

Heavy metal recovery from contaminated soil

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Teijin Fibers Limited has developed an epochal soil-cleaning technology that can treat and clean soil polluted by heavy metals. This technology is fundamentally different from the conventional procedures to prevent heavy metals from elution into groundwater such as insolubilization and solidification, in that it can also recover the heavy metals from contaminated soil. The process consists of chemical extraction of heavy metals from contaminated soil and heavy metals recovery from the extracting agent. The 'precipitate flotation' technology is adapted to recovery the heavy metals. Teijin group is under study of the contaminated soil purification business.

Key words: Heavy metals, Flotation, Contaminated soil, Precipitation

1. INTRODUCTION

The Teijin Group's corporate philosophy states, "We place the highest priority on safety and the preservation of our natural environment." The Group's brand statement "Human Chemistry, Human Solutions" was established in April of this year. In an on-going effort to embody these thoughts, Teijin Fibers Limited has developed an epochal soil-cleaning technology that can treat and clean soil polluted by heavy metals. As a result of the Soil Pollution Control Law, which came into effect last February, the liabilities associated with polluted land have substantially increased. Conventional processes for treating contaminated soil do not remove heavy metals. Teijin's method, however, is based on its unique new technology, selectively removing and recovering heavy metals pollutants on-site, then cleaning and replacing the cleaned soil on-site. Moreover, recovered heavy metals become recyclable with the new process, and the risk of secondary pollution is therefore eliminated. It is a new application of Teijin's secondary waste processing technology, used in the highly advanced chemical recycling of polyester products in soil cleaning. This new application now extends that recycling technology to include inorganic compounds, in addition to organic compounds, through "Highly Advanced Chemical Recycling".

2. BACKGROUND OF TECHNOLOGICAL DEVELOPMENT

Teijin Fibers Limited has been steadily

developing the capacity to recycle organic parts from polyester products, and launched its "Highly Advanced Chemical Recycling" system at the Tokuyama factory in April, 2002 with the goal of complete recycling of polyester products. Teijin Fibers started a full-scale "Fiber-to-Fiber" recycling process implementation from July of last year, and will launch the world's first commercial PET "Bottle-to-Bottle" chemical recycling operation this autumn.

"Highly Advanced Chemical Recycling" is an original technology developed by the Teijin Group that recovers high quality polyester raw materials from used polyester products such as fiber products and PET bottles, among others. This was achieved by separating and removing the various dyestuff and additives contained in the catalyst metals used in the manufacturing processes of polyester products and final products. Teijin Fibers is developing technology that can separate, refine and recover useful components from the removed materials. The aim is to reduce waste as much as possible and reuse these components through recycling. The company has succeeded in developing and applying the capability to recover heavy metals from the soil based on its metal compound recovery technology. The soil pollution problem is becoming increasingly apparent nationwide, and the costs of soil cleaning have been estimated at 11 trillion yen by the Geo-Environmental Protection Center, a corporation in public interest. Immediate measures are required. The February 2003 Soil Pollution Control Law has now set standards for the content level of contaminants. As a consequence, technology that can effectively decrease the amount of contaminants in soil on-site without removing the polluted soil is in very

strong demand. To meet this demand, Teijin Fibers extended in-house technology to develop an epochal on-site soil cleaning technology.

3. PROCESS DESCRIPTION

Fig.1 shows the outline of the new soil cleaning process, 'Extraction and Precipitate flotation'. This new soil cleaning technology consists of chemical extraction of heavy metals from polluted soil and recovery of the heavy metals from the extract by unique technology called "precipitate flotation".

Firstly, polluted soil is shoveled and put in extractor with extractant. Polluted soil and extractant are mixed at predetermined time in the extractor and heavy metals move into liquid phase. Secondly, the soil extracted heavy metals is separated into cleaned soil and liquid phase containing heavy metals by separator. Thirdly, separated soil has extractant liquid containing heavy metals, so it is mixed with agent and washed by washer and re-separated into soil and washing liquid by separator and cleaned soil can be buried back. On the other hand, extractant and washing liquid containing heavy metals are detoxified by neutralize agent, at that time Iron element contained in the soil changes to precipitate. At the same time heavy metals are coprecipitated with Iron. Injecting surfactant into the liquid and bubbling at flotation unit, Iron precipitate with heavy metals is collected bubble surface by electrical force, fig.2 shows the principle of precipitate flotation,

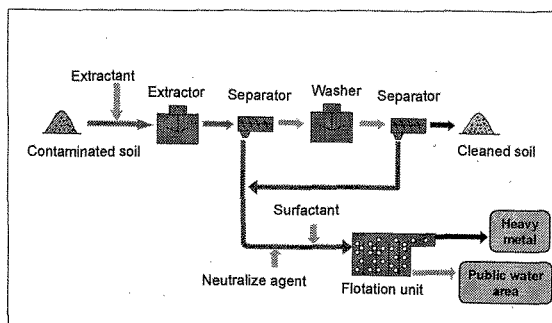


Fig.1 Outline of the Teijin soil-cleaning process

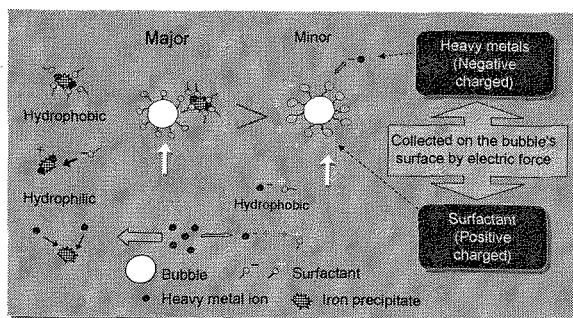


Fig.2 The principle of precipitate flotation

Apparent gravity of coprecipitate gets lower, so Iron precipitate is rising up in the liquid, finally it is out of flotation unit and after antifoaming recovered heavy

metals are reused as resources. Cleaned liquid is discharged into public water area.

4. SUMMARY

'Extraction and Precipitate flotation' is developed. This technology can allow for the removing all regulated heavy metals from polluted soil and actively control the cleaning degree, from set Environmental Quality Standards for Soil Pollution levels to completely pollutant-free levels, selecting the heavy metals to be removed by setting and controlling the extraction standards and separating of polluted soil into "clean soil" and "heavy metals." Clean soil can be buried back on-site, and the recovered heavy metals can be reused, creating a virtuous recycling of materials. Because the device is compact it is possible to treat the polluted soil on site. This enables prevention of contaminated soil from dropping and abandonment to outside during transporting of polluted soil, and alleviates the risk of secondary pollution. The extraction technology allows for the removal of chlorinated hydrocarbon compounds and other organic compounds, as well as heavy metals. In addition to soil cleaning, the technology can be applied to the detoxification of fly ash (extraction of heavy metals), as well as to the treatment of wastewater containing heavy metals.

The Teijin Group will continue to study and develop its polluted soil cleaning business and this technology. Further, the Teijin Group is considering the possibility of alliances with other companies and will contribute the establishment of recycle-based society.

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