

EFFECT OF ULTRA-LOW CONCENTRATIONS OF HYDRATED FULLERENE C₆₀ ON WHOLE HUMAN BLOOD AND ON CULTURED CHINESE HAMSTER CELLS

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Hydrated fullerene (HyFn) is the molecule of C₆₀-fullerene (C₆₀) encased in a stable shell of water molecules, providing hydrophilic properties to this complex and its solubility in aqueous solutions [1]. HyFn is known to have a broad spectrum of biological activities both in vivo and in vitro. HyFn exhibits a peculiar chemical activity – it can be regarded as a strong antioxidant as well as an electron donor for oxygen, i.e. a prooxidant [2]. Given that C₆₀ is chemically rather inert, it could be assumed that the entire pattern of HyFn activity is due to unique properties of the water shell formed around C₆₀. There is also some evidence of influence of HyFn on biochemical processes and free radical reactions occurring in vitro, in particular in aqueous bicarbonate solutions at very low and ultra-low concentrations (down to 10⁻²⁰ M) [3]. Here we report on effects of ultra-low concentrations of HyFn on living systems – whole human blood and cultured Chinese hamster cells.

It has been shown that intensity of lucigenin-dependent photon emission from healthy donors' whole blood gets increased 3-5-fold after addition to blood of HyFn to concentrations equivalent to 10⁻⁶ or 10⁻¹⁷ - 10⁻¹⁹ M. At intermediate concentrations HyFn produced much smaller if any effect on photon emission from blood. However, 1-2 days after addition of HyFn to blood the photon emission from control blood and blood with 10⁻¹⁷ - 10⁻¹⁹ M HyFn decreased while photon emission from blood samples with 10⁻⁷ - 10⁻¹⁵ M HyFn increased drastically. Thus HyFn at low and ultra-low concentrations stabilize non-equilibrium state of whole non-diluted blood.

HyFn aqueous solution produced also a pronounced effect on the growth and "stationary phase aging" (accumulation of "age" changes in cultured cells during cell proliferation slowing down within a single passage and subsequent "aging" in the stationary phase of growth) of transformed B11-dii FAF28 Chinese hamster cells at ultra-low concentration (equivalent to 10⁻¹⁹ M). It is paradoxical, but, in contrast to the known data about absence of HyFn cytotoxicity at higher concentrations, in our experiments it inhibited cell proliferation and accelerated the process of "stationary phase aging" of the cell culture. Moreover, addition of HyFn aqueous solution at this calculated concentration to the cells that had already reached the stationary phase of growth caused a rapid (within no more than 24 h) death of a significant part of the cell population (see Figure). Perhaps, the observed features of HyFn at ultra-low concentration are determined by some special properties of the water surrounding C₆₀, namely, its ability to serve as an electron donor and acceptor regulating redox processes in aqueous systems, especially those in which oxygen is involved.

It is interesting that while HyFn at ultra-low concentrations stimulate metabolic processes in whole blood and stabilize blood activity it significantly inhibits growth and accelerates "aging" of cultured cells. At the moment we cannot to rule out the possibility that HyFn at ultra-low concentrations affect transformed cells only. Therefore in our further studies we plan to carry out the similar experiments on normal fibroblasts possessing limited mitotic potential. Probably, the anti-aging effect of fullerenes revealed by other researchers in experimental animals is related to their antitumor and antibacterial activities.

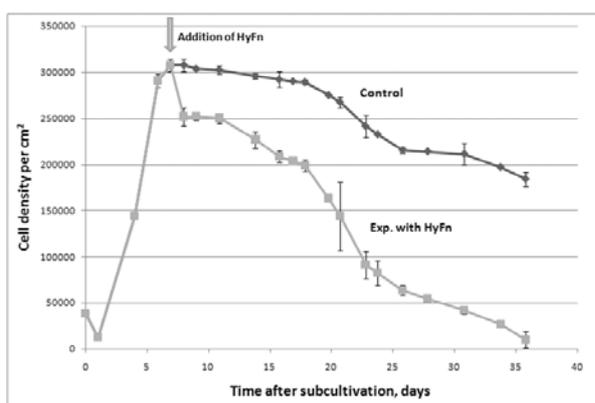


Figure. Effect of addition of HyFn solution to cultured Chinese hamster cells to the final concentration equivalent to 10⁻¹⁹ M. Arrow – addition of HyFn or (control) water

Литература

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