

Staticomatic



Figure 1 Vision

By Christopher John Rooney

www.roontech.co.uk

Contents

Staticomatic.....	1
Figures	2
Summary.....	3
Introduction	4
Solution	5
ROONTECH Initiative.....	7
Prototype Research.....	11

Figures

Figure 1 Vision	1
Figure 2 Static Electricity	6
Figure 3 Particle Separator	8
Figure 4 Tractor & Trailer.....	9
Figure 5 Factory Set-Up	9
Figure 6 Onsite Build.....	10
Figure 7 Prototype.....	10
Figure 8 Staticomatic Concept	11

Summary

Plastic pollution in agricultural soil has become a critical environmental threat, reducing plant growth, damaging soil structure, and lowering crop yields. As the document notes, “agricultural soils are the biggest environmental sink for intentionally added microplastics in the UK,” with sources including sewage sludge, pesticide containers, crop covers, and seed coatings. These plastics fragment into millions of particles, accumulating year after year with no effective removal method currently available.

Staticomatic is a new concept developed by ROONTECH to address this challenge using a sustainable, physics-based approach. The system separates plastic from soil by exploiting the triboelectric properties of plastics. After contaminated soil is dried, ground, and sieved, the particles fall through a chamber whose inner walls are charged with high-voltage static electricity. As described in the document, “the plastic particles are attracted to the static wall and stick whilst the soil particles fall freely.” This process can be repeated until contamination levels are significantly reduced.

Powered by solar energy and designed for mobility, Staticomatic can be deployed in multiple formats tractor-mounted, onsite, or factory-scale making it adaptable to farms of different sizes. The proposal outlines a prototype intended to demonstrate the feasibility of static-based separation without high cost, forming the foundation for future development.

Staticomatic aims to restore soil health, improve food security, and offer a scalable, environmentally conscious solution to one of agriculture’s most persistent pollution problems.

Introduction

This is a research document; it will demonstrate the methods used to determine a viable solution to the plastic problem. To understand the problem better I need to home in on what contributes to soil contamination, and how do we prevent it from here on out whilst what already exists needs removing.

Sewage sludge

A major contributor, Defra research shows that agricultural soils are the biggest environmental sink for intentionally added microplastics in the UK, largely because sewage sludge (biosolids) is spread on farmland. Up to 99% of microplastics entering wastewater treatment end up in sludge. Repeated sludge application caused a 1,450% increase in soil microplastics over four years. This pathway is so significant that Defra is considering reducing sludge use on farmland by 50–95% by 2030.

Microplastic levels

In the UK range from 1,320 to 8,190 particles per kg of soil. Fields using plastic crop covers had ~75% higher microplastic loads than fields without them 4,689 particles/kg vs. 2,667 particles/kg. Pesticide container waste is another huge contributor, Almost all pesticides come in HDPE plastic jugs, drums, sachets, or bags. The UK generates millions of empty pesticide containers every year and the recycling rates are low. Even when rinsed, these containers:

- Shed microplastic flakes during handling
- Leave residues that contaminate wash water
- Are often burned or buried illegally
- Are sometimes crushed on-farm, releasing fragments into soil

Pesticide seed coatings

Many seeds are coated with polymer binders, plastic colourants and microplastic film coatings. These coatings break down in soil and contribute to long-term accumulation.

Difficulty

You must ask why no current solution exists, well, micro and nano plastics are difficult to separate using current methods without damaging the soil. A single mulch sheet can fragment into millions of pieces. Over time all these contributors' build-up and prevent crops from growing.

Solution

The research and design of a unique separation system will be designed. The system also needs to incorporate ROONTECH's core values.

- Sustainability
- Environmental Awareness

Taking these factors into account a solution has been developed that meets all criteria.

Static Electricity

The best way to solve separation is to use static electricity. Static electricity is a fascinating phenomenon, when you rub one neutral electrically insulated object against another. Some of the electrons transfer across leaving an excess of negative charge on one of the objects and a deficit on the other. This buildup of electric charge on an object is what we call static electricity. Now, how does static electricity interact with other objects? Well, charged objects exert electrostatic forces on each other. These forces can then be either attractive or repulsive.

Opposites Attract

If you bring a positively charged object close to a negatively charged object, they will pull together due to their opposite charges.

Repel

If two objects have the same type of charge (both positive or both negative), they will push away from each other.

Plastic

Becomes static due to a fascinating phenomenon known as Triboelectric Charging. When you rub two different materials together, such as plastic and fabric, their surface atoms interact. Some electrons are transferred from one material to the other. This exchange leaves one material with an excess of electrons (becoming negatively charged) and the other with a deficit (becoming positively charged). Plastic materials, especially those made from polymers like polyethylene or polypropylene, have a high affinity for electrons. Their surface structure allows them to hold on to these electrons more effectively. As a result, they become negatively charged.

Insulating Properties

Plastic is an excellent electrical insulator. Unlike metals, which allow electrons to move freely, plastic keeps its charge localized. The electrons remain trapped on the surface, creating static electricity.

Low Conductivity

Plastic's low conductivity prevents the charge from dissipating quickly. Unlike conductive materials, where charges flow away, plastic retains its static charge for longer periods.

Friction and Separation

Rubbing plastic against other materials (like your hair or a wool sweater) generates friction. This friction causes electron transfer, leading to static buildup. Similarly, separating two charged plastic surfaces can also create static electricity.

Everyday Examples

Ever notice how a plastic comb attracts your hair? That's static electricity at work! Plastic bags sticking together, balloons clinging to walls, and crackling sounds when you peel off plastic wrap all these phenomena involve static charges.

Vision

Below is how I imagine the basic operation of the system works, all evidence suggests this is a viable option with regards to separating organic matter from plastics. This system will obviously need to be improved and tested in real world conditions, but this is a good start that will raise a few eyebrows.

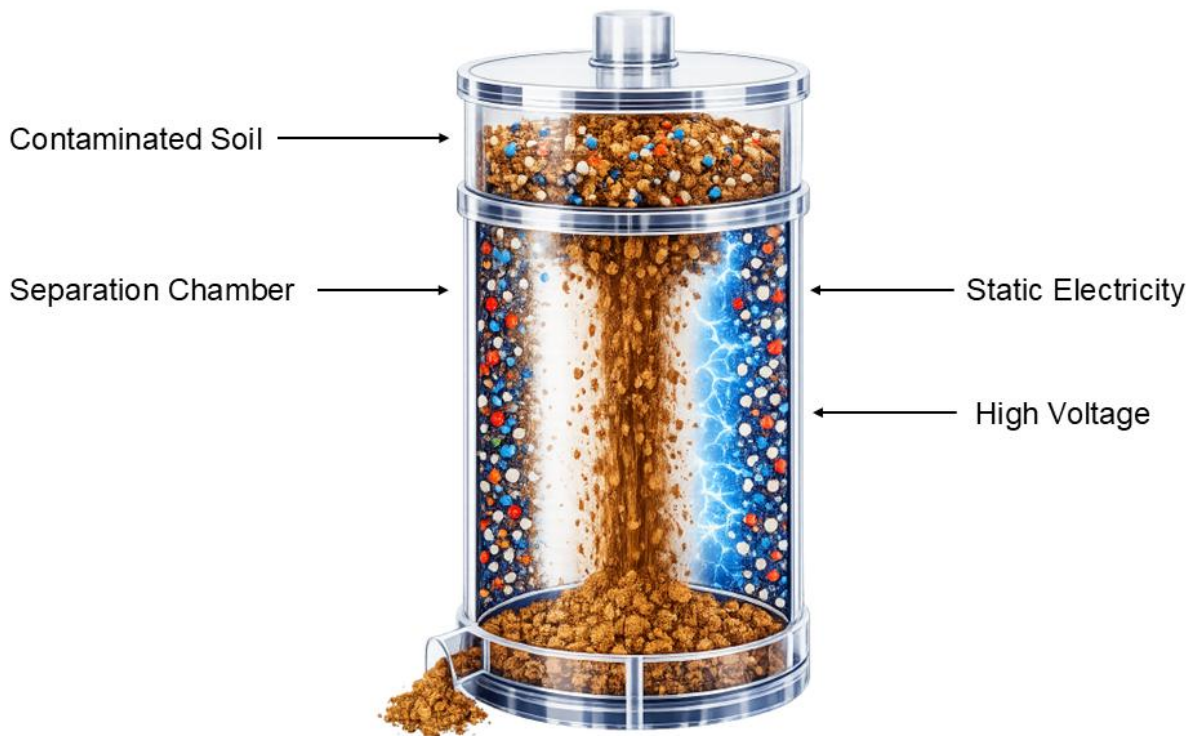


Figure 2 Static Electricity

Conclusion

Static Electricity does what I need it to do; it also plays into the hands of sustainability and mobility of a system deployed on a farmland. To generate Static, we need an energy source of high voltage, and nothing delivers this better than solar cells. So, we have a method of separation and a suitable method of remote power. To add a third a name for the system "Staticomatic" a little play on Wallace and Grommet.

ROONTECH Initiative

How it Works

There are four key functions to making this process work and each function is designed to overcome significant barriers. If you thought taking clumps of contaminated soil and separating the microplastics is easy you are mistaken. However, with the key functions in place fine tuning per application can be applied making this a viable option.

1. Heated Grinder

Soil contaminated with plastics is sent to a Heated Grinder System, where it is dried and reduced to dust.

2. Sieve and Vibration

The dust-like material is then transferred to a holding tank/silo. Materials pass through a mesh aided by vibration and fans which helps to agitate and separate particles.

3. Static Electricity

The inner walls of the holding tank/Silo are induced with high voltage supplied via solar arrays. As the materials fall the plastic particles are attracted to the static wall and stick whilst the soil particles fall freely.

4. Repeat Process

The process repeats until the batch of soil shows very low levels of contaminants. By removing plastics, Staticomatic contributes to environmental health and food security.

Initial Method

To visualize this innovative system a simple design needs to be developed, this is not the final design but a start to which can be improved. There's several items required to make this work that would be beneficial, and considering we are to power the system via Solar a list of suitable equipment has been selected.

Equipment List

- Holding Tank
- Mesh Screen
- Fans & Oscillators
- Static Inner Wall
- Cleaning Mechanism
- Pumps & Pipes
- Heating Element
- Material Grinder
- System Controls
- Power Supply

Materials List

- Plastic Particles
- Soil Particles

Basic Engineering Design Principle

Illustrated below is a sketch of how this system could potentially operate based on engineering principles. The use of electrical and mechanical components come together to form what is now known to be the Staticomatic.

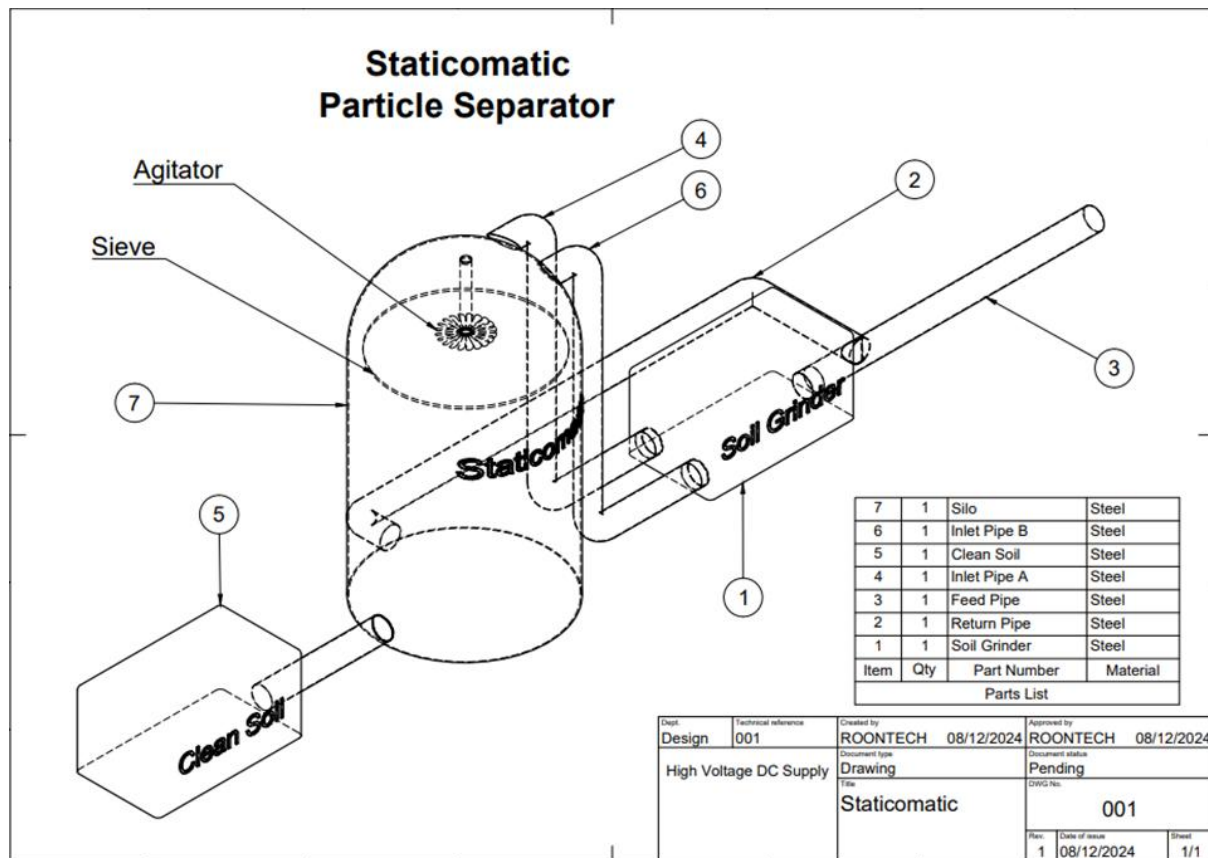


Figure 3 Particle Separator

Feasibility

I have selected three methods of implementation.

- Tractor and Trailer
- Factory Build
- Onsite build

All three are relevant, however, it is not a small task to separate thousands of tonnes of soil from plastic. Also, upon separation I believe a method to add minerals to replenish the soil would be beneficial because this will increase crop yields. I also believe that both summer and winter operations are feasible with both methods having their own advantages.

Summer

Is better if a Farmer has fields not in use, soil is dryer and easier to separate.

Winter

Worms go deeper in the winter to stay warm, this method would ensure they are not killed as they play a significant role in healthy soil.

Tractor & Trailor

Small scale operations and sample testing could be done using a Tractor & Trailor, there is nothing to suggest multiple Tractors could not be used but this would have to be calculated.

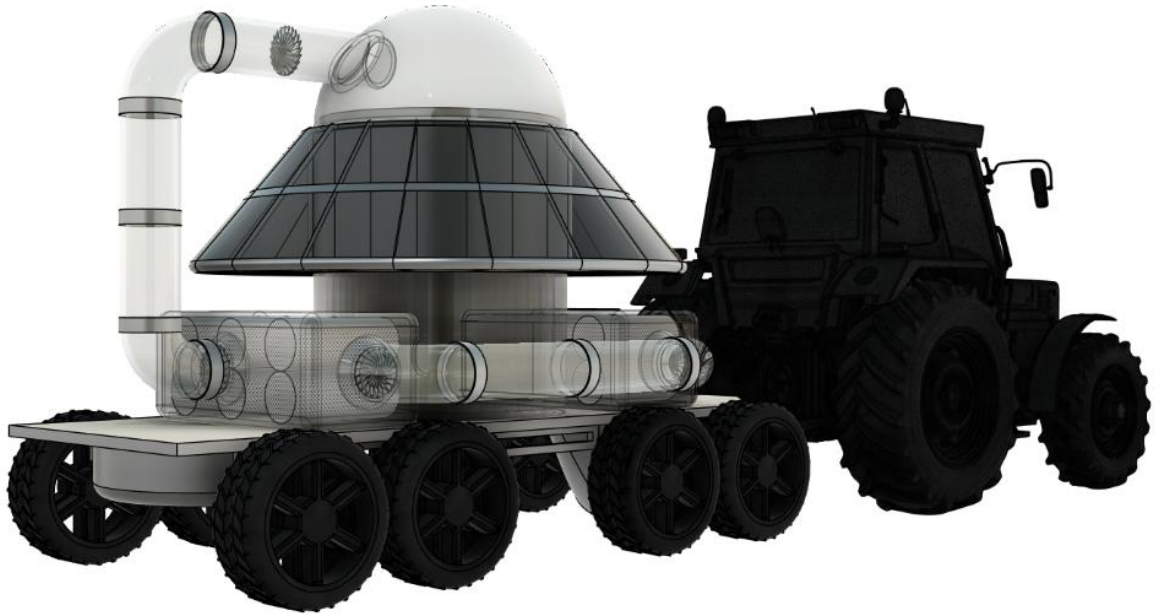


Figure 4 Tractor & Trailor

Factory Build

Large scale operations, fixed position industrial factories would be beneficial with a stockpile of contaminant free soils.



Figure 5 Factory Set-Up

Onsite Build

Smaller in scale but practical, this method is sustainable due to less transport of materials.



Figure 6 Onsite Build

I believe all methods have their pros and cons; however, the purpose of this report is to develop a Prototype to demonstrate the Staticomatic ability.

Prototype

This is what needs to be studied.

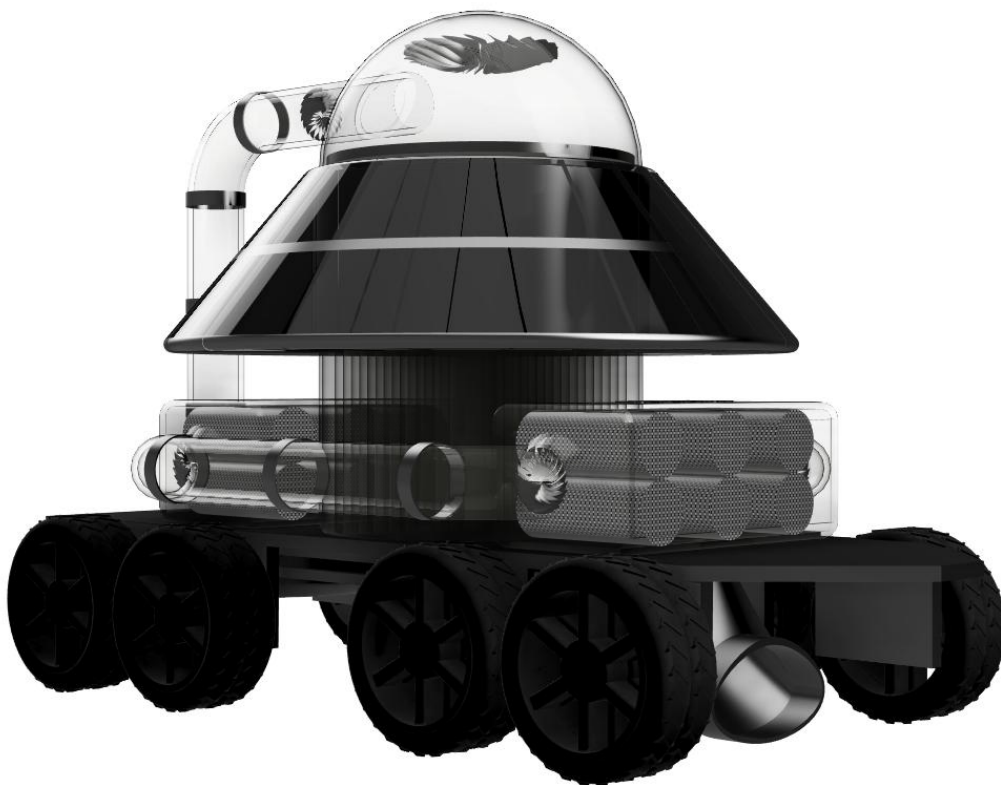


Figure 7 Prototype

Prototype Research

The main purpose of the Prototype is to justify using Static Electricity without breaking the bank. Below is a simple design that will demonstrate the fundamental operation of using Static Electricity to separate plastics from soil, it is not a current thing and there may be scepticism, so proof of concept needs to be addressed which will help solve for the following.

Unknown Factors

- Safety
- Cleaning
- Wear & Tear
- Soil Samples
- Waste Disposal
- Process Control
- Moisture Sensors
- Drying Thresholds
- Particle Size Control
- Charge Neutralisation

Due to secrecy, unlike my other projects, there will be no technical details, and no list of materials used.



Figure 8 Staticomatic Concept