

Tire Crumb toxicity- benzothiazoles, dioxin-like activity

(See attachments and citations).

Benzothiazoles, 2 mercapto-Benzothiazole and metabolites are omnipresent in all tire field studies that look for them. The attached and their citations (along with all the studies that show benzothiazoles in tires, released from tires and highly "bioaccessible" -migrating into synthetic body fluids) make a case: In the soup of tire crumb toxins, benzothiazoles may be one of the chemicals responsible for toxicity by activating the same receptors that dioxins and PAHs do (along with other uncharacterized dioxin-like components) :

1) **Benzothiazoles are clearly released at high levels from tire crumb synturf fields** indoors and out (even where the release of PAHs has been harder to show, Connecticut-Ginsberg study and others)

2) **Tire dust generated by tire abrasion is inhalable and contains benzothiazole toxins such as Mercapto-benzothiazole** (Agavayan 2014: "***Tire tread wear particles in ambient air—a previously unknown source of human exposure to the biocide 2-mercaptobenzothiazole***" R.Avagyan, I.Sadiktsis, C.Bergvall, R.Westerholm Email author : roger.westerholm@anchem.su.se)

Mechanism of toxicity?:

3) **Benzothiazoles** as well as PAHs and other chemicals in tire leachate **activate the same systems as toxic dioxins** which are carcinogenic, reprotoxic and endocrine disrupting (note many studies show **Tire leachate is demonstrated to be toxic to living systems**):

3a) **Tire rubber contains dioxin-like activity** <<http://www.ncbi.nlm.nih.gov/pubmed/23441220>> PLoS One. 2013;8(2):e56860. 2013 Feb 18. "***Common commercial and consumer products contain activators of the aryl hydrocarbon (dioxin) receptor***". Zhao B1, Bohonowych JE, Timme-Laragy A, Jung D, Affatato AA, Rice RH, Di Giulio RT, Denison MS. "Activation of the Ah receptor (AhR) by halogenated aromatic hydrocarbons (HAHs), such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD, dioxin), can produce a wide variety of toxic and biological effects. ...Solvent extracts of paper, ***rubber and plastic products*** contain chemicals that can bind to and stimulate AhR DNA binding and/or AhR-dependent gene expression in hepatic cytosol, cultured cell lines, human epidermis and zebrafish embryos. ...Solvent extracts of **rubber products** produce AhR-dependent developmental toxicity.... "

3b) **Benzothiazoles in tire leachate** activate the same systems **as toxic dioxins**: He, Zhao, Denison 2011:"***Identification of Benzothiazole Derivatives and Polycyclic Aromatic Hydrocarbons as Aryl Hydrocarbon Receptor Agonists Present in Tire Extracts***" Guochun He†, Bin Zhao†,‡, and Michael S. Denison†, *Corresponding Author: Michael S. Denison, University of California, DavisTel: 530-752-3879, msdenison@ucdavis.edu.

and BIOACCESSIBLE!

4) **Benzothiazoles from tire crumb are released and BIOACCESSIBLE (along with lead and others** : <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4038666/pdf/nihms565643.pdf>> "***Bio-accessibility and Risk of Exposure to Metals and SVOCs in Artificial Turf Field Fill Materials and Fibers***", 2013 Brian T. Pavilonis1, Clifford P. Weisel1, Brian Buckley1, and Paul J. Lioy1; (One of the more revealing studies because identified Benzothiazoles from tire crumb and Lead from turf and tire crumb at variable levels... but up to and beyond actionable lead levels. **Both Benzothiazoles and LEAD migrated from plastic and tire crumb into synthetic biofluids used to assess "bioavailability" in this study**).

Also present in the syn-biofluids were: **4-tert-octyl phenol** was present in the lung and sweat ...
....**2,2 benzothiazole, a dimer of benzothiazole**, in the digestive fluid. along with a similar
compound **Phenol, 2,5-bis(1,1-dimethylethyl)-** which is used as a UV stabilizer and has
environmental toxicity **was also present in the total extract**

PRECEDENT FOR BANNING FROM EPA - CPSC SHOULD TAKE NOTE:

5) **EPA has BANNED 2 Mercapto-Benzothiazole and methyl ethyl ketone** from **pesticides**. <<https://www.regulations.gov/document?D=EPA-HQ-OPP-2014-0558-0056>>

So there is precedent to ban tire crumb because of this - *if it is too toxic for pesticides why should children or athletes be exposed to it??!* See attached - **Methyl ethyl ketone which is in synturf tire crumb and 2 mercapto benzothiazole were BANNED!**

also Phthalates likely present in the plastic rug were banned: Dioctyl phthalate, Dimethyl phthalate, Diallyl phthalate

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