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CONVERTING ENVIRONMENTAL WASTES INTO VALUABLE RESOURCES

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ABSTRACT

This concept employs a viable energy saving method that uses a solvent to separate oil from particle matter; it can be used in metal forming industries to deoil sludges, oxides, and particle matter that is presently committed to landfill. If oily particles are used in their oily state, severe consequences to environmental control systems such as explosions or filter blinding, occur in the air handling equipment. This is due to the presence of hydrocarbons in the stack gasses resulting from the oily particles.

After deoiling, the particles can be recycled and the separated oil can be used as a fuel.

The process does not produce a waste of it's own and does not harm air or water. It demonstrates the dual benefits of being commercially viable and in the national interest of conserving resources.

INTRODUCTION

This presentation covers a method to recover valuable resources from oily wastes by means of solvent extraction of the oil from the wastes. This method is known as the Duval Process and allows for:

- Recovery of solids
- Recovery of oil
- Elimination of harmful effects of oil on solids
- Elimination of harmful environmental problems caused by oil in disposal sites

This process has been licensed to major engineering and construction firms.

Some practical applications are as follows:

- Removal of oil from sludges and fine particle matter
- Decontamination of soils when the contaminant is a hydrocarbon
- Removal of solids from oily material

The process is one that maximizes the use of wastes that, at great cost, must be landfilled or destroyed to safeguard the environment. The process employed is an economical approach to maximizing resource recovery from oily wastes by use of solvent extraction of the oil from the solid particles.

Large generators of oily wastes are steel mills and machine shops. Accidental spills of oily materials have caused contamination of soils that require cleansing as insurance against future environmental damage.

In order to change the size or shape of metal components, machining operations such as shaving, forging, pressing, grinding, or polishing are required. A lubricant, usually an oil, is used to assist the tools during the machining operation by cooling and lubricating the tools and materials. Small particles of the metal are removed with the lubricant and later separated by gravity-settling so that the lubricant can be reused. Solids from a metal forming operation are coated with substantial quantities of the oil used in a metal forming operation. Larger particles may contain as much as 2% of their weight in oil while smaller sizes may contain as much as 25% of their weight in oil and form a sludge like mass.

Quantities of metal fractions generated at a location are directly related to the type of forming and parts being manufactured; ie., in the manufacture of aircraft hydraulic fittings the metal removed may be as much as 50% of the original metal weight while metal removed during a grinding operational may only be a small fraction of the metal part. The oil quantity on these particles would likewise vary from 2-4% on machinings to 25% on grindings.

Much of the oily particle matter is being wasted due to difficulties resulting from its reuse, and this waste is sufficiently harmful to the environment to draw attention of environmental groups, research institutes, engineering companies, waste treatment firms, and firms engaged in resource recovery.

Thousands of tons of valuable resources are being sent to landfill disposals by the metal forming industries.
and there are numerous reports of landfills leaching contaminants into streams and the water table.

The cost of handling and managing the landfills has increased dramatically and therefore costs of disposing wastes to landfills is substantial. In addition to the direct cost of landfilling is the contingent legal liability of using the landfill. There have been cases where small waste producers have contaminated a non-hazardous landfill by disposing of hazardous materials which have contaminated the landfill and thus made all disposers that used the landfill responsible for the condition. The legal liabilities associated with public landfill disposal are so great that larger firms often find it necessary to operate their own landfills.

At present , operators of machining plants will use various methods to reduce the oil on the recyclable scrap, by storing the scrap in heated rooms and centrifuging. This is to reduce the loss of expensive cutting oil on the scrap as well as to make the scrap acceptable to the smelter. In addition, the waste generator is penalized by the smelter due to the pollution caused by the oil on the scrap shipped to the smelter.

If the oily wastes are used, serious damage to exhaust gas handling systems will result. Fires in electrostatic filters and blinding of bag filters in standard systems are dangers when the consuming facility involves high temperatures as in smelting or incineration. The oil on wastes being smelted cause detrimental metallurgical effects because of the sulfur in the oil. When incineration of oil at the smelter is required, the elevated temperature causes decomposition of particles requiring a replacement of lost components Unavoidable wastes result from metal forming due to the oil on the wastes being generated.

If the wastes are piled or landfilled, the dedication of a large area for the landfill, costs associated with managing the landfill, hazards to ground water and ever changing regulation become prohibitive.

The solution to these problems is a program to make the wastes recyclable. The key to maximizing the recycling of the oily waste is the elimination of the oil on the waste being generated so that it can be either recycled directly back into the generator's production, or used as a raw material for another industry. Steel manufacturing produces a large amount of oily iron oxides that can be recycled back into steel making as a replacement for raw iron ore. Steel making oxides are also used as mason hardeners and colorings, in mixes for exothermic welding, as dense media and also as iron supplements in animal feed.

DESCRIPTION OF THE PROCESS

The process consists of a low-temperature, multi-stage (usually 3 or 4 stages) extraction using methylene chloride flowing counter current to the oily solids, that extracts the oil and water linked to the solids. The solvents are settled and filtered for fines separation. The solids are dried by evaporating the residual solvent and water which are then condensed and recycled in the process.

The oily solvent is recovered by standard azeotropic distillation of the solvent and oil mixture carried out at 39 degrees Centigrade. The water is removed by gravity separation from the solvent.

Since the solvent has some affinity for the water, it is subjected to chilling in order to promote the gravity separation of the solvent and water. The water is further subjected to a polishing operation consisting of air-stripping the solvent to a carbon pack. The recovered water is used for make-up requirements within the process. This result is a reduced need for fresh water and a zero discharge of water into the environment.

The solvent also contains an amount of water which must be eliminated in order to insure against acidification of the solvent. The solvent containing the water is passed through a medium of recyclable desiccant which absorbs the water leaving the solvent relatively free of water. This stage of the process includes an automated system for maintaining solvent stability by addition of stabilizing agents as required.

Vents of the system pass through a granulated carbon column for collection of any solvent. The solvent is then recovered from the carbon column and returned to the process.

The entire system is close looped to maximize the solvent recovery. The circuits for recovering the solvent from the water and air, the value of the recovered oil as a fuel and elimination of landfill costs makes possible the conversion of an environmental problem into a profit center.