Chemical Factsheet

Piperonyl butoxide (PBO)

General Information

- Fact Sheet: Piperonyl Butoxide.pdf
- Product Names:
  Terro insect killer (Senoret) formulated with Pyrethrins, and Permethrin
  Ortho Tomato & Vegetable Insect Killer (Scotts) formulated with Pyrethrins
  Repel-XP Emulsifiable Fly Spray (Farnam) formulated with Pyrethrins
  Wasp, Hornet, and Yellow Jacket Killer (FMC) formulated with Tetramethrin, and Permethrin
  Purge (FMC) formulated with Pyrethrins
  Intruder Residual (FMC) formulated with Pyrethrins, and Cyfluthrin
  Scourge (Bayer) formulated with Resmethrin
  Aquapy (Bayer) formulated with Pyrethrins
  Butacide (Bayer)
  Gordon's Wasp & Hornet Spray (PBI/Gordon) formulated with Tetramethrin, and Peremethrin
  Raid Flea Killer (S.C. Johnson) formulated with Pyrethrins, Tetramethrin and N-Octyl bicycloheptene dicarboximide
- Chemical Class: Pesticide synergist
- Uses: Preharvest and postharvest uses on crops, direct and indirect treatments of livestock animals and premises, treatments of commercial and industrial facilities and storage areas where raw and processed food/feed commodities are stored or processed, and mosquito abatement areas; targets ants, worms, beetles, mites, flies, gnats, spiders, weevils, caterpillars, grubs, moths, ticks, lice, wasps, aphids, midges, and fish.
- Alternatives: Organic agriculture, Least-toxic mosquito control
- Beyond Pesticides rating: Toxic

Health and Environmental Effects

See citations at end of document.

- Cancer: Possible (**1**)
- Endocrine Disruption: Yes (**2**)
- Reproductive Effects: Yes (**3**)
- Neurotoxicity: Yes (**3**)
- Kidney/Liver Damage: Yes (**4**)
- Sensitizer/ Irritant: Yes (**4**)
- Birth/Developmental: Not documented
- Detected in Groundwater: Not documented
- Potential Leacher: Not documented
- Toxic to Birds: Not documented
- Toxic to Fish/Aquatic Organisms: Yes (**4**)
- Toxic to Bees: Not documented

Residential Uses as Found in the ManageSafe™ Database

- Mosquitoes
- Bed Bugs
- Carpet Beetle
- Centipedes

Additional Information

- Regulatory Status:
  - EPA Reregistration Eligibility Decision (RED) signed (6/2006)
- Supporting information:
  - Asthma, Children and Pesticides (Beyond Pesticides)
  - PAN Pesticides Database: PBO (Pesticide Action Network)
- Studies [compiled from the Pesticide-Induced Diseases Database]
  - Influence of pyrethroids and piperonyl butoxide on the Ca(2+)-ATPase activity of rat brain synaptosomes and leukocyte membranes. Grosman, N. 2005. *Int Immunopharmacol.* 5(2):263-70.
  - Global DNA methylation screening of liver in piperonyl butoxide-treated mice in a two-stage hepatocarcinogenesis model.. Yafune A, Kawai M, Itahashi M, et al. 2013. Toxicol Lett. 222(3):295-302
  - Impact of Prenatal Exposure to Piperonyl Butoxide and Permethrin on 36-Month Neurodevelopment. Horton, et al. 2011. Pediatrics, Online February 7, 2011 (doi:10.1542/peds.2010-0133)
  - Occurrence of pesticide residues in indoor dust of farmworker households across Europe and Argentina.. Navarro, I., de la Torre, A., Sanz, P., Baldi, I., Harkes, P., Huerta-Lwanga, E., Nørgaard, T., Glavan, M., Pasković, I., Pasković, M.P. and Abrantes, N., 2023. Science of The Total Environment, p.167797.
  - Organic farming reduces pesticide load in a bird of prey. Fuentes, E. et al. (2024) Organic farming reduces pesticide load in a bird of prey, Science of The Total Environment. Available at: https://www.sciencedirect.com/science/article/pii/S0048969724029255.
  - Exposure to pesticides, persistent and non − persistent pollutants in French 3.5-year-old children: Findings from comprehensive hair analysis in the ELFE national birth cohort. Macheka, L. et al. (2024) Exposure to pesticides, persistent and non − persistent pollutants in French 3.5-year-old children: Findings from comprehensive hair analysis in the ELFE national birth cohort, Environment International. Available at: https://www.sciencedirect.com/science/article/pii/S0160412024004677.
  - Advances and future prospects of pyrethroids: Toxicity and microbial degradation. Singh, S. et al. (2022) Advances and future prospects of pyrethroids: Toxicity and microbial degradation, Science of The Total Environment. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0048969722016540.
  - Piperonyl butoxide, a synergist of pesticides can elicit male-mediated reproductive toxicity. Bae, J.W. and Kwon, W.S. (2021) Piperonyl butoxide, a synergist of pesticides can elicit male-mediated reproductive toxicity, Reproductive Toxicology. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0890623821000253.
  - A Review on Non-target Toxicity of Deltamethrin and Piperonyl Butoxide: Synergist. Basak, Mrinmoy and Choudhury, Rejwan Ahmed and Goswami, Priyanka and Dey, Biplab Kumar and Laskar, Moksood Ahmed (2021) A Review on Non-target Toxicity of Deltamethrin and Piperonyl Butoxide: Synergist. Journal of Pharmaceutical Research International, http://scholar.researcherseuropeans.com/id/eprint/323/
  - Pharmacokinetic analysis of acute and dietary exposure to piperonyl butoxide in the

mouse. Jenkins, A. et al. (2023) Pharmacokinetic analysis of acute and dietary exposure to piperonyl butoxide in the mouse, Toxicology Reports. Available at: https://www.sciencedirect.com/science/article/pii/S2214750023001099.
- Subacute oral toxicity of combinations of selected synthetic pyrethroids, piperonyl butoxide, and tetramethrin in rats. Yavuz O, Aksoy A, Das YK, et al. (2013). Subacute oral toxicity of combinations of selected synthetic pyrethroids, piperonyl butoxide, and tetramethrin in rats. Toxicology and Industrial Health. https://journals.sagepub.com/doi/abs/10.1177/0748233712469651
- Monitoring the aquatic toxicity of mosquito vector control spray pesticides to freshwater receiving waters. Phillips, B. M., Anderson, B. S., Voorhees, J. P., Siegler, K., Denton, D., TenBrook, P., Larsen, K., Isorena, P., & Tjeerdema, R. S. (2014). Monitoring the aquatic toxicity of mosquito vector control spray pesticides to freshwater receiving waters. Integrated environmental assessment and management, 10(3), 449–455. https://doi.org/10.1002/ieam.1534
- American Healthy Homes Survey: A National Study of Residential Pesticides Measured from Floor Wipes. Stout, D. M., 2nd, Bradham, K. D., Egeghy, P. P., Jones, P. A., Croghan, C. W., Ashley, P. A., Pinzer, E., Friedman, W., Brinkman, M. C., Nishioka, M. G., & Cox, D. C. (2009). American Healthy Homes Survey: a national study of residential pesticides measured from floor wipes. Environmental science & technology, 43(12), 4294–4300. https://doi.org/10.1021/es8030243
- Pesticide contamination in indoor home dust: A pilot study of non-occupational exposure in Argentina. Aparicio, Virginia & Kaseker, Jessica & Scheepers, Paul & Alaoui, Abdallah & Figueiredo, Daniel & Mol, H. & Silva, Vera & Harkes, Paula & dos Santos, Danilo & Geissen, Violette & Costa, José. (2025). Pesticide Contamination in Indoor Home Dust: A Pilot Study of Non-Occupational Exposure in Argentina. Environmental Pollution. 373. 126208. 10.1016/j.envpol.2025.126208.
- Monitoring of Non-Maximum-Residue-Level Pesticides in Animal Feed: A Study from 2019 to 2023. Giugliano, R., Armenio, V., Savio, V., Vaccaro, E., Ciccotelli, V., & Vivaldi, B. (2024). Monitoring of Non-Maximum-Residue-Level Pesticides in Animal Feed: A Study from 2019 to 2023. Toxics, 12(9), 680. https://doi.org/10.3390/toxics12090680

Gateway Health and Environmental Effects Citations

1. US EPA, Office of Prevention, Pesticides and Toxic Substances, Reregistration Eligibility Decisions (REDs), Interim REDS (iREDs) and RED Factsheets. https://archive.epa.gov/pesticides/reregistration/web/html/status.html.

2. European Commission. Endocrine Disruptors: Study on Gathering Information on 435 Substances with Insufficient Data. Final Report. EU DG Environment: B4-3040/2001/325850/MAR/C2. BKH Consulting Engineers: M0355037. November 2002. http://ec.europa.eu/environment/chemicals/endocrine/pdf/bkh_report.pdf#page=76.

3. Northwest Coalition for Alternatives to Pesticides (NCAP), Pesticide Factsheets. http://www.pesticide.org/pesticide-factsheets.

4. Beyond Pesticides ChemWatch Factsheets. (Cited under factsheets on Beyond Pesticides Gateway; see top of individual chemical page)

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