

REFERENCES

- Agrawal, R., and Suman, A. (2011). *Production of Bisphenol A*. Madhya Pradesh: Jaypee University of Engineering and Technology.
- Anonymous. (2011). *How toxic is BPA?* Retrieved January 16, 2013, from exposure/effect: <http://ashartus.wordpress.com/2011/04/27/how-toxic-is-bpa/>
- Austen, I. (2007). *Canadian Retailer Bans Some Plastic Bottles*. Retrieved January 17, 2013, from The New York Times: <http://www.nytimes.com/2007/12/08/business/worldbusiness/08water.html>
- Bailey, A. B., and Hoekstra, E. J. (2010). Background Paper on Sources and Occurrence of Bisphenol A Relevant for Exposure of Consumers. *FAO/WHO Expert Meeting on Bisphenol A (BPA)*. Ottawa, Canada: World Health Organization.
- Ballesteros-Gómez, A., Ruiz, F.-J., Rubio, S., and Pérez-Bendito, D. (2007). Determination of bisphenols A and F and their diglycidyl ethers in wastewater and river water by coacervative extraction and liquid chromatography–fluorimetry. *Analytica Chimica Acta*, 603(1), 51–59.
- Banjongproo, P. (2012). Development of Low Carbon Society in Wasteland Wastewater Treatment Facilities Section: Issues and Action in Bangkok. *KU, IGES, SITT-TU Seminar*, (p. 28). Bangkok.
- Ben-Jonathan, N., Hugo, E. R., and Brandebourg, T. D. (2009). Effects of bisphenol A on adipokine release from human adipose tissue: Implications for the metabolic syndrome. 304, pp. 49-54.
- Bergeron, R. M., Thompson, T. B., Leonard, L. S., Pluta, L., and Gaido, K. W. (1999). Estrogenicity of bisphenol A in a human endometrial carcinoma cell line. *Molecular and Cellular Endocrinology*, 150, 179–187.
- Biedermann, S., Tschudin, P., and Grob, K. (2010). Transfer of bisphenol A from thermal printer paper to the skin. *Anal Bioanal Chem*, 398, 571–576.

- Bing-zhi, D., Hua-qiang, C., Lin, W., Sheng-ji, X., and Nai-yun, G. (2010). The removal of bisphenol A by hollow fiber microfiltration membrane. *Desalination*, 250(2), 693-697.
- Breast Cancer UK (BCUK). (2011). *What is BPA?* Retrieved February 4, 2013, from No More Bisphenol A: <http://www.nomorebpa.org.uk/whatisbpa/>
- Cao, X. (2010). Background Paper on Chemistry and Analytical Methods for Determination of Bisphenol A Food and Biological Samples. *FAO/WHO Expert Meeting on Bisphenol A (BPA)*. Ottawa, Canada: World Health Organization.
- Carlisle, J., Chan, D., Golub, M., Henkel, S., Painter, P., and Wu, K. L. (2009). *Toxicological Profile for Bisphenol A*. California: Office of Environmental Health Hazard Assessment (OEHHA).
- Chen, J., Huang, X., and Lee, D. (2008). Bisphenol A removal by a membrane bioreactor. *Process Biochemistry*, 43, 451–456.
- Clark, M. N., and Nielsen, C. R. (2013). *The Regulation of Food Packaging in the Pacific Rim*. Retrieved June 26, 2014, from http://www.packaginglaw.com/3591_.shtml#
- Clarke, T. H. (2012). *Update on BPA Use and Production*. Retrieved January 24, 2013, from Environmental Law and Climate Change Community: <http://www.lexisnexis.com/community/environmental-climatechangelaw/blogs/publichealthsafety/archive/2012/09/30/update-on-bpa-use-and-production.aspx>
- Crain, D. A., Eriksen, M., Iguchi, T., Jobling, S., Laufer, H., LeBlanc, G. A., and Guilleye Jr., L. J. (2007). An ecological assessment of bisphenol-A: Evidence from comparative biology. *Reproductive Toxicology*, 24, 225-239.
- Doherty, L. F., Bromer, J. G., Zhou, Y., Aldad, T. S., and Taylor, H. S. (2010). In Utero Exposure to Diethylstilbestrol (DES) or Bisphenol-A (BPA) Increases EZH2 Expression in the Mammary Gland: An Epigenetic Mechanism Linking Endocrine Disruptors to Breast Cancer. *Horm Cancer*, 1(3), 146-155.

- EFSA. (2014). *Bisphenol A*. Retrieved June 30, 2014, from <http://www.efsa.europa.eu/en/topics/topic/bisphenol.htm>
- Erlar, C., and Novak, J. (2010). Bisphenol A Exposure: Human Risk and Health Policy. *Journal of Pediatric Nursing*, 25, 400-407.
- European Communities. (2010). *4,4'-Isopropylidenediphenol (Bisphenol A)*. Summary Risk Assessment Report, Institute for Health and Consumer Protection European Chemicals Bureau, Joint Research Centre, United Kingdom.
- Fent, G., Hein, W. J., Moendel, M. J., and Kubiak, R. (2003). Fate of ¹⁴C-bisphenol A in soils. *Chemosphere*, 51, 735–746.
- Flint, S., Markle, T., Thompson, S., and Wallace, E. (2012). Bisphenol A exposure, effects, and policy: A wildlife perspective. *Journal of Environmental Management*(104), 19-34.
- Fromme, H., Kuchler, T., Otto, T., Pilz, K., Muller, J., and Wenzel, A. (2002). Occurrence of phthalates and bisphenol A and Fin the environment. *Water Research*, 36, 1429–1438.
- Fu, P., and Kawamura, K. (2010). Ubiquity of bisphenol A in the atmosphere. *Environmental Pollution*, 158, 3138-3143.
- Fürhacker, M., Scharf, S., and Weber, H. (2000). Bisphenol A: emissions from point sources. *Chemosphere*, 41, 751-756.
- Gilala, J. (2010). *Determination Of Phenols In Water By High Performance Liquid Chromatography With A UV-Detector*. Poland: Technology and Business, Kokkola.
- Hunt, P. A., Koehler, K. E., Susiarjo, M., Hodges, C. A., Ilagan, A., Voigt, R. C., . . . Hassold, T. J. (2003). Bisphenol A Exposure Causes Meiotic Aneuploidy in the Female Mouse. *Current Biology*, 13, 546-553.
- Inoue, M., Masuda, Y., Okada, F., Sakurai, A., Takahashi, I., and Sakakibara, M. (2008). Degradation of bisphenol A using sonochemical reactions. *Water Research*, 42(6-7), 1379–1386.
- Japan National Institute of Advanced Industrial Science and Technology. (2007). *Bisphenol A (BPA) Risk Assessment Document*. Retrieved March 28, 2013, from Research Center for Chemical Risk Management: https://unit.aist.go.jp/riss/crm/mainmenu/e_1-10.html

- Johnson, A., and Jürgens, M. (2003). Endocrine active industrial chemicals: Release and occurrence in the environment. *Pure Appl. Chem.*, 75(11-12), 1895–1904.
- Kang, J.-H., and Kondo, F. (2005). Bisphenol A degradation in seawater is different from that in river water. *Chemosphere*, 60, 1288-1292.
- Kang, J.-H., Kondo, F., and Katayama, Y. (2006). Human exposure to bisphenol A. *Toxicology*, 226, 79-89.
- Kang, J.-H., Kondo, F., and Katayama, Y. (2006). Importance of control of enzymatic degradation for determination of bisphenol A from fruits and vegetables. *Analytica Chimica Acta*, 555, 114–117.
- Kang, J.-H., Ri, N., and Kondo, F. (2004). Streptomyces sp. strain isolated from river water has high bisphenol A degradability. *Letters in Applied Microbiology*, 39, 178-180.
- Lang, I. A., Galloway, T. S., Scarlett, A., Henley, W. E., Depledge, M., Wallace, R. B., and Melzer, D. (2008). Association of Urinary Bisphenol A Concentration With Medical Disorders and Laboratory Abnormalities in Adults. *American Medical Association*, 300(11), 1303-1310.
- Le, H. H., Carlson, E. M., Chua, J. P., and Belcher, S. M. (2008). Bisphenol A is released from polycarbonate drinking bottles and mimics the neurotoxic actions of estrogen in developing cerebellar neurons. *Toxicol Lett.*, 176(2), 149-156.
- Lee, J., Lee, B. C., Ra, J. S., Cho, J., Kim, I. S., Chang, N. I., . . . Kim, S. D. (2008). Comparison of the removal efficiency of endocrine disrupting compounds in pilot scale sewage treatment processes. *Chemosphere*, 71, 1582–1592.
- Lee, J.-M., Kim, M.-S., and Kim, B.-W. (2004). Photodegradation of bisphenol-A with TiO₂ immobilized on the glass tubes including the UV light lamps. *Water Research*, 38, 3605–3613.
- Legislative Counsel of California. (2011). *AB 1319 Assembly Bill - Bill Analysis*. Retrieved January 21, 2013, from California Legislative Information: http://www.leginfo.ca.gov/pub/11-12/bill/asm/ab_1301-1350/ab_1319_cfa_20110705_165045_sen_comm.html

- Li, R., Chen, G.-Z., Tam, N. F., Luan, T.-G., Shin, P. K., Cheung, S. G., and Liu, Y. (2009). Toxicity of bisphenol A and its bioaccumulation and removal by a marine microalga *Stephanodiscus hantzschii*. *Ecotoxicology and Environmental Safety*, 72, 321–328.
- Logistics Digest. (2012). *Ministry of Commerce, Thailand issued a warning that EU has banned the using of BPA in products* . Retrieved June 26, 2014, from <http://www.logisticsdigest.com/news/policyaregulation/item/8454-%E0%B8%9E%E0%B8%B2%E0%B8%93%E0%B8%B4%E0%B8%8A%E0%B8%A2%E0%B9%8C%E0%B9%80%E0%B8%95%E0%B8%B7%E0%B8%AD%E0%B8%99%E0%B8%9C%E0%B8%B9%E0%B9%89%E0%B8%9B%E0%B8%A3%E0%B8%B0%E0%B8%81%E0%B8%AD%E0%B8%9A%E>
- Maffini, M. V., Rubin, B. S., Sonnenschein, C., and Soto, A. M. (2006). Endocrine disruptors and reproductive health: The case of bisphenol-A. *Molecular and Cellular Endocrinology*, 179–186.
- Melcer, H., and Klecka, G. (2011). Treatment of Wastewaters Containing Bisphenol A: State of the Science Review. *Water Environ Res.*, 83(7), 650-666.
- Ministry of Public Health, Thailand. (1988). *Notification of Ministry of Public Health No.111 B.E.2531 (1988)*.
- Ministry of Public Health, Thailand. (2005). *Notification of Ministry of Public Health No.295 B.E.2548 (2005)*.
- Ministry of Public Health, Thailand. (2005). Re: Qualities or standard for container made from plastic. *Notification of The Ministry of Public Health No. 295 (B.E. 2548 (2005))*.
- Ministry of Public Health, Thailand. (2009). Notification of Ministry of Public Health B.E.2535 (2009). In *Cosmetic Act B.E.2535 (1992)*.
- Ministry of the Environment Government of Japan. (2008). *Overview of the PRTR system*. Retrieved March 27, 2013, from <http://www.env.go.jp/en/chemi/prtr/about/overview.html>

- Nagel, S. C., vom Saal, F. S., Thayer, K. A., Dhar, M. G., Boechler, M., and Welshons, W. V. (1997). Relative Binding Affinity-Serum Modified Access (RBA-SMA) Assay Predicts the Relative In Vitro Bioactivity of the Xenoestrogens Bisphenol A and Octylphenol. *Environmental Health Perspectives*, 105(1), 70-76.
- Nordic Council of Ministers. (1996). Chemicals with Estrogen-like Effects. Copenhagen: Ekspressen Tryk og Kopicenter.
- Nunley, M. (2011). *Estrogen – A Hormone Much Maligned*. Retrieved February 4, 2013, from Marsha Nunley, MD:
<http://marshanunley.md.wordpress.com/2011/03/04/estrogen-a-hormone-much-maligned>
- OEDE. (2013). *Introduction to Pollutant Release and Transfer Register*. Retrieved March 25, 2013, from <http://www.oecd.org/env/ehs/pollutant-release-transfer-register/introductiontopollutantreleaseandtransferregistersprtrs.htm>
- PC/BPA-group-PlasticsEurope. (2007). *Applications of Bisphenol A*. Retrieved December 31, 2012, from Bisphenol A: European Information Centre on Bisphenol A:
<http://www.bisphenol-a-europe.org/uploads/BPA%20applications.pdf>
- PCD. (2010). *PCD in cooperation with DIW and JICA*. Retrieved March 27, 2013, from
<http://www.pcd.go.th/public/News/GetNewsThai.cfm?task=lt2009andid=16313>
- PCD. (2011). PRTR. Retrieved March 28, 2013, from <http://www.pcd.go.th>
- Pirard, C., Sagot, C., Deville, M., Dubois, N., and Charlier, C. (2012). Urinary levels of bisphenol A, triclosan and 4-nonylphenol in a general Belgian population. *Environment International*, 48, 78-83.
- Polycarbonate/BPA Global Group. (2013). *Bisphenol A Toxicological Research Information*. Retrieved January 20, 2013, from Bisphenol-A:
<http://www.bisphenol-a.org/human/herGeneralToxicity.html>
- PRTRLearn Training and Knowledge Sharing Platform. (2013). Retrieved March 28, 2013, from <http://prtr.unitar.org/>

- Rubin, B. S. (2011). Bisphenol A: An endocrine disruptor with widespread exposure and multiple effects. *The Journal of Steroid Biochemistry and Molecular Biology*, 127(1-2), 27–34.
- Sala, M., Kitahara, Y., Takahashi, S., and Fujii, T. (2010). Effect of atmosphere and catalyst on reducing bisphenol A (BPA) emission during thermal degradation of polycarbonate. *Chemosphere*, 78, 42-45.
- Santhi, V., Sakai, N., Ahmas, E., and Mustafa, A. (2012). Occurrence of bisphenol A in surface water, drinking water and plasma from Malaysia with exposure assessment from consumption of drinking water. *Science of the Total Environment*, 427-428, 332-338.
- Saxe, D. (2010). *BPA- a toxic substance*. Retrieved January 24, 2013, from Environmental Law and Litigation: <http://envirolaw.com/bpa-toxic-substance/>
- Staples, C. A., Dom, P. B., Klecka, G. M., O'Block, S. T., and Harris, L. R. (1998). A Review of The Environmental Fate, Effects, and Exposures of Bisphenol A. *Chemosphere*, 36(10), 2149-2173.
- Stasinakis, A. S., Gatidou, G., Mamais, D., Thomaidis, N. S., and Lekkas, T. D. (2008). Occurrence and fate of endocrine disrupters in Greek sewage treatment plants. *Water Research*, 42, 1796–1804.
- Tang, S., Lu, N., Li, J., and Wu, Y. (2012). Removal of bisphenol A in water using an integrated granular activated carbon preconcentration and dielectric barrier discharge degradation treatment. *Thin Solid Films*, 521, 257–260.
- The Dow Chemical Company. (2012, September 25). Bisphenol A. *Product Safety Assessment*, pp. 1-13.
- Tsutsumi, Y., Haneda, T., and Nishida, T. (2001). Removal of estrogenic activities of bisphenol A and nonylphenol by oxidative enzymes from lignin-degrading basidiomycetes. *Chemosphere*, 42, 271-276.
- U.S. Environmental Protection Agency (U.S. EPA). (2012). *Products and Materials: BPA in Thermal Paper*.
- U.S. Environmental Protection Agency. (2011). Testing of Bisphenol A: advance notice of proposed rulemaking. *Federal Register*, 76(143), 44535-44547.

- U.S. Environmental Protection Agency. (2012). *Bisphenol A. (CASRN 80-05-7)*. Retrieved December 21, 2012, from Integrated Risk Information System: <http://www.epa.gov/IRIS/subst/0356.htm>
- U.S. Geological Survey. (2012). *Emerging Contaminants In the Environment*. Retrieved December 21, 2012, from Toxic Substances Hydrology Program: <http://toxics.usgs.gov/regional/emc/>
- U.S. National Library of Medicine. (2012). *Bisphenol A (BPA)*. Retrieved January 16, 2013, from Tox Town - Environmental health concerns and toxic chemicals where you live,: http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=69
- Umweltbundesamt (German Federal Environment Agency). (2010). *Bisphenol A: An industrial chemical with adverse effects*. Dessau-RoBlau, Germany: Umweltbundesamt.
- UNECE. (2014). *About PRTR*. Retrieved July 3, 2014, from <http://www.prtr.net/en/about/>
- Vandenberg, L. N., Hauser, R., Marcus, M., Olea, N., and Welshons, W. V. (2007). Human Exposure to Bisphenol A. *Reprod Toxicol.*, 24(2), 77-139.
- vom Saal, F. S., and Hughes, C. (2005). An extensive new literature concerning low-dose effects of bisphenol A shows the need for a new risk assessment. *Environ Health Perspect*, 113(8), 926-933.
- vom Saal, F. S., and Myers, J. P. (2008). Bisphenol A and Risk of Metabolic Disorders. *JAMA*, 300(11), 1353-1355.
- Water Quality Management Office under Drainage and Sewerage Department(DDS), BMA. (2008). *Water Quality Management and Remediation*. Retrieved June 2, 2012, from Water Quality Management Office: <http://dds.bangkok.go.th/wqm/English/inplementation.html>
- Water Quality Management Office under Drainage and Sewerage Department(DDS), BMA. (2012). *Water Quality Analysis of Central Wastewater Treatment Plant*. Retrieved February 14, 2013, from Water Quality Management Office: http://dds.bangkok.go.th/News_dds/WQMD2555/wqm12_01.htm

- Weltin, D., Gehring, M., Tennhardt, L., Vogel, D., and Bilitewski, B. (2002). Occurrence and Fate of Bisphenol A during Wastewater and Sewage Sludge Treatment in Selected German Wastewater Treatment Plants. *American Water Works Association*.
- Zalko, D., Jacques, C., Duplan, H., Bruel, S., and Perdu, E. (2011). Viable skin efficiently absorbs and metabolizes bisphenol A. *Chemosphere*, 82, 424–430.

APPENDIX

Results of ANOVA Analysis for influent and effluent concentrations during three sampling events

Table A.1 Influent BPA concentrations for ANOVA analysis

Events	BPA concentration (µg/l)				
	DD	RK	CN	TK	NK
Oct.	0.235	0.226	0.129	0.438	0.606
	0.246	0.222	0.110	0.368	2.252
	0.269	0.549	0.147	0.403	1.429
Dec.	0.280	0.285	0.321	0.559	0.388
	0.337	0.247	0.272	0.576	0.214
	0.224	0.210	0.242	0.543	0.160
Feb.	0.595	0.264	0.152	0.232	0.430
	0.471	0.203	0.168	0.232	0.437
	0.355	0.191	0.137	0.232	0.422

Table A.2 Effluent BPA concentrations for ANOVA analysis

Events	BPA concentration (µg/l)				
	DD	RK	CN	TK	NK
Oct.	0.126	0.271	0.230	0.339	0.133
	0.222	0.257	0.219	0.599	0.135
	0.131	0.284	0.208	0.079	0.138
Dec.	0.082	0.111	0.072	0.052	0.086
	0.091	0.120	0.077	0.052	0.089
	0.073	0.103	0.075	0.052	0.092
Feb.	0.041	0.077	0.088	0.068	0.130
	0.036	0.047	0.098	0.072	0.102
	0.039	0.076	0.109	0.074	0.134

Table A.3 ANOVA: two-factor with replication result for influent BPA concentrations

Anova: Two-Factor With Replication

SUMMARY	DD	RK	CN	TK	NK	Total
<i>Oct.</i>						
Count	3	3	3	3	3	15
Sum	0.75	0.997	0.3855	1.209	4.287	7.6285
Average	0.25	0.332333	0.1285	0.403	1.429	0.508567
Variance	0.000301	0.035212	0.000342	0.001225	0.677329	0.337924
<i>Dec.</i>						
Count	3	3	3	3	3	15
Sum	0.841305	0.74247	0.83492	1.67796	0.76294	4.859595
Average	0.280435	0.24749	0.278307	0.55932	0.254313	0.323973
Variance	0.003184	0.00144	0.001571	0.00027	0.01415	0.01796
<i>Feb.</i>						
Count	3	3	3	3	3	15
Sum	1.42162	0.657865	0.45715	0.694935	1.28854	4.52011
Average	0.473873	0.219288	0.152383	0.231645	0.429513	0.301341
Variance	0.014469	0.001546	0.00023	0	6.37E-05	0.019467
<i>Total</i>						
Count	9	9	9	9	9	
Sum	3.012925	2.397335	1.67757	3.581895	6.33848	
Average	0.334769	0.266371	0.186397	0.397988	0.704276	
Variance	0.015546	0.012146	0.005394	0.02052	0.47408	
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample	0.387648	2	0.193824	3.869599	0.031984	3.31583
Columns	1.421074	4	0.355269	7.092753	0.000382	2.689628
Interaction	2.331184	8	0.291398	5.817612	0.000164	2.266163
Within	1.502668	30	0.050089			
Total	5.642575	44				

Table A.4 ANOVA: two-factor with replication result for effluent BPA concentrations

Anova: Two-Factor With Replication

SUMMARY	DD	RK	CN	TK	NK	Total
<i>Oct.</i>						
Count	3	3	3	3	3	15
Sum	0.479	0.8115	0.657	1.017	0.406	3.3705
Average	0.159667	0.2705	0.219	0.339	0.135333	0.2247
Variance	0.00292	0.000182	0.000121	0.0676	6.33E-06	0.015992
<i>Dec.</i>						
Count	3	3	3	3	3	15
Sum	0.246345	0.33378	0.223575	0.15534	0.26743	1.22647
Average	0.082115	0.11126	0.074525	0.05178	0.089143	0.081765
Variance	7.79E-05	7.55E-05	6.79E-06	0	9.34E-06	0.000426
<i>Feb.</i>						
Count	3	3	3	3	3	15
Sum	0.11607	0.200377	0.295053	0.214165	0.365648	1.191313
Average	0.03869	0.066792	0.098351	0.071388	0.121883	0.079421
Variance	6.38E-06	0.000302	0.000109	1.15E-05	0.000309	0.000972
<i>Total</i>						
Count	9	9	9	9	9	
Sum	0.841415	1.345657	1.175628	1.386505	1.039078	
Average	0.093491	0.149517	0.130625	0.154056	0.115453	
Variance	0.003568	0.008744	0.004559	0.036215	0.000504	
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample	0.20771	2	0.103855	21.7157	1.47E-06	3.31583
Columns	0.022456	4	0.005614	1.17389	0.342104	2.689628
Interaction	0.077536	8	0.009692	2.026556	0.077233	2.266163
Within	0.143475	30	0.004782			
Total	0.451177	44				

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