Wet Separation techniques (Soil Washing) - From Niche Recovery to Common Application for Solid Waste Recovery

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ABSTRACT: Wet separations techniques have been in use in the mining industry for many centuries and more than a decade in the contaminated land markets in Europe. At the moment these applications seem ever more promising for solid waste recovery. The promise lies in the increase of the number of countries where the technology is used and in the application of the technology for new types of waste.

Keywords: Solid Waste, Soil Washing, Recovery, Separation Technique, Urban Mining, Environmental Economics.

1. INTRODUCTION

Wet separation of solids can involve a large set of sub-processes and techniques. Scrubbers, vibrating screens, screws, jigs, hydrocyclones, spirals, floatation cells, attrition cells, polymer stations, clarifiers and filtering presses are all building stones for a wet solids separation plant process. Depending on the specific needs and the demanded purity of the recovered substrate, all these building blocks can be used in different combinations.

2. THE CONVENTIONAL AND MAINSTREAM APPLICATION OF WET SEPARATION

The conventional and mainstream application of wet separation is a process most used in the commodities market. As an extraction process of, for example, sand recovery or an additional process in the coal mining industry. The application in the contaminated land market (contaminated soils) requires the additional use of chemicals (polymers) for an enhanced separation. Tax exemptions are mainly the reason why wet separation techniques found their entry into the European waste market in the mid-‘90.

Table 1. An overview of some soil washing plants in Europecaption caption.

Company and Country	***Application***	***Recovered***
Erberhard, Switzerland	Contaminated soil	Sand
Teseco, Italy	Contaminated soil	
SITA Remediation, Belgium	Contaminated soil	
Boskalis, The Netherlands	Contaminated soil, dredged sediments	

Over the years these conventional soil washing plants started to treat wastes like roadsweepings, metals castings sand, grid residues, etc. These small quantities of different types of wastes would not be enough to build a recovery plant, but recurrent waste flows proved interesting enough as an add-on to what the market had to offer as quantities of contaminated soils. The soil washing plants for the contaminated land market have typically a through put of 20 ton/h and higher, so smaller quantities of waste help to cover the investment and operational costs of these plants.

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3. DEDICATED SOLID WASTE PLANTS ESTABLISHED THE LAST COUPLE OF YEARS AND THE GEOGRAPHICAL SPREAD OF THE APPLICATION

The last couple of years more plants are been set up for dedicated solid waste treatment. Some of these plants are quite similar to the application of the plants for contaminated soils. . Especially in countries like Italy and the UK, these plants are erected at a rate of about 3 – 5 new treatment sites a year. Although these plants are in terms of treatment capacity smaller, the simplified process and operations have proven economical under the current market circumstances

Table 2. An overview of some soil washing plants in Europe.

Company and location	***Application***	***Recovered***
SITA UK, Neachells Lane, UK	Roadsweepings	Sand & organics
Ecotec Group, Italy	Roadsweepings	

The reason why these plants are economical is because of the contractual conditions. The contracts are made with local counsels and are typically long term contracts (5 – 7 years). Here the waste stream allows the depreciation of the plant over the term of the contract. Still, there are some challenges and issues left, these plants often operate without an agreed tax exemption. So, securing outlets for the recovered fractions is key to successful and long term operations.

4. WET SEPARATION TECHNIQUES APPLICATION WHICH PROVED A LIMITED PERIOD ECONOMICAL BUT LATER DISAPPEARED AGAIN.

The recovery of metals from solid waste proved to be less successful on the long term. The recovery of aluminum metal out aluminum slags and dross, took a high flight in the years 2000, but a lot of the plants were shut down or discontinued at a certain point. The best know examples are the ALSA plants in Germany. Also other projects and operations either disappear because of cheaper solutions at hand or falling commodity prices caused by the economical downturn after 2008.

Table 3. Some wet separation operation abandoned over the years

Waste Type	***Company and location***	***Recovered***
Aluminum Slags and Dross	ALSA, DE	Aluminum metal & salt, clean slags
Iron cutting waste	SITA Remediation, NL	Iron scrap residue

5. NEW PROMISING DEVELOPMENTS AND NEW WASTE STREAMS RECOVERED

Other inert fractions like fly ashes and recycled glass are finding their way to the wet solid waste recycling process. The wet separation allows a successful separation of recoverable factions for final re-use.

Table 4. Some plants processing solid waste sucessfully

Industry & waste type	***Company***	***Recovered***
Power Plant, - Cooling tower regeneration	SITA Remediation, BE	PVC
Waste incineration, Bottom ashes	Dolfin Metals Recycling, NL	Hard Ashes, Metals
Waste incineration, Bottom ashes	HVC & Boskalis Dolman, NL	Hard ashes, Metals
Glass Recycling	EWC Recycling, UK	Glass

In The Netherlands, the year 2017 will be a turning point for recycling of bottom ashes. The long awaited ban on landfilling of bottom ashes will trigger the recycling industry to find new solutions and application for different recovered fractions.

Also the nuclear decommission industry might prove to be a new market. The wet separation can help to concentrate low radiation impacts in the filter cake for further treatment and disposal.

Table 5. Nuclear demonstration project

Waste	***Operator***	***Recovered***
Radioactive soils Maywood Interim Storage Site e soil, New Jersey, USA	US Army	Sand

6. HOT WATER APPLICATION

Additionally, it is expected that the future will bring some applications of hot water separation. This technique might find its way in the waste market between the liquid-liquid oily waste recovery process (decanter & centrifuges) and the thermal process for solid-liquid oily recovery in the E&P Oil Sector (low temperature thermal desorption). Hot water wet separation is a process that to a certain extent is used on tar sands, but it is only used once at a large scale on a solid waste. The hot water wet separation has proven its technical capabilities, but still the economical long term prospect needs to be proven.

Table 6. Some plants processing solid waste with hot water sucessfully

Waste	***Company***	***Recovered***
Prestige Shipwreck waste, ES	SITA Remediation, BE	Sand

Picture series 1. Prestige shipwreck waste (left), high caloric filter cake (middle), recovered sand (right)

7. RESULTS AND DISCUSSION

Although industrial wet separation techniques have been around for more than a century, only financial incentives have been able to prove their sustainability in the recycling market place. Either tax exemption or rising landfill taxes are pushing recovery solutions in the recycling markets and keep these solutions economically viable. On occasions and during periods of economical boom, when commodities markets are at a high, recovery of some historical accumulated waste has proven to be economical, but these solutions soon disappear during a period of economical downturn. Urban mining is becoming more tangible, but an utopia without proper legislative and economic incentives.

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