Composted Biosolids Bind Lead In Soil, Reducing Danger Of Poisoning

Adding composted biosolids rich with iron, manganese and organic matter to a lead-contaminated home garden in Baltimore appears to have bound the lead so it is less likely to be absorbed by the bodies of children who dirty their hands playing outside or are tempted to taste those delicious mud pies they "baked" in the backyard.

The garden soil in the study is similar to potentially hundreds of thousands of yards contaminated with lead in Baltimore and other inner cities, according to Sally L. Brown, University of Washington research assistant professor of forest resources and lead author of an article in the current issue of the Journal of Environmental Quality.

Even yards that were never near smelter operations can have contaminated soils because of lead-based paints from older buildings and auto exhaust from leaded gasoline. The Centers for Disease Control and Prevention says that 50 percent of inner-city children in the United States have lead levels in their blood high enough to cause irreversible damage to their health.

Children swallow particles of lead if they are still at the age when they'll put anything – including dirt – into their mouths or if they pick up particles on their hands and clothes and then go inside to eat a snack.
The bioavailability – that is the amount of lead available to enter the bloodstream – was lowered 20 percent to 38 percent after mixing composted biosolids with the contaminated garden soil, according to Brown and her co-authors, Rufus Chaney, Judith Hallfrisch and Qi Xue of the U.S. Department of Agriculture, Agricultural Research Service, Maryland. The best mixture for reducing bioavailability was one made from Baltimore biosolids that contained more iron and manganese than the others tested.

Biosolids are the organic residuals produced during wastewater treatment. Once composted, biosolids look like other commercially available composts and are approved for use by the U.S. Environmental Protection Agency as a soil amendment by home gardeners, farmers and others.
Using composted biosolids to remediate soils would be far less costly than other alternatives, Brown says. While soil contaminated with lead might be removed and replaced if it was at a Superfund site that is just not possible within cities.

"We're not going to be able to 'remove' Baltimore," Brown says.

Co-author Chaney, a metals specialist, says, "Ever since we found the extensive urban-soil lead problems in the mid '80s, we've been seeking a lower-cost option to soil removal. This appears to be the answer."

In the study, funded by the non-profit Water Environment Research Federation headquartered in Virginia, the scientists tested seven different biosolids and composted biosolid treatments, adding 3 inches of each to different areas of the garden, and then thoroughly mixing the soils weekly for 30 days. Soil samples and laboratory rats exposed to the soils were tested for changes in lead levels. Since then, findings from a pilot program adding composts to other home gardens in Baltimore and East St. Louis, Ill., appear to confirm the findings.

Brown says researchers still need to find out how long the effects last and if similar results can be obtained using compost that doesn't come from biosolids.

They'd also like to investigate exactly why composted biosolids change the nature of lead so it's not so readily available for absorption by the body. Brown and her co-authors hypothesize that this happens because biosolids are generally more than 50 percent organic matter, often contain high concentrations of iron, as well as high levels of phosphorous and manganese. Studied singly by other groups of scientists, each of these soil conditions was shown to reduce lead availability in soils, according to studies published in 1999 and 2000. Brown and her co-authors studied all three components at once and monitored effects on living organisms as well as changes in soils.
