chemistry.

They separate a new carbon's variety: a fullerene. It is an elementary substance in a form of soft yellow crystals, which becomes an object of interest of many scientists in nanoelectronic industry for the purposes of displays (from active bigboards to flexible computers) producing. Fullerene production processes includes the following five stages:

1. synthesis of fullerenes or fullerene-containing soot; (ii)
2. extraction; (iii)
3. separation (purification) for each fullerene molecule, yielding pure fullerenes

such as C_{60}; (iv)

4. synthesis of derivatives (mostly using the techniques of organic synthesis);
5. other post-processing such as dispersion into a matrix.

There are a lot of previously unknown substances that are perspective to use in different areas (including pharmacy) created on the base of fullerene. Also, fullerene allows scientist to use nanometrs in their activities except micrometers.

Fullerene has a noticeable pharmacological activity: biological active substances with fullerene and with addition of some vitamins, antibiotics, hormones become very useful in healing of damaged brain cells. The first experiment with fullerene in such area was committed on experimental animals in Tel-Aviv by Israel scientist. Potentially, such substances may become a revolution in healing of disseminated sclerosis and Alzheimer's disease, other forms of gerontic dementias.

After usability in the above-stated practical issues, which are ready to massive producing, fullerene is a core element of several perspective pharmacological and medical novelties. There are methods of viruses' genom destruction without vaccines developed on the base of fullerene. Fullerene may become an integral part of many detoxes against animal and non-biological poisons. There are some positive results of using fullerene in healing of cancer. From the viewpoint of military and space medicine, fullerene attracts the great interest as potential radioprotective agent. Hydrated fullerenes C_{60} prove themselves as effective radioprotectos for animals. Their molecules catalyzed recombination of free radicals. In case of high radioactivity, for example, in space flight out of magnetic field of Earth, fullerene based radioprotectos may be indispensable: for example, it can solve a problem of astronauts protection from star wind and other space radiation during mission on Mars. Scientists from Institute of physiological active compounds of Kharkov have already achieved some positive results on such course.

Even a new subdivision of chemistry was founded because of Fullerene explorations. Fullerene chemistry is a field of organic chemistry devoted to the chemical properties of fullerenes. Research in this field are oriented to functionalize fullerenes and tune their properties for commercial and industrial use. For example, fullerene is notoriously insoluble and adding a suitable group can enhance solubility. By adding a polymerizable group, a fullerene polymer can be obtained.

Taking into account the foresaid facts, despite the fact that many of the above-stated concepts are in the early stage of development, even now it is an obvious fact that development of new pharmacological and other compounds on the base of fullerene is now one of the most perspective development projects both from scientific, social and commercial viewpoints.