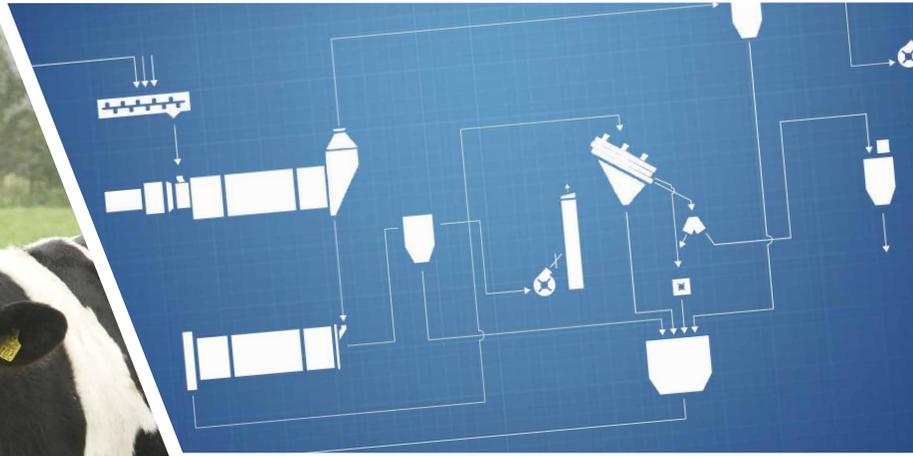


MANURE NUTRIENT RECOVERY



FORTUNE

SPOTLIGHT ON THE PROCESS

Featured on Fortune.com: Fair Oaks Dairy Farm, located in Indiana, and its co-founder and farmer Mike McCloskey are innovating how large farms do business with the goal of a zero carbon footprint. Fair Oaks has been transforming manure into the energy that powers the farm's operations and vehicle fleet. Now they plan to take it a step further by converting the byproduct of this waste to energy process into a high quality, marketable fertilizer. The process of nutrient recovery from manure is described in this brochure. For more information, visit: www.feeco.com/manure-processing/



FEECO
INTERNATIONAL



THE PROBLEM

Manure poses significant challenges for large-scale farms. An increasing population has put mounting pressure on the agriculture and livestock industries to provide more food. Herd sizes continue to grow, while prohibitively high land costs and surrounding land development are reducing the available farmland for waste disposal. Additionally, the high cost associated with transporting manure discourages the transportation of manure to land farther than a few miles from the farm.

Recent research and news articles have shown that nutrient runoff from manure application has caused ground and surface water contamination in certain areas. When nutrient runoff occurs, the farmer is not able to reap the full nutrient benefits from his fertilizer, resulting in a loss of value.

THE SOLUTION

Transformation of manure into a granular fertilizer product alleviates all of the issues mentioned above, offering numerous benefits to the soil and delivering value back to the farmer.

FEECO is a leader in process design and equipment manufacturing and offers a unique approach to the granulation of manure, which is highly customizable to the manure source being processed and the desired end product characteristics. The end result is a cutting edge fertilizer production system that converts manure into a premium granular fertilizer product** that minimizes odor and has little attrition.

The technologies mentioned here are proven, and backed by our international reputation in providing the best in fertilizer production equipment and complete process systems. Nearly every major player in the fertilizer industry trusts FEECO for their equipment and process design needs, some of which include:



** Fertilizer produced through a FEECO granulation system goes beyond EPA qualifications for pathogen destruction for a **Class A Biosolid**

(according to the EPA's 503 regulations)

THE PROCESS

The process described here and illustrated on the next page is a general approach to nutrient recovery. The process may vary per source of manure, and as mentioned, is highly customizable.

Step 1. Anaerobic Digestion

Anaerobic digestion is a biological process that serves to break down material in order to reduce pathogens. This step yields a slurry with reduced odor and pathogens.

It should be noted that if sand is used as a bedding, an optional sand removal step prior to anaerobic digestion is desirable. Sand causes increased wear on equipment and should be removed.

Step 2. Solid/Liquid Separation with Nutrient Capture

Solid/Liquid separation with nutrient capture is the practice of recovering, reprocessing, and redistributing nutrients such as nitrogen and phosphorus from the manure stream, thus reducing the environmental and regulatory impact. This step yields three products: nutrient rich cake, which is generally 75% water and 25% solids, coarse fibers, and the remaining tea water. The coarse fibers can be used as a Recycled Manure Solids (RMS) bedding, or dried to produce a Dried Manure Solids (DMS) bedding.

Step 3. Fertilizer Granulation

The resulting cake can be transformed into a conventional granular fertilizer product. These granules can be 100% manure based, or combined with traditional chemical based fertilizer ingredients or minerals to create a custom blend or boutique fertilizer.

Step 4. Irrigation

The tea water remaining after the nutrient separation process can be utilized in irrigation. This tea water has been stripped of 85% of the Phosphorus, 40-50% of the Nitrogen, and 99% of the solids.



BENEFITS TO GRANULATION

Improved Product Handling

Granules are more easily handled, transported, and applied.

Reduced Waste Management Costs

Dry granules can be stored on-farm and are much less costly to transport than raw manure.

Reduced Runoff

Dry granules aid in the prevention of runoff, because they are used only as needed, and do not add additional moisture to the soil.

Premium Product

Additives can be included in the process to create custom products and fertilizer blends, allowing the product to be tailored to specific soil needs and nutrient management programs, or to be sold as a premium product.

Additional Source of Revenue

Granulated manure can provide an additional source of revenue or reduce waste management costs where once incurred.

Enhanced Nutrient Management

Granular fertilizer makes it easier to effectively follow and monitor application rates for a nutrient management program. It is also a valuable tool in precision agriculture applications, where a granular product provides improved dispensing capabilities.

FEEDSTOCK PREPARATION FOR GRANULATION

In order to granulate manure into a dry pellet product, the manure must be prepared before it can be used as a feedstock for granulation. Since manure is different from source to source, this preparation can vary. In general, however, this process consists of sand removal, anaerobic digestion, coarse fiber removal, and nutrient recovery.

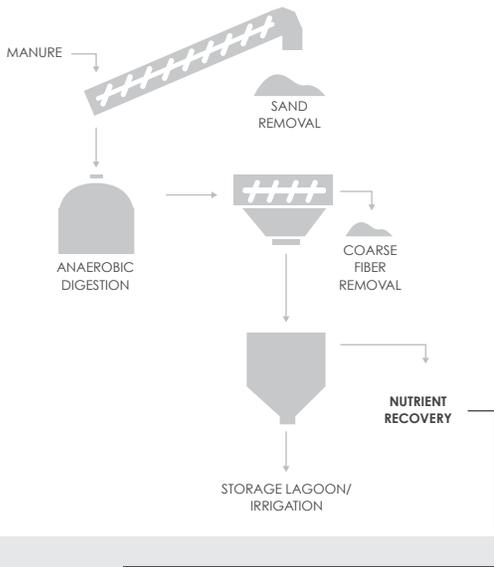
COMMON FEEDSTOCK FOR GRANULATION

Moisture Content

Dairy Manure	60% - 80%
Hog Manure	60% - 80%

Particle Size Distribution

< 60 mesh



MIXER-DRYER GRANULATION

In this process, granulation occurs in the mixer, usually a pug mill. Pellets are then dried in a rotary dryer. This approach yields rounded pellets.

A NOTE ON CAPACITY

While FEECO can accommodate nearly any capacity, typical capacity ranges from 5 to 10 TPH of product, or 20 to 40 TPH of raw cake feedstock. For more information, visit:

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