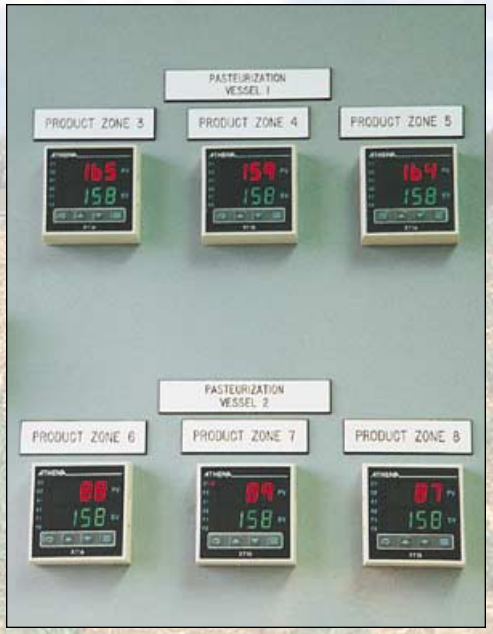
EnVessel Pasteurization™



RDP Technologies, Inc.

EnVessel Pasteurization™

EnVessel Pasteurization™ reduces biological, municipal wastewater-sludge pathogens and vector attraction properties. This patented process pasteurizes sludge and produces sludge that is pathogen free.

- Pasteurized sludge is ideal for land and agricultural application.
- Pasteurized sludge may be applied to lands without need for site-specific permits, according to federal regulations and, thus may be marketed, distributed, and sold as fertilizer.

EnVessel Pasteurization™ uses time, temperature, and high pH to destroy harmful pathogens.

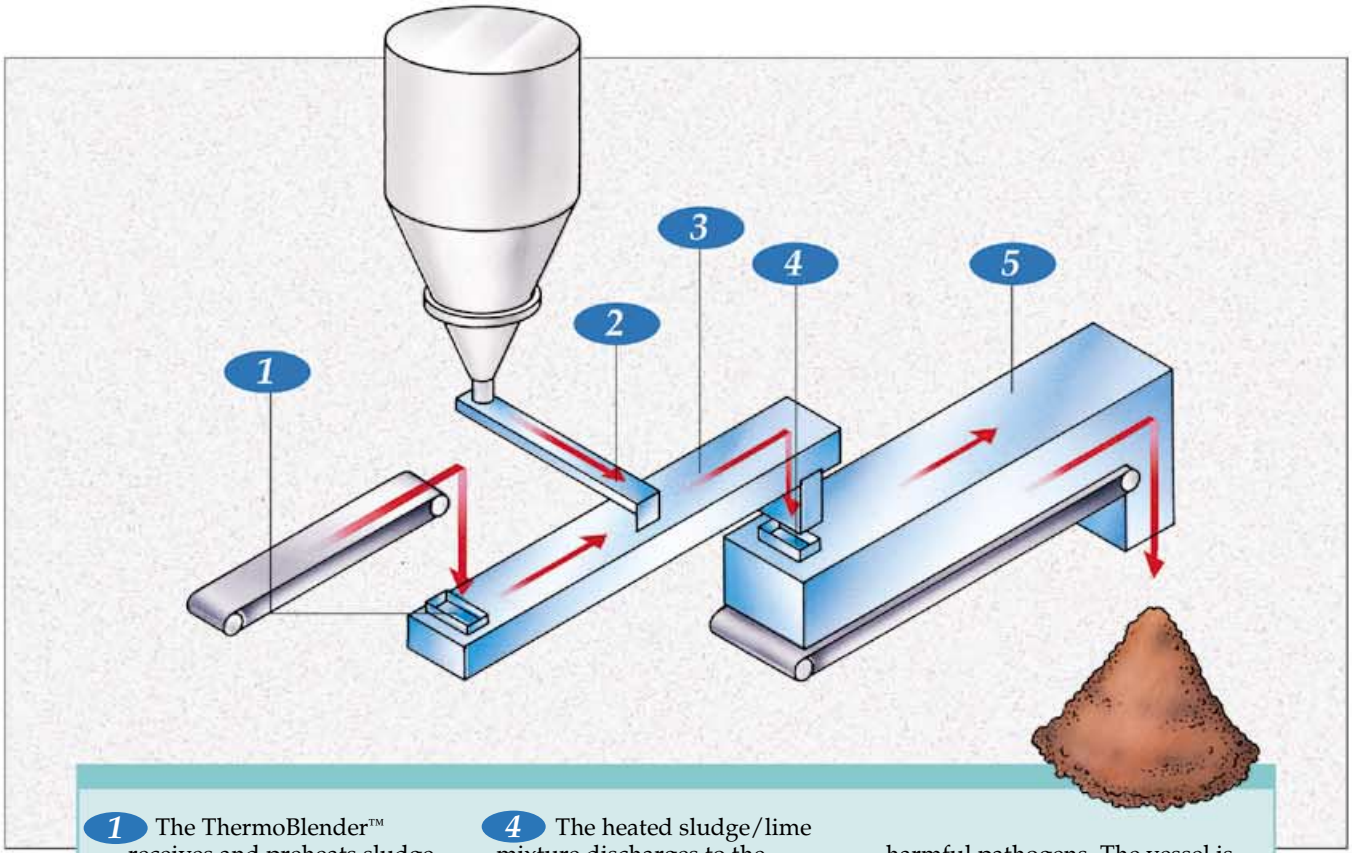
- Specialized equipment heats sludge solids and lime increases pH.
- Extended processing ... windrowing, aerating, or drying ... are not required.

From start to finish, the process needs only 30 minutes and EnVessel Pasteurization™ can be operated under $10 per wet ton.

RDP manufacturers and designs the patented EnVessel Pasteurization™ equipment and controls.

- Equipment purchasers receive a license to use the patented EnVessel Pasteurization™ process without ongoing royalty payments.
- Licensees are free to purchase process alkaline materials from any source.

A typical flow sheet consists of the following steps:



1 The ThermoBlender™ receives and preheats sludge.

2 Lime from a lime storage bin is added to the ThermoBlender™ at a proportional rate to the sludge feed.

3 The ThermoBlender™ mixes sludge with lime and heats the contents to approximately 70°C. (157°F).

4 The heated sludge/lime mixture discharges to the Pasteurization Vessel.

5 The Pasteurization Vessel stores the entire mass of material, for approximately 30 minutes, in an enclosed, insulated environment, maintaining the proper temperature over time to destroy harmful pathogens. The vessel is heated to temperatures that overcome any possible heat losses in its contents. Vessel sensors provide for temperature records that demonstrate compliance with regulations.

Equipment Features/Description

Overall view of a 1.5 dry ton per hour system utilizing a ThermoFeeder™, ThermoBlender™ and Pasteurization Vessel.

Pasteurization has been used for years to remove or kill harmful pathogenic organisms. Pasteurization temperatures kill pathogenic organisms while lime prevents regrowth of organisms. The result is an end product that can be stored for extended periods of time. The process is so complete, RDP unconditionally guarantees that the end product will meet U.S.E.P.A. criteria for Class A pathogen reduction and vector attraction reduction levels. (40 C.F.R. Part 503.32 and 503.33)

From the lime storage silo to the conveyor used to load trucks with pasteurized sludge, RDP brings over 15 years experience to every system component. RDP is the only supplier with experience in manufacturing and designing all components and equipment necessary to provide a complete system.

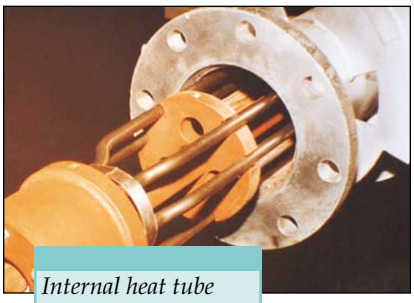
Mixing sludge and lime is the most important sludge-stabilizing step. RDP is the largest U.S. manufacturer of sludge/lime mixing equipment. RDP knows the variables necessary to ensure uniform and complete mixing of sludge and lime.

RDP's patented mixing technology produces a unique spiral action that provides for optimum lime-sludge surface contact and a highly marketable granular end product.

By combining heating and mixing in a single apparatus, EnVessel Pasteurization™ reduces the number of processing steps and capital cost.

RDP's ThermoBlenders™ and ThermoFeeders™ utilize the same patented technology as our standard sludge/lime mixers with specialized heating equipment. ThermoBlenders™ and ThermoFeeders™ use heated mixing rotors and a heated, insulated mixing enclosure to efficiently transfer heat in a compact design. Material is simultaneously and uniformly mixed and heated by combining RDP's patented mixing technology with heated mixing rotors.

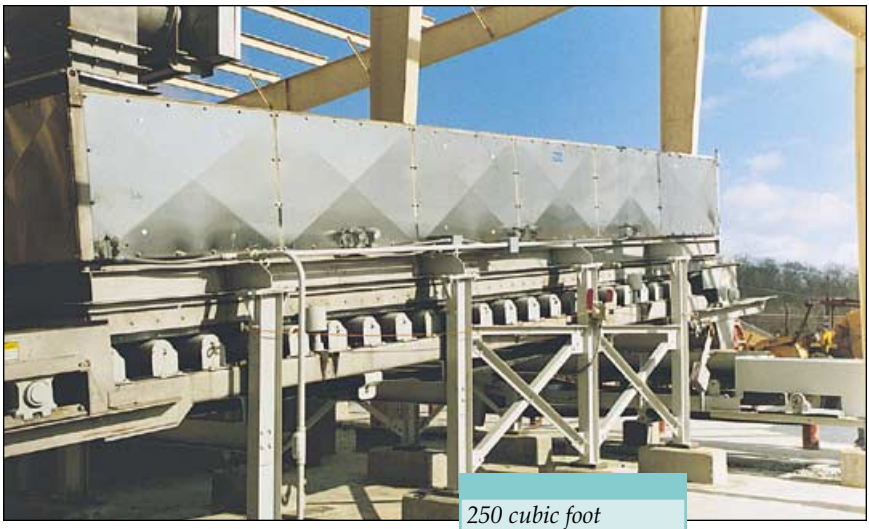
Because the rotating and heated rotors are submerged in the material, the efficiency is extremely high. Because all heat from the rotors must radiate out and into the material, RDP developed a specialized method of heating rotors. Inside the rotors, RDP put heat tubes.



Internal heat tube assembly shown partially removed from the mixing rotor.

The heat tubes are electrically heated to produce temperatures up to 1,000^{0}F. The internal heat tube is a self contained unit which can be removed and replaced easily. Mixing rotors are built to specialized standards and tolerances to house the heat tubes and to allow for expansion during the heating and cooling cycles. Special end connections allow for easy removal and replacement of internal heat tube assemblies.

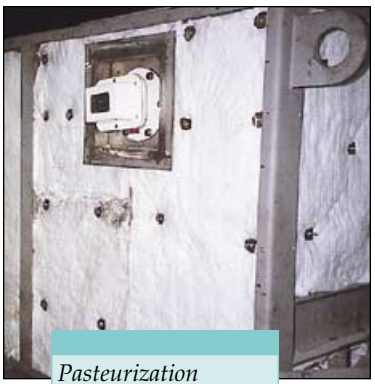
RDP'S patented mixing action provides a granular end product.



250 cubic foot Pasteurization Vessel designed to provide 30 minutes of retention time.

The Pasteurization Vessel provides approximately 30 minutes of retention time at the elevated temperature. The vessel is encased with a minimum of 2″ of insulation and protective steel cover. Specially designed insulation protects the vessel contents from cooling.

The vessel design also provides supplemental heat. The combination of supplemental heat and insulation ensures the entire mass of material maintains the proper temperature, including the very outside edges. No extra lime or heat are required to overcome any heat loss.



Pasteurization vessel with covers removed showing insulation and temperature sensors.

The material will not drop in temperature within the Pasteurization Vessel.

The Pasteurization Vessel is furnished with multiple temperature sensors. The sensors are used to verify that the material is maintaining the proper temperature during the heat pulse step. Temperature sensors can be connected to computerized controls to provide documentation of compliance with all regulations.

E.P.A. regulations require municipalities to certify, under penalty of law, that the treated sludge complies with all regulations. RDP's EnVessel Pasteurization™ provides the documentation and confidence to sign the EPA certifications required under 40 C.F.R. Part 503.17.

Theory of EnVessel Pasteurization ™

Lime pasteurization relies on a high pH sludge maintaining a 70° C (158° F) temperature for 30 minutes to destroy pathogenic organisms. The heat generated from the exothermic reaction of lime and water in the sludge raises the sludge temperature.

RDP's EnVessel Pasteurization™ process uses supplemental heat to reduce the need for a high lime dosage and, thus, costs.

Calculations show that EnVessel Pasteurization™ saves lime and predicts the quantity of lime required to pasteurize one ton of sludge cake containing 18 % dry solids.

Step 1 Determine liquid and solid fraction in one-ton of sludge:

2,000 lbs → Solids 2,000 lbs x 18% = 360 lbs. dry solids
→ Liquid 2,000 lbs x 82% = 1,640 lbs. water

Step 2 Calculate heat required to elevate the sludge temperature from 68° F to 158° F. using the following formula:

Weight(lbs). x Spec. Heat (Btu/lb/°F) x Temp. Rise (°F) = Btu's Required

Solids:	360 lbs	x	0.30	x	90°	=	9,720
Water:	1,640 lbs	x	1.0	x	90°	=	147,600
					Total		157,320

Step 3 Calculate lime required based on 490 Btu's/lb., CaO's heat of reaction with water:

157,320 Btu's ÷ 490 = 320 Lbs. of CaO or
344 Lbs of Lime @ 93 % CaO

Step 4 Costs for Lime Pasteurization based on $75.00/ ton for lime:

344 Lbs of lime x $75 per ton = $ 12.90/ton cake

By using supplemental heat, EnVessel Pasteurization™ reduces the amount of lime required and the cost for operating pasteurization. The savings by using supplemental heat can be calculated by modifying the previous calculations as shown below:

Step 5 Reduce lime addition to 30% by a dry weight basis:

360 lbs. sludge dry solids x 30% = 108 Lbs. of lime

Step 6 Calculate the exothermic heat available from the lime:

108 lbs. lime x 93% CaO x 491 Btu's/Lb. CaO = 49,316 Btu's

Step 7 Calculate supplemental heat required:

(From step #2) 157,320 Btu's Required
- 49,316 Available From Lime addition
108,003 Btu's Required from supplemental heat

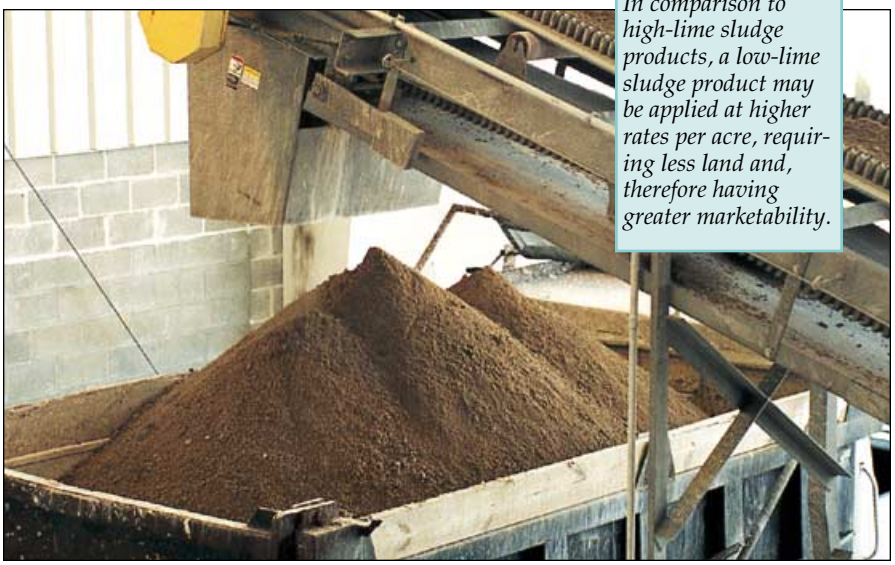
Step 8 Costs per ton of cake using supplemental heat:

108 Lbs. of Lime x $75.00 per ton = $ 4.05
108,003 Btu's x $.075 per Kw-Hr. = 2.37
$ 6.42 per ton of cake

EnVessel Pasteurization™ reduces lime consumption by 164 lbs./ ton of cake and reduces cost from $12.90 to $6.42 / ton.

EnVessel Pasteurization™ offers the following advantages

1. *Guaranteed Class A*
2. *Low operating costs*
3. *Low capital costs*
4. *Single source responsibility for pathogen-reduction; equipment and process guarantee*
5. *High value agricultural end product*



In comparison to high-lime sludge products, a low-lime sludge product may be applied at higher rates per acre, requiring less land and, therefore having greater marketability.

Supplemental heat reduces the operating costs by reducing the amount of lime needed to obtain pasteurization temperatures. The reduced lime increases the value of the end product. The ratio of nitrogen to lime more closely matches the agronomic demand for proper crop production as seen by actual data from field test.

Lime Dosage (Dry weight basis)	Sludge Feed	34%	112%
Total Nitrogen	6.3%	5.2%	1.5%
Calcium Carbonate Equivalent	N/A	27%	72%

RDP Technologies, Inc. *Practical Technologies... that Simply Perform*

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