Abstract Title: Process for treating waste

A process for treating waste, in particular animal by-products or food waste, comprises shredding the waste in a shredder 7, drying in a drum dryer 9 and passing waste through an elongate heated sterilizing vessel 13, where pathogens are deactivated. The sterilizing vessel may be pressurized as well as heated. Preferably the waste is exposed to a temperature of 133°C and a pressure of at least 300kPa for at least 20 minutes. The waste may be shredded to give particle sizes of less than or equal to 20mm and then dried to a moisture content of about 10%. The product of this process may be used as a fuel or a soil substitute.
Process for Treating Waste

Field of the Invention

The invention relates to treatment of waste, more particularly to the treatment of waste with heat.

Background of the Invention

Disposal of waste products is an increasingly difficult problem for most industries. Disposal into landfill is becoming increasingly expensive and for environmental reasons landfill is not an ideal solution, especially for disposal of bio-degradable waste.

Recent legislation sets out to reduce the amount of bio-degradable waste that is sent to landfill in order to reduce emissions of 'greenhouse' gases into the atmosphere.

Further legislation is likely to force separation of 'bio-waste' from other waste in order to divert this waste from landfill and to realize the bio-fertilizer value of organic waste.

Potentially contaminated waste products comprising animal by-products pose greater problems and must be decontaminated before disposal. Currently methods of disposal for this type of waste include rendering, incineration, bio-gas (anaerobic digestion of waste) or composting.

Rendering and incineration of waste involve heating the waste to a very high temperature eliminating any pathogens in the process. The rendering process results in production of fats, tallow and greases which are used in various industries; however the process is very energy intensive and very costly.

Anaerobic digestion is not suitable for all animal by-product substrates. The digestion process releases continuous emissions of gas which can cause problems with the siting of these facilities. Control of foul odours released from anaerobic digesters and composters can also be problematic.

It would be desirable to provide an improved process for treating animal by-product and foodstuff waste.
Summary of the Invention

The invention provides a process for treating waste as specified in Claim 1.

Another aspect of the invention provides apparatus for treating waste as specified in Claim 23.

Another aspect of the invention provides a fuel material as specified in Claim 27.

Another aspect of the invention provides an organic material as specified in Claim 29.

Brief Description of the Drawings

In the drawings, which illustrate one embodiment of a process for treating waste according to the invention:

Figure 1 is a cross-sectional view of the reception area of a waste treatment plant;
Figure 2 is a plan view of the reception area of Figure 1;
Figure 3 is a plan view of the remainder of a waste treatment plant;
Figure 4 is a cross-sectional view of a drying unit; and
Figure 5 is a longitudinal cross section of the sterilizing apparatus.

Detailed Description of the Preferred Embodiments

With reference to Figures 1 and 2, waste food products, including any packaging, are discharged into bins (1) in the reception area of a waste treatment plant. Each bin comprises at least one conveyor at the bottom of the bin. In the illustrated embodiment there are six bins, each with four screw conveyors (2) at the bottom. The waste is carried along the length of each bin (1) by the screw conveyor (2), through an opening at the opposite end of the bin and onto a substantially horizontal conveyor (5). Waste is carried along the conveyors (5, 5') towards a central hopper (4). The central hopper subsequently discharges waste onto a central inclined conveyor (3). In the illustrated embodiment conveyors 5 and 6 are screw conveyors.

With reference to Figure 3, the waste is then transferred to metal detection apparatus (6) and subsequently shredding apparatus (7). The metal detection apparatus detects and removes metal
particles from the waste. The shredding apparatus breaks up the waste material and packaging into nuggets of diameter less than 20 mm.

After passing through the shredding apparatus, the waste is then passed through a pug mill (8). The pug mill comprises blades which are turned by a motor to mix or blend the shredded waste producing a homogeneous mixture.

With reference to Figures 4 and 5, the waste is then transferred to at least one drying unit (9) to remove moisture from the waste. In the illustrated embodiment there are two drying units, both of which are drum dryers. The drum dryers operate at a temperature of approximately 400°C. Dried waste is collected by means of a cyclone (10) which separates the dried waste from the air. Water content of the waste is reduced down to approximately 10% after passing through the drying unit. Dried waste is discharged from the cyclone (10) onto a conveyor (12) and air removed from the dryer is treated in an air treatment unit (11) to remove odours.

Dried waste is then transferred to at least one sterilising unit (13). In the preferred embodiment the sterilising unit comprises an elongate steam heated vessel (15) and a conveyor (16) as shown in Figure 5. Steam at elevated pressure is piped through the vessel via an inlet (17) and outlet (19). Waste is carried through the vessel on the conveyor. In the illustrated embodiment the conveyor is a helical screw conveyor which is rotated by a motor (18) thereby moving waste through the vessel. As the waste is carried through the heated vessel it is heated to a temperature of at least 133°C for a time of at least 20 minutes at a pressure of at least 300 kPa to ensure that all pathogens are eliminated and that the waste is sterilised according to legal guidelines.

After the sterilising step is completed, the treated waste is then exposed to a process in order to produce a flowable granular waste product with a bulk density of about 800 Kg/m³. In the illustrated embodiment the treated waste is transferred to milling machines (14) reducing the particle size down to approximately 2-3mm. Finally, the particulate material is screened using a vibrating screen (20). Any oversized material can be separated and transferred by conveyor (21, 21') to either a bin (1) in the reception area of the plant or the pug mill (8) in order to be re-processed.

The process for treating waste of the invention reduces energy consumption associated with incineration or rendering processes and eliminates gas production associated with composting processes by shredding and heating the waste and subsequently drying and pulverising the waste under controlled conditions. By shredding and heating the waste any pathogens in the waste are
destroyed. By further drying and pulverising the waste the volume of waste is reduced making it much easier to handle. The end product is easily stored and transported and can be disposed of safely. In addition, the end product is suitable for use as an organic material either for use with soil for land recovery applications or as a compost or soil additive. Alternatively, the end product is ideal as a fuel material for use in power stations or cement kilns and the like.

The invention will now be illustrated with an example.

Example 1 – Processing of Waste

226.8 kg waste comprising:

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<tr>
<td>68 Kg</td>
<td>Meat Products (in packaging)</td>
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<tr>
<td>136 Kg</td>
<td>Bread (in packaging)</td>
</tr>
<tr>
<td>22.8 Kg</td>
<td>Vegetable waste</td>
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The mixed waste was passed through shredding apparatus (7) reducing the size of waste particles to less than 20mm in diameter. The waste was then dried in a drum dryer at a temperature of 380°C, reducing the moisture in the waste from 58% in the raw materials, to 8% after drying.

The dried waste was then discharged into a steam-heated vessel (15) and was then carried along the length of the vessel on a screw conveyor (16). The temperature within the vessel was maintained at a minimum of 133°C, the pressure inside the vessel was maintained at at least 300kPa and waste was passed through the vessel at such a rate that all waste remained at this temperature and pressure inside the vessel for at least 20 minutes.

Treated waste was then milled to produce a granular powder having a particle size of 2-3mm and a moisture content of 0.1%.
Claims

1. A process for treating waste products comprising the steps of
   (a) shredding the waste;
   (b) drying the waste;
   (b) introducing dried waste into an elongate heated vessel; and
   (c) transporting the waste through the vessel;
   wherein, the combination of the time taken for waste to pass through the vessel, the
temperature inside the vessel and the pressure inside the vessel is sufficient to inactivate
pathogens in the waste.

2. A process as claimed in Claim 1, wherein the temperature inside the vessel is at least 133°C.

3. A process as claimed in Claim 1 or 2, wherein the pressure inside the vessel is at least 300
   kPa.

4. A process as claimed in any preceding claim, wherein the time taken for waste to pass
   through the vessel is at least 20 minutes.

5. A process as claimed in any preceding claim, wherein the waste products are shredded to
   give particles having a grain size of less than or equal to 20mm.

6. A process as claimed in any preceding claim, wherein waste products are animal by-products
   or food waste products and any packaging material.

7. A process as claimed in any preceding claim, wherein the waste is dried mechanically.

8. A process as claimed in claim 7, wherein the waste is dried in a drum dryer.

9. A process as claimed in claim 7 or 8, wherein on drying waste is heated at a temperature of
   up to 400°C.

10. A process as claimed in any preceding claim wherein the dried waste has a moisture content
    of about 10%.
11. A process as claimed in any preceding claim, wherein the heated vessel is a steam jacketed vessel.

12. A process as claimed in any preceding claim, wherein high pressure steam is passed through the body of the heated vessel.

13. A process as claimed in any preceding claim, wherein waste is moved through the heated vessel by means of a conveyor.

14. A process as claimed in Claim 13, wherein the conveyor is a helical screw conveyor.

15. A process as claimed in any preceding claim, wherein the waste is homogenized prior to drying.

16. A process as claimed in Claim 15, wherein the waste is homogenized in a pug mill.

17. A process as claimed in any preceding claim, wherein treated waste is subsequently exposed to a process in order to produce a flowable granular waste product with a bulk density of about 800 Kg/m³.

18. A process as claimed in Claim 17, wherein the process is a milling or crushing or rolling process.

19. A process as claimed in claim 17 or 18, wherein the granular waste product has a particle size of 3mm or less.

20. A process as claimed in any of claims 17 to 19, wherein the granular waste product is screened.

21. A process as claimed in Claim 20, wherein the granular waste product is screened using a vibrating screen.

22. A process as claimed in Claim 21, wherein granular waste product with a particle size greater than 3mm is rejected and returned for reprocessing.
23. Apparatus for treating waste according to the processes claimed in any of Claims 1 to 22 comprising shredding means, drying means, heating means for heating the waste products to a desired temperature, pressure means for bringing the inside of the heated vessel to a desired pressure and means for crushing or milling.


25. Apparatus as claimed in claim 23 or 24, further comprising means for homogenizing waste products.

26. Apparatus as claimed in any of claims 23 to 25, further comprising means for screening crushed or milled waste products.

27. A fuel material derived from waste animal by-products or food products treated according to the process as claimed in any of Claims 1 to 22.

28. A fuel material as claimed in Claim 27, comprising a calorific value of 18000-20000 KJ/Kg and an ash content of 4-5%.

29. An organic material derived from waste animal by-products or food products treated according to the process as claimed in any of Claims 1 to 22, for use as a soil substitute or compost.

30. A process for treating waste substantially as shown in and described with reference to the drawings.

31. Apparatus for treating waste substantially as shown in and described with reference to the drawings.
### Patents Act 1977: Search Report under Section 17

#### Documents considered to be relevant:

<table>
<thead>
<tr>
<th>Category</th>
<th>Relevant to claims</th>
<th>Identity of document and passage or figure of particular relevance</th>
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<tr>
<td>X</td>
<td>1 at least</td>
<td>US 4692167 A (LEVASSEUR) see especially column 3 lines 33-40 and column 5 lines 4-30</td>
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<td>X</td>
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<td>US 4063903 A (BENINGSON ET AL.) see especially column 5 lines 58-64, column 8 lines 48-51 and figure 1</td>
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<td>X</td>
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<td>WPI Abstract Accession No. 1998-306257 &amp; JP 10110176 (Nihon Cement) 28/04/1998 (see abstract)</td>
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<td>WPI Abstract Accession No. 2002-126200 &amp; JP 2001299312 (Kanai Masao) 30/10/2001 (see abstract)</td>
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- **Y** Document indicating lack of inventive step if combined with one or more other documents of the same category
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- **A** Document indicating technological background and/or state of the art
- **P** Document published on or after the declared priority date but before the filing date of this invention
- **E** Patent document published on or after, but with priority date earlier than, the filing date of this application

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

- **C1K; C5G**

Worldwide search of patent documents classified in the following areas of the IPC:

- **B09B; C10L**
The following online and other databases have been used in the preparation of this search report:

WPI and EPODOC