# Biosolids used as fertilizer in China and other countries

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The increasing use of bio-solid or human sewage as fertilizer in farms is posing great environmental and health risks. Sewage is well known for its nutrients and cheap price. The use of sewage sludge as fertilizers can be a solution for disposal problems. Nevertheless, heavy metals such as lead are likely to be found in sewage: such materials can be absorbed by plants (the amount absorbed varies among different plants, details of which are found in fact sheet "Is your yard lead safe" by The LEAD Group) and can, in turn, significantly impair functions of human organs.

Raw sewage contains a lot of different nutrients and is likely to be used to irrigate cereal crops and certain vegetables such as spinach. It has been a long time since sewage consisted only of human and animals' faecal material. Since the first industrial revolution took place many undesirable materials have been included in sewage. As a result, nowadays most of the sewage collected from communities must be processed and treated before it is used as a farm fertilizer. The following materials are likely to be found in sewage sludge: water, faecal matter, toilet paper, hair, rancid grease and industrial chemicals (containing heavy metals such as aluminium, copper, zinc, lead, chromium, nickel, molybdenum, selenium, silver, arsenic, mercury etc).

Heavy metal content of the soil after harvest at varying levels of liquid sewage sludge application. (Source: PCARRD, 2002. Highlights 2001, Los Banos, Laguna. From Philippine Organic Agriculture Information Network.)

| **Heavy Metals** | **Standard Limit* (ppm)** | **Level of Metals (ppm) in Soils Applied with Liquid Sewage Sludge (t/ha)** | | | |
|---|---|---|---|---|---|
| | | **0** | **40** | **80** | **120** |
| **Arsenic (As)** | 5.00 | 0.002 | 0.002 | 0.002 | 0.002 |
| **Cadmium (Cd)** | 5.00 | 0.001 | 0.001 | 0.001 | 0.001 |
| **Chromium (Cr)** | 5.00 | 0.067 | 0.065 | 0.065 | 0.079 |
| **Lead (Pb)** | 5.00 | 0.869 | 0.845 | 0.852 | 0.907 |
| **Mercury (Hg)** | 0.20 | 0.001 | 0.001 | 0.001 | 0.001 |
| **Selenium (Se)** | 1.00 | 0.001 | 0.001 | 0.002 | 0.002 |

For many years it has been unusual for farmers in western countries to use biosolids as fertilizer, as waste treatment is very complicated and expensive. In contrast, farmers in China have used human waste to fertilize fields for more than 4,000 years. After thousands of years of cultivation, China's soil is still fertile and suitable for farming, and soil erosion is not yet common. Given the low price of sewage sludge as a practicable environmental option, movements for the use of sewage sludge have emerged in some developed countries such as the United Kingdom and the United States.

In China, given the rising price of water and chemical fertilizers, up to 10 million farmers are using raw sewage to irrigate and fertilize cropland. Most of the farm operations are highly dependent on local resources, such as drawing water from seriously polluted rivers and lakes and using human sewage as fertilizers.

In parched regions of China, untreated wastewater is the only viable irrigation source keeping farmers in business, as the expense of delivering water from nearby rivers and lakes is prohibitive for farmers who earn less than $2000 a year. In order to reduce the expenditure, they frequently harvest untreated human faeces from latrines and spread it as fertilizer on farms. Even without the direct use of wastewater, there is another serious issue causing lead contamination of soil. The Chinese government does not have well- defined criteria for industrial waste disposal; many factories frequently emit wastewater into rivers and lakes without any processing and treatment, since there is little possibility of being fined and jailed. As a result, many toxins and heavy metals such as lead are released into the rivers and lakes where farmers tend to gather water for irrigation. This results in spreading toxins on their farms, which will remain in the soil for millennia if a clean-up never takes place. Toxins and heavy metals will be absorbed by the crops.

**(Editor's note: A study in 2006 found that 33.8% of children in China had a blood lead level greater than 10 µg/dL. See: Wang and Zhang)**

Biosolids are also widely used in Europe and the US. In parts of Europe and elsewhere biosolids have been applied on agricultural land for more than a century. In the United States biosolid recycling is as old as farm reclamation, even as old as power generation from wind, solar and hydroelectric power sources. But in the US the use of biosolids in agricultural irrigation is regulated at both Federal and State level. Under certain sections of the rules, limits for metal such as lead in biosolids and requirements for biosolids applied to farmland have been maintained and established while also enforcing a risk assessment capability (Biosolid.com, 2002). In recent decades, many countries have actively participated in conducting field trials to determine the safety and environmental security of biosolid management.

**The following accounts are from SourceWatch**

In 1993, a team of researchers at the University of Arizona published a research paper that found significant numbers of human disease organisms even in treated sewage sludge.

Sludge pathogens can move through many environmental pathways – direct contact with sludge, evaporation in inhalation, contaminated groundwater, contamination of rodents burrowing in sludge, and uptake through the roots of crops

In Islip, New York, sludge was the cause of the disease that killed 25-year-old Harry Dobin, who ran a coffee truck at a Long Island Railroad station 1000 feet away from a sludge composting site. In July 1991 Dobin began suffering health problems. Doctors treated him unsuccessfully for asthma, arthritis, Lyme disease, kidney disorder and bronchitis. Finally in January 1992 when he could no longer breathe, they performed a lung biopsy and discovered Aspergillus fumigatus, a common byproduct of sludge composting. By the time the disease was correctly diagnosed, it was unstoppable, spreading to his spine, his legs, and finally his heart, leading to his death on September 23, 1992. Other residents of Islip complained of chronic coughing, nausea and other reactions.

Viruses, bacteria, protozoa, fungi and intestinal worms are present in sewage sludge. Many of the pathogens cause diseases that sicken, cripple and kill humans, including salmonella, shigella, campylobacter, E-coli, enteroviruses (which cause paralysis, meningitis, fever, respiratory illness, diarrhoea, encephalitis), giardia, cryptosporidium, roundworm, hookworm, and tapeworm.

Outside Sparta, Missouri, a tiny rural town whose sewage plant began operations in the late 1980s, dairy farmer Ed Rollers began having problems with his cows in 1990. They were falling sick and dying,

and no veterinarian or university scientists could tell him why. The death and disease continued until late 1993 when the farm declared bankruptcy.

Scientific soil tests initiated by Rollers revealed that sludge dumped on a field ran onto his fields, which were found to contain lots of heavy metal contaminants. Tests on dead cows were postive for heavy metals, and lead was found in the liver, kidneys, bones and teeth.

In Lynden, Washington, dairy farmers Linda and Raymond Zander began to lose cows one year after sludge was spread on an adjoining farm. "We noticed . . . lameness and other malfunctions," said Linda Zander. Tests found heavy metals in soils at the sludge disposal site and in water from two neighbourhood wells that served several families. Raymond Zander was diagnosed with heavy metal poisoning, and several family members showed signs of neurological damage, which they believe is linked to heavy metal poisoning, including lead. Sixteen neighbouring families have experienced health problems ranging from flu symptoms to cancer.

Sewage sludge is often marketed as “free fertilizer” and welcomed by many farmers. However, problems do not show up overnight. Lead is more likely to produce chronic long term problems rather than an acute attack, except at very high quantities, but the long term accumulation of lead can have as severe an impact on health, for both humans and animals. Symptoms of this may appear years later. In the case of Zander and Roller, they did not realize what was happening until 2 years later (SourceWatch, 2010).

Legislation of Australia on controlling the amount of lead and other heavy metals that can be added onto agriculture land via sewage sludge

According to the environmental guidelines for the use and disposal of biosolids products published by NSW Environment Protection Authority, a grading system of contaminants has been developed to assist in identifying the suitability of biosolids products for land use or disposal. Each contaminant is to be graded A, B, C, D or E (Grade E being the lowest grade), Contaminant Acceptance Concentration Thresholds for lead (on dry weight basis) are Grade A: 150(mg/kg), Grade B: 150(mg/kg), Grade C: 420(mg/kg), Grade D: 500(mg/kg). The maximum allowable soil lead concentrations for agricultural land following biosolids application is 150 (mg/kg dry weight of soil) (EPA, 2000).

According to the Bureau of Statistics of China’s customs department, the total value of exports of agricultural product in China has reached 38 billion US dollars recently.

According to the Shanghai Agriculture Committee, the total value of exports of agricultural product in China reached 31 billion US dollars in 2006 , which accounted for 3.9% of total global exports of 788 billion US dollars.

The proportion of exports of agricultural products from China to main import countries from 2002 to 2007 (Shanghai Agriculture Committee, 2009)

| **Years** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** |
|---|---|---|---|---|---|---|
| **Nations** | **%** | **%** | **%** | **%** | **%** | **%** |
| **Japan** | 31.7 | 28.5 | 32.0 | 29.2 | 26.5 | 22.8 |
| **Hong Kong** | 11.4 | 10.4 | 11.3 | 9.7 | 8.6 | 8.3 |
| **Korea** | 11.3 | 12.1 | 9.2 | 10.5 | 9.3 | 9.8 |
| **US** | 9.0 | 9.7 | 10.0 | 10.4 | 12.2 | 12.0 |
| **Total** | 66.7 | 63.7 | 65.5 | 63.2 | 60.1 | 56.7 |

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