

The 7th Green and Sustainable Chemistry Award Awarded by the Minister of the Environment

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Development of new watch lubricant for decrease of burdens on the environment

Watches started out as instruments for telling time. In the beginning, most of them used a mechanical movement, which had to be adjusted regularly to maintain the correct time. Later, electronic watches were developed with much greater accuracy. Then as mass production technologies progressed, large numbers of watches came to be manufactured. They were turned into fashion items featuring a variety of designs. Further advances in precision processing technology made it possible to produce smaller watches, and to embed sensors in them for sale as diving watches and the like. Through the course of such developments, the watch has evolved into a convenient and essential part of daily life.

Despite these advances in precision manufacturing and electronics technologies, major progress has not been made with regard to the lubricant by which watches operate. The quality of conventional watch lubricants deteriorates over time, impeding the watch operation and eventually causing the watch to stop altogether in some cases. This phenomenon can shorten battery life, using up batteries wastefully, causing watches to be discarded, or even leading to the sale of "disposable" watches. Considering that around 1.2 billion watches are manufactured annually and sold all over the world, the environmental impact of this situation cannot be ignored.

At our laboratory, we have been conducting research and development on lubricants that enable us to solve this problem and achieve longer watch lifetime. A lubricant can deteriorate in the form of gelation, evaporation, infiltration into watch parts, or corrosion. Such deterioration results in increased sliding friction, significantly shortening battery life. Based on this reality, our company has been recommending that maintenance be performed every three to five years.

One way of providing watches that do not stop would be to design a new kind of watch. That approach, however, would not enable the environmental issues to be dealt with effectively on a broad scale. By contrast, the development of a better lubricant is a technological approach that can be applied to all watches now in production, as well as

to watches sold in the past, by replacing their lubricant. Moreover, it is an approach that can be extended throughout the entire watch industry. It is for this reason that we embarked upon research aimed at developing a better lubricant for watches.

Along with making watches more reliable, the development project took pains to comply with recent EU regulations aimed at eliminating use of fluorine compounds. This led to even further environmental benefits, as companies like ours became Perfluorooctane Sulfonate (PFOS)-free.

Another problem with conventional lubricants is that their lubricating ability tends to diminish at low temperatures. Solving this problem has made it possible to reduce the power consumption by the many watches used in cold locales.

The lubricant we developed differs from conventional lubricants in that the functional expression of the additives for improving lubricating ability is separated from that of the lubricant base oil. The result is a lubricant that achieves improved functionality along with reliability. At the same time, we were able to resolve the problem of using PFOS and other such substances.

The use of this lubricant has allowed a major advance for watches, ushering in a new era. Electronic watches appeared on the market equipped with a solar power converter and secondary battery cell, and employing radio time signals to keep the displayed time constantly accurate. The environmental benefit of this kind of watch is a reduction in the number of primary batteries used, which is estimated to number 2.5 batteries per clock over a ten-year period. The benefits are expected to grow in the future, as the use of a lubricant that does not corrode watch parts allows parts to be recycled. The same technology can also be applied to small motors in general, and therefore should be able to generate environmental benefits from a wide range of precision parts besides watches.