Development of Mitigation Technology for Endocrine Disrupters by using Electrochemical Method

Shojiro Maki

Department of Applied Physics and Chemistry, The University of Electro-communications, Chofu, Tokyo 182-8585, Japan
e-mail: maki@pc.uec.ac.jp

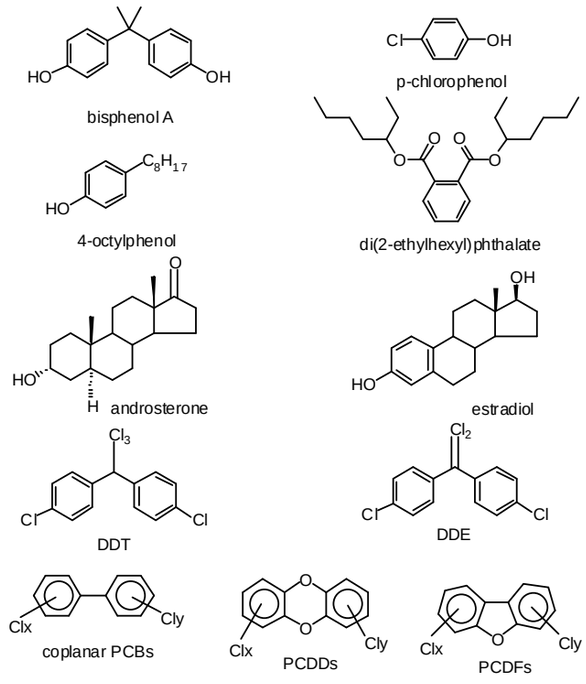
In 1974, Ministry of the Environment (i.e. MOE) of Japan introduced a “System of Investigation of Chemical Substances in the Environment”. Since then, a systematic environmental survey and monitoring on chemicals, including persistent organic pollutants (i.e. POPs), have been carried out.

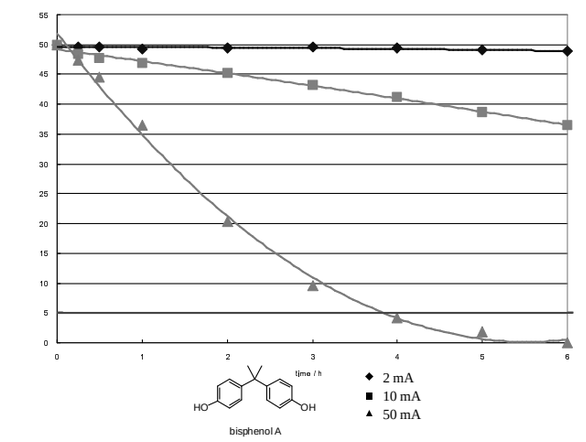
The MOE issued an interim report, “Exogenous Endocrine Disrupting Chemical Task Force” in July 1997. In May 1998, a document titled “Strategic Programs on Environmental Endocrine Disrupters SPEED '98” was released, setting forth its basic position toward exogenous endocrine disrupters, as well as specific approaches to the problem. The 67 substances (including octylphenol bisphenol-A, PCBs) listed in this document as “chemicals suspected of causing endocrinological disruption”, have not been conclusively proven to have, or not have such a disruptive effect. They have only been identified as the high- priority targets for future research, leading to frequent misunderstanding about “environmental hormones”. However, development of mitigation technology for endocrine disrupters is quite important mission for scientists.

The mechanism of endocrine disrupters has been studied from the viewpoint of a chemical substance, rather than a hormone binding to a receptor, resulting in the gene receiving the wrong signals. Many endocrine disrupters are known to exert estrogen-like effects, so the connection to the receptors in the cell has been the focus of attention. When an endocrine disrupting chemical binds to a receptor, it either exerts hormone-like effects or impedes such effects. The estrogen-like effects of such chemicals as PCBs, DDT, octylphenol, nonylphenol and bisphenol-A are examples of the former. They bind to estrogen receptors (ER) and exert estrogen-like effects. Examples of compounds that impede hormonal effect are DDE (a derivative of DDT) and vinclozolin. These bind to androgen receptors (AR) and impede androgen function (anti-androgen activity).

Our group has carried out anodic oxidation for converting endocrine disrupters into innocuous chemicals. The famous endocrine disrupters, octylphenol and bisphenol-A, were decomposed by simple electrolysis condition. When the polluted water containing bisphenol-A (50 mg / l) was subjected to galvanostatic electrolysis (50 mA) for 4 hours, pollutant was decomposed to be lower than imposed legal controls level[1] (5 mg / l). After 6 hours, pollutant was completely disappeared.

The results of detail including the other endocrine disrupters will be report in the presentation.





References

1) In Tokyo, the sewage quality of standard connecting with phenols content is established to be lower than 5 mg /

l.