

# Nutrient Reclamation Technologies



Biofilter



Partnerships to Improve our Environment

## Digester Nutrient Recovery Process Schematic

### Separator (Digester Recycle)

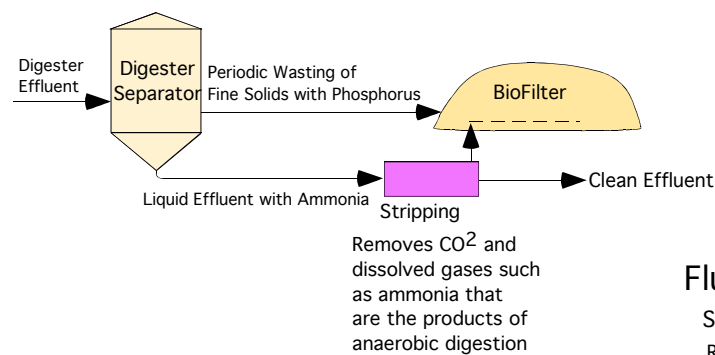
Removes fine solids containing a majority of the phosphorus from the digester effluent to produce a solids free liquid, containing ammonia and a fine solids slurry.

### BioFilter

Concentrates stripped gases including ammonia and fine solids containing phosphorus with coarse fiber from a screw press to make a nutrient rich compost material containing a majority of the nitrogen & phosphorus.

Anaerobic digestion does not alter the mass of nitrogen, phosphorus, and sulphur. Anaerobic digestion does however change the form of the nutrients from particulate matter to dissolved gases and soluble constituents.

During conventional digester operations the digester effluent is discharged to a storage pond where the noxious gases are discharged to the atmosphere and the solids continue to degrade and produce methane gas.



The E<sup>3</sup> nutrient recovery process removes fine solids containing a majority of the nutrients for incorporation into a biofilter that is also used to fix stripped gases, such as ammonia from the effluent liquid.

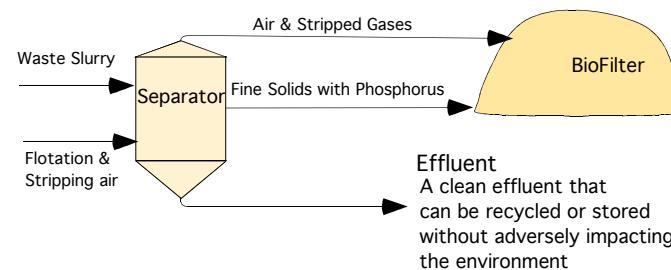
## Flush Liquid Nutrient Recovery Process Schematic

### Separator

Removes fine solids containing a majority of the phosphorus from the slurry to produce a solids free liquid, containing ammonia and a fine solids slurry. Since air is used in the flotation process, CO<sub>2</sub> and dissolved gases, such as ammonia, are removed.

### BioFilter

Concentrates stripped gases including ammonia and fine solids containing phosphorus with coarse fiber from a screw press or slope screen to make a nutrient rich compost material containing a majority of the nitrogen & phosphorus.



## Separation Technologies

High rate (5X Conventional) liquid / solids separation in totally enclosed stand alone non-mechanical solids removal and thickening units.



## High Rate Anaerobic Digestion Technologies

Reduce anaerobic reactor size to one third the conventional size while achieving greater solids conversion to gas.



## Nutrient Recovery Technologies

Technologies to recover and reclaim ammonia and phosphorus from the anaerobic effluent through fine solids separation and ammonia sequestration.





## Liquid / Solids Separation Technologies

### High Rate Liquid Solids Separation

The "Solids Accumulating Flotation Separators" (SAFS) are totally enclosed non-mechanical units that can be insulated and stand alone in an exterior environment. No collection devices or chain drives are used.

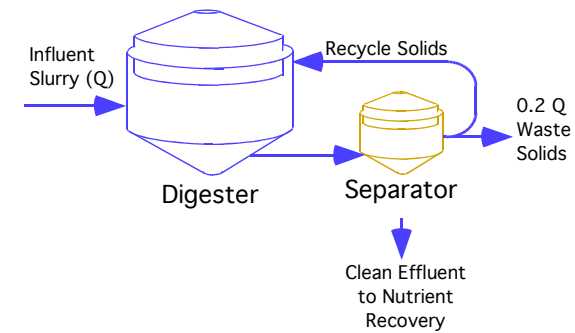
They are totally enclosed. All air or gases are discharged to the anaerobic digester or a biofilter to eliminate odor and the discharge of any noxious gases to the environment.

The SAFS achieve solids surface loading rates 5 to 6 times conventional separators (200 pounds per square foot per day as compared to conventional values of 35 pounds per square foot per day). Consequently, the surface area of the separator is 5 to 6 times less than conventional flotation separators.

A high quality effluent is produced while the solids are concentrated to 6, 8, or 10%.



## Anaerobic Digestion Technologies



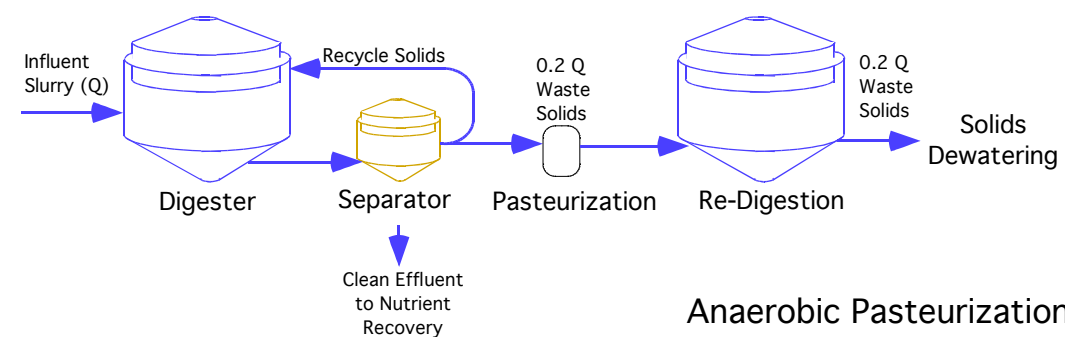
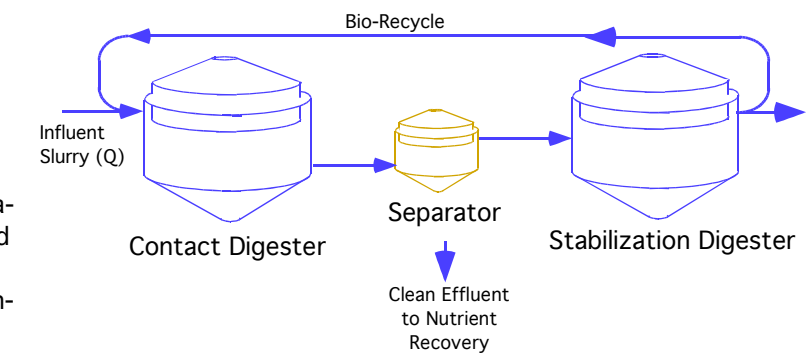
### Anaerobic Contact Process

The AGF process uses biogas to separate and recycle bacteria to the digester. The mass of microorganisms is substantially higher in an AGF digester. The solids retention time (SRT) is increased by three times. As a result the digester volume, mixing and heating energy can be reduced to one third that of a conventional digester. Substantial process energy savings and capital cost reductions are achieved.

### Anaerobic Stabilization Process

The stabilization process increases the SRT by an additional 25% to 50%. The influent slurry is first contacted with the recycled biomass (bacteria and undigested solids) in a contact digester where the easily degradable solids are digested.

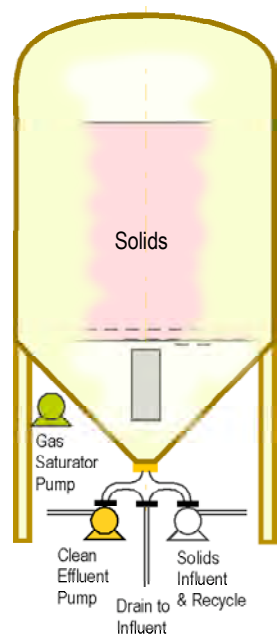
The effluent from the contact digester is then separated into a clean effluent liquid and a concentrated biomass which is then transferred to a stabilization digester where the slowly degradable solids are converted to gas.



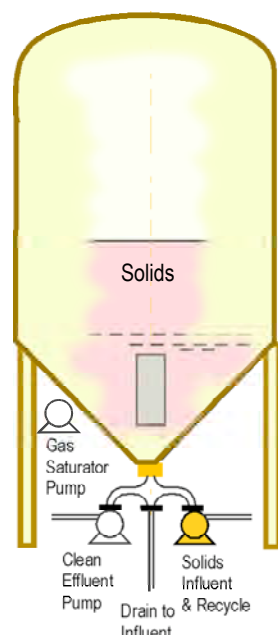
### Anaerobic Pasteurization Process

The pasteurization process is basically the AGF process described above followed by the pasteurization and re-digestion of the waste solids in a pathogen free digester. It is the most economical method of producing pathogen free solids. Only 20% of the influent flow must be heated to pasteurization temperatures. Only a small quantity of heat is required for the pasteurization that takes place in a small pasteurization reactor.

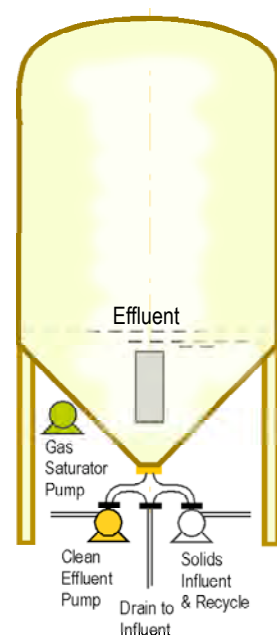
### Flotation Separation Cycle



### Solids Return Cycle



### Begin Separation Cycle



The SAFS operates with an influent and effluent pump and a gas saturator pump. During the flotation cycle the solids accumulate in the tank. When the tank is full of solids the flotation cycle stops and the solids are returned to the digester. Upon completion of solids transfer the tank is partially filled with effluent and the flotation cycle begins again.