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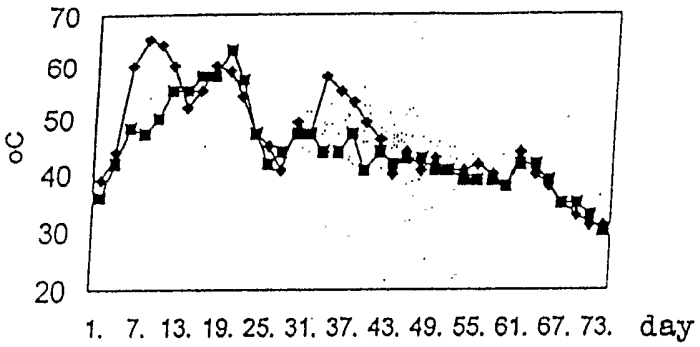
(54) Title: A PROCESS FOR TREATMENT OF MEAT INDUSTRY WASTES



(57) Abstract: The process of invention is characterized in that the 100 mass parts of meat industry waste products is optionally mixed with 15 to 35 mass parts of watery cattle or pig dung and 3 to 5 mass parts of mucilage of vegetable oil industry and 0.25 to 0.75 mass parts of copper (II) sulfate solution. The mixture is heat-treated and degreased in two stages then 0.2 to 0.7 mass parts of solution of a mixture of carbacrole and thymol or 0.2 to 0.8 mass parts of solution of a mixture of thymol and magnesium chloride is admixed and the mixture is incubated. The 30 to 40 mass parts of meat industry waste product treated in the above way and having dry material content of 10 to 40 mass %, 25 to 30 mass parts of residue material originating from biogas production, 10 to 20 mass parts of meat industry sewage sludge and 2 to 35 mass parts of pretreated chopped branches, -twigs vine-branches or -stalks of arboreous plants are mixed together and the mixture is then homogenized and optionally pre-milled and the mixture is composted in open or closed stacks, the compost - in a given case - is sieved after the thermophylic composting stage and the fine grained material is further composted.

WO 2006/087594 A1

A PROCESS FOR TREATMENT OF MEAT INDUSTRY WASTES

The invention relates to a process for treatment of meat industry wastes.

The product resulting from the process may be used as soil fertilizer or carrier of artificial fertilizers or microbial inoculating preparations.

A method for treatment of wastes of animal origin, which cannot be used as pet food, is described in the Hungarian patent description of No. HU 219 774. According to the description the wastes of animal origin to be disposed are chopped into pieces of 50 mm and homogenized. The dry material content of the mixture is set the mixture is then treated with protolytic enzymes then heat-treated at 100 to 180 C° and under overpressure of 2 to 3 bars during 20 to 60 minutes and the pH is set to a value between 8 and 10 after the treatment. The product is used as fertilizer.

According to the Hungarian patent description of No. HU 198 662 the humidity of meat industry waste is set to 40 to 60 volume % then the material is filled into a retention basin provided with drainage.

The C/N proportion of the waste material deposed in layers is set to 40 to 50 the mixture is sterilized in anaerobic way at the temperature of 50 to 60 C°. The waste material is then compacted and aerobically treated during 60 to 90 days.

One of the best-known compost preparation methods is described in the published Hungarian patent application registered under No. P0004917. According to the description compost is prepared in stacks covered with

laminated foil in closed system wherein oxygen is automatically supplied in accordance to the temperature and oxygen concentration of the stack.

After the ripening of 3 to 4 weeks the composted material may be delivered to after-ripening.

The Hungarian patent description of No. 217 670 describes a process aiming at the utilization of relatively high fat content of wastes of animal origin for energetic purposes.

According to the process the coarse waste is reduced to pulp in mechanic way then the mixture is heated up to 120 C° under pressure of 2 bars.

The pressure is reduced thereafter the pulp is allowed to stand during 5 to 120 minutes. The fat content settles out in this time.

The gases and vapors produced during the process are condensed and the watery phase is soaked up with vegetable material.

The Hungarian patent description of No. HU 205 739 aims at the disposal of hair, hooves or claws remaining in slaughterhouses. The process produces slowly degradable biological dung of high organic material content from dangerous wastes, which, in addition may be enriched with trace elements.

The process is performed in such a way that the waste material is chopped mixed with quicklime then the mixture is treated with heat at 140 to 150 C° under changing pressure.

The target described in the published patent application of No. PCT/DK0100553 is to reduce number of viable microorganisms in meat industry wastes.

The solid or liquid organic material is hydrolyzed with calcium hydroxide or calcium oxide at a temperature of 100 to 220 C° in a high pressure cooker.

The lime added for disinfecting precipitates orthophosphates solved in the waste material.

The processes of biological degradation of waste products of slaughterhouses or meat packing plants especially those under incomplete anaerobic conditions are accompanied with considerable odor emission (Mackie R. I. & others: "Biochemical identification and biological origin of key odor components in livestock waste" Journal of Anim.Sci.76, pp 1331 to 1342, 1998).

The research results up to now show that the odor emission is closely connected with the intensity of odor the quantity of fatty acids of short carbon chain with concentration of dimethyl-sulfide and hydrogen sulfide, as well as with carbon dioxide emission.

The concentration of ammonia gas is not always in direct ratio with the rise of odor emission (R. Noble & others: "Olfactory response to Mushroom Composting Emissions as a Function of Chemical Concentration" Journal of Environmental Quality 30, pp: 760 to 767, 2001).

The most important odoriferous matters are listed in the table below (I. Barótfi: Environment Technique [Környezettechnika], Publisher for Agriculturists [Mezőgazda Kiadó] pp: 203 to 206, 2000).

Compound	Threshold limit value of odor (ppm)
Allylic mercaptan	0.005
Ammonia	20
Crotyl mercaptan	0.002
Hydrogen sulfide	0.1
Methyl sulfide	0.002
Pyridine	5
Skatole	3
Thiophenol	0.005

The application of the following materials is recommended to reduce the emission of ammonia and odor:

- preparations of enzymes and microbes,
- additives of acidifying effect,
- magnesium and calcium nitrates,
- unstable carbon source,
- adsorbents like clinoptilolite or peat,
- urease inhibitors,
- saponin as vegetable extract,
- oxidizing agents like potassium permanganate, hydrogen peroxide, chlorine, ozone, treatment with UV rays.

We have set the target to develop a process for treatment of meat industry

the heat-treated waste material is mixed with other waste materials then the mixture is composted.

The characteristics of the process are as follows.

The pH of the meat industry waste material is set to a value between 5.8 and 7.0. and 100 mass parts of waste is optionally mixed with watery cattle or pig dung buffered to pH of 6.8 to 7.5. Optionally 0.2 to 0.7 mass parts of solution of 6 to 10 mass % of mixture of carbacrole and thymol in ratio of 1 to 1 or 0.2 to 0.8 mass parts of solution of 3 to 12 mass % of mixture of thymol and magnesium chloride in ratio of 2 to 1 are added to the mixture then 3 to 5 mass parts of mucilage of vegetable oil industry and 0.25 to 0.75 mass parts of copper (II) sulfate solution of 10 to 15 mass % are added. The mixture is treated with heat in two stages at 130 to 160 C° and 110 to 130 C° respectively. The supernatant fat is removed in both stages of heat-treatment and 0.2 to 0.7 mass parts of solution of 6 to 10 mass % of mixture of carbacrole and thymol in ratio of 1 to 1 or 0.2 to 0.8 mass parts of solution of 3 to 12 mass % of mixture of thymol and magnesium chloride in ratio of 2 to 1 are admixed. The mixture is incubated at pH between 7.2 and 8.4 and 35 to 43 C° in anaerobic environment.

The following components:

30 to 40 mass parts of meat industry waste of dry material content of 10 to 40 mass % treated in this way,

25 to 30 mass parts of residual material of biogas production from meat industry waste,

10 to 20 mass parts of meat industry sewage sludge having dry material content of 15 to 30 mass % and fat content of at least 20 mass % and

2 to 35 mass parts of chopped branches, twigs, vine-branches or stalks of arboreous plants pre-treated with microorganism cultures of Peniophora gigantea or Ceriporiopsis subvermisphora or mixture of these ones

are mixed together the mixture is homogenized and the dry material content is set to 40 to 48 mass %.

The mixture is then optionally pre-chopped and undergoes wet grinding until the grain size less than 2 mm is reached.

The mixture is then composted in an open or covered stack.

In given case the compost is sieved after the thermophylic composting stage the particles of size greater than 2 to 2.5 cm are separated then the composting of fine grained material is continued.

Fat cattle or pig dung diluted with water in proportion 1 to 1 is advantageously added to the mixture before the heat-treatment in an advantageous embodiment of the process.

Lean cattle or pig dung diluted with water in proportion 1 to 3 is added to the mixture according to another advantageous embodiment.

It is advantageous to add 0.2 to 0.5 mass parts of trisodium monophosphate or sodium metasilicate solution to the mixture after the first stage of heat-treatment.

The composting advantageously continues until dynamic breathing intensity of at most 80 mg of O_2 per kg of compost per hour and Dewar's self-heating

The meat industry waste produced in slaughterhouses and in meat packing plants applicable for the process advantageously consists of the following components calculated to the dry material content:

30 to 40 mass parts of maw and bowel content, 10 to 15 mass parts of feather or skin, 5 to 15 mass parts of unhatched eggs, 10 to 20 mass parts of colostrum turned into waste, 10 to 20 mass parts of meat products for human consumption turned into waste and 10 to 15 mass parts of blood of normally slaughtered ruminants.

The dry material content of the mixture is advantageously set to 15 to 35 mass % the particle size of components is set to 1.8 to 3.4 cm in the process.

The mixture is homogenized optionally 0.2 to 0.7 mass parts of a mixture of solutions of 3 to 9 % of carvacrole and thymol in proportion 2 to 1 or 0.2 to 0.8 mass parts of a mixture of solution of 3 to 6 mass % of thymol and solution of 10 to 12 mass % of $MgCl_2$ in proportion 2 to 1 is added to the mixture of wastes in order to reduce odor emission and for antiseptic effect.

The odor emission may be reduced in unexpected extent by adding the above mentioned additives either before and/or after the heat treatment.

The multi-stage heat treatment of meat industry waste materials accompanied with removing fat constitutes essential part of the process.

The heat-treatment is performed in such a way that the pH value of the meat industry waste is set to 5.8 to 7.0 with solution of 0.2 to 1 mass % of ortophosphoric acid. 15 to 35 mass parts of either fat cattle or pig dung of dilution ratio 1 to 1 buffered to pH 6.8 to 7.5 or lean liquid dung of dilution

ratio 1 mass part of dung to 3 mass parts of water is optionally added to 100 mass parts of mixture.

3 to 5 mass parts of mucilage gained from sunflower or colza oil production containing fine fiber stuff gained by desliming having pH of 6.0 to 6.5 and dry material content of 15 to 30 mass % or 2 to 4 mass parts of other mucilage of vegetable oil production and 0.25 to 0.75 mass parts of copper (II) sulfate solution of 10 to 15 % are added to the mixture as anti foam additive and/or catalyst.

The heat-treatment is performed in two stages in anaerobic environment with condensation of the produced gases and vapors.

In the first stage the temperature of the mixture is raised up to 130 to 160 C° during 25 to 40 minutes then the mixture is cooled to a temperature lower than 80 C° advantageously by adding condensation liquid then the mixture is allowed to stand during 40 to 65 minutes and the supernatant fat is removed mechanically.

0.2 to 0.4 mass parts of trisodium monophosphate of 0.2 to 1 mass % or 0.25 to 0.50 mass parts of sodium metasilicate of 0.2 to 1 mass % is added then to the mixture to inhibit deposition of contaminants.

The mixture is heated again up to 110 to 130 C° this temperature is maintained during 20 to 25 minutes then the mixture is cooled to a temperature lower than 50 C° advantageously by adding condensation liquid.

The mixture is then allowed to stand during about 35 to 50 minutes and the fat collected on the surface is mechanically separated.

After the intensive heat-treatment either 0.2 to 0.7 mass parts of mixture of proportion 1 to 1 of carvacrole solution of 6 to 10 mass % and that of thymol or 0.2 to 0.8 mass parts of mixture of proportion 2 to 1 of thymol solution of 3 to 6 mass % and $MgCl_2$ solution of 10 to 12 mass % are added to the mixture in order to reduce odor and ammonia emissions.

The pH value is set to the range of 7.2 to 8.4.

The mixture is then continuously mixed and incubated at 35 to 43 C° in anaerobic environment during 24 to 48 hours.

The dry material content is set to 10 to 40 mass % after the treatment.

The mixture of the following composition is made hereafter:

- 30 to 40 mass parts of heat-treated and aerobically stabilized meat industry waste material as described above of dry material content of 10 to 40 mass %,
- 25 to 30 mass parts of residual material produced by biogas production from pet food and meat industry waste having dry material content from 25 to 30 mass % dynamic breathing intensity less than 1000 mg of O_2 per kg of dry material per hour, pH from 6.5 to 8.0; germ counts of f. coliform and f. Streptococcus are 20 cells per g,
- 10 to 20 mass parts of meat industry sewage sludge of high fat content having fat content higher than 20 % and total nitrogen content of at most 0.5 mass %,
- 2 to 35 mass parts of chopped and pre-treated branches, twigs, vine-branches or stalks of arboreous plants.

The pre-treatment is performed in such a way that the vegetable waste of arboreous plants is inoculated either with culture of Peniophora gigantea of ATCC No. 32894 or that of Ceriporiopsis subvermisphora of ATCC No. 96608 or with a mixture of them in proportion 1 to 1 on liquid carrier 1 or 1.5 months before compost making.

The germ number of the microorganism culture is 10^6 to 10^9 cells per ml.

The plant parts are chopped into parts of size of 2 to 5 cm before stacking.

The mixture of wastes of above-mentioned composition is homogenized and the dry material content is set to 40 to 48 mass %.

The mixture is wet-ground if necessary.

The mixture is then composted in either open or closed stack composting system.

The width of stack is 3 to 3.5 m the height is 1.5 to 1.7 m in the compost making in open stacks.

The width of stacks is 6 to 8 m the height is 3 to 4 m in the compost making in closed stacks.

The whole stack material is optionally sieved after the thermophylic stage at less than 50 C° in such a way that the particles larger than 2 to 2.5 cm are separated.

Having removed the separated particles the stacks are re-built and the compost making continues.

The compost making continues until the dynamic breathing intensity of at most 80 mg of O_2 per kg of compost per hour, respectively the V. ripening

stage according Dewar's self-heating test i. e. self-heating of 20 to 30 C° is reached.

The produced compost may be used as soil fertilizer or as carrier of artificial fertilizers or microbial inoculating preparations.

The advantages of the process according to invention are as follows.

The meat industry waste material is specially pre-treated, which results in a reduced odor and ammonia emission during composting.

In the process the pre-treated meat industry waste material is composted in mixture with other waste materials of meat industry. The common utilization of different kinds of meat industry waste materials is enabled in this way.

Meat industry sewage sludge of high fat content may be utilized as component of initial mixture without degreasing in the process.

A product, which may be used as either fertilizer to restore production capacity of the soil or as carrier material of large surface, may be produced by an environment-sparing process.

The process according to invention is shown by the examples of embodiments below.

Example 1

The components of mixed waste product originating from slaughterhouses or meat packing plants are as follows: 40 mass parts of maw and bowel content, 10 mass parts of feather or skin , 5 mass parts of unhatched eggs, 10 mass parts of colostrum turned into waste, 20 mass parts of meat products for

human consumption turned into waste and 15 mass parts of blood of normally slaughtered ruminants.

The dry material content of the mixture is set to 20 mass %, the particle sizes of components are set to 1.8 to 2.5 cm and the mixture is then homogenized.

The above described mixture undergoes a multi-stage heat treatment based on fat extraction.

The pH of the mixture is set to 6.2 with 1 mass part of orthophosphoric acid solution of 1 mass % and 25 mass parts of fat cattle liquid dung buffered to pH 7.2 (diluted with water in proportion 1 to 1) is added to 100 mass parts of the mixture before the heat-treatment.

3 mass parts of mucilage containing fine fiber stuff of pH 6.5 and dry material content of 15 mass % gained by desliming of sunflower oil with separator is added to the mixture as anti foam agent and catalyst.

The heat-treatment is performed in two stages in anaerobic environment with condensation of produced gases and vapor.

In the first stage the temperature of the mixture is raised to 150 C° and kept during 38 minutes then the mixture is cooled to a temperature lower than 80 C° advantageously by adding condensation liquid and allowed to stand during 44 minutes and the supernatant fat is removed mechanically. 0.4 mass parts of trisodium monophosphate solution of 0.5 mass % is then added to the mixture.

The mixture is then heated again up to 120 C°, the temperature is maintained during about 25 minutes then the mixture is cooled to a temperature lower

The mixture is then allowed to stand during 47 minutes then the fat collected on the surface is mechanically separated.

After the intensive heat treatment 0.3 mass parts of the mixture of proportion 1 to 1 of solutions of 0.7 mass % of carvacrole and thymol is added in order to reduce odor and ammonia emission and to gain antiseptic effect.

The pH is set to 8.0

The mixture is then continuously mixed and incubated at 40 C° in anaerobic environment during 24 hours.

The dry material content of the mixture is set to 41 mass % after the treatment.

A mixture consisting of the following raw materials is made hereafter:

- 40 mass parts of heat-treated and aerobically stabilized meat industry waste material (as described above),
- 28 mass parts of residual material of biogas production from meat industry waste comprising maw and bowel content, feather, skin, meat products for human consumption, pet food having pH 7.5, dry material content of 40 %, germ counts of f. coliform and f. Streptococcus of 20 cells per g,
- 10 mass parts of meat industry sewage sludge of high fat content wherein the fat content is 41 mass % calculated to dry material content,
- 22 mass parts of chopped and pre-treated branches, twigs, vine-branches or stalks of arboreous plants.

The pre-treatment is performed in such a way that arboreous plant parts are inoculated with a culture of Peniophora gigantea of ATCC No. 32894 delivered in liquid carrier one month before composting to render lignocellulose workable.

The efficient germ count is 10^8 germs per ml.

The vegetable particles are chopped to particle size of 4 cm before building up of the stacks.

The above-described mixture of waste products is homogenized, the dry material content is set to 46 mass % and composted in open stack composting system.

The width of stack is 3 m the height is 1.5 m.

The stacks are turned over each week.

After the thermophylic stage where x<50 C° the whole material of stack is sieved in such a way that the particles larger than 2 cm are separated.

Having removed the separated particles stacks are built up again and the composting continues.

The composting continues until the dynamic breathing intensity of at most 80 mg of O_2 per kg of compost per hour and V. ripening stage according to Dewar's self-heating test i. e. self-heating to 20 to 30 C° is reached.

The important parameters of the compost end product according to the invention and those of the product of control experiment are listed in the Table 1.

The temperatures of stacks measured every day during compost making are shown in the Figure 1. The daily temperatures of stacks are shown in the graph in Figure 1.

In the Figure 1 the marks • show the values corresponding to the invention, the marks ■ show those of the control experiment.

The mixture used in the control experiment consists of 30 mass parts of slaughterhouse waste products i. e. skin, feather, content of maw and bowels heat-treated at 180 C°, and under overpressure of 3 bar, 30 mass parts of cattle manure, 30 mass parts of straw and 10 mass parts of soil comprising 25 mass % of clay.

This mixture is composted in stacks of trapezoid cross-section in open form.

It may be established on the base of results in the Table 1 that the minimum temperature necessary for sterilization of 55 to 60 C° is reached in some days in the stack according to invention in contrast with the control stack, wherein this value was reached after 19 to 22 days.

A second thermophylic phase took place after the 33rd day in the process described in the example, which promoted the sterilization as high as possible of the material constituting the stack.

The most important percentages of components and parameters of compost produced according to invention and those of the control experiment are shown in the Table 1.

Table 1

Characteristics	**Compost made according to invention**	**Compost of the control experiment**
pH	7.8	10.28
Total organic material content in mass % calculated to dry material	13.47	10.28i
Total nitrogen mass % of dry material	0.58	0.36
Total phosphorus mass % of dry material	0.25	0.23
Total potassium mass % of dry material	0.45	0.23
Mass per volume kg/m^3	610	580
Dynamic breathing intensity mg O_2/kg of dry material/hour	45	65
Germ number of f. coliform	<1	18
Germ number of f. Streptococcus	<1	12
Salmonella species	negative	negative
Clostridium perfringens	negative	negative

It may be established on the base of results received that the compost according to invention has potassium and nitrogen contents higher by 18 to 28 % than that of control experiment.

The measured germ numbers of f. coliform and f. Streptococcus were higher by one order of magnitude in the control example.

The dynamic breathing intensity of the compost according to invention shows significantly higher oxygen consumption, at the same time the compost according to invention may be regarded much more ripened.

Example 2

All is done as in the Example 1 but 0.3 mass parts of mixture consisting of solutions of carvacrole and thymol of 7 mass % in proportion of 1 to 1 is added to the mixture both before and after the heat-treatment.

Example 3

The components of the mixed waste produced in the slaughterhouses and meat packing plants and used in the process are as follows: 30 mass parts of maw and bowel content 15 mass parts of skin, 15 mass parts of unhatched eggs, 20 mass parts of colostrum turned into waste, 10 mass parts of meat products aimed for human consumption and turned into waste and 10 mass parts of blood of normally slaughtered ruminants.

The dry material content of the mixture is set to 23 mass % and the particle sizes of components are set to 2 to 3 cm by chopping then the mixture is homogenized.

A mixture of above mentioned meat industry waste products of defined proportions undergoes heat-treatment of two stages based on degreasing.

The pH of the above mentioned meat industry waste is set to pH 6.7 with orthophosphoric acid of 0.8 mass % before the heat-treatment.

2 mass parts of mucilage gained from sunflower oil production containing fine fiber stuff gained at desliming by separator after pressing having pH 6.5 and dry material content of 22 % and 0.55 mass parts of copper (II) sulfate solution of 11 mass % are added to the mixture before the heat-treatment.

The heat-treatment is performed in two stages in anaerobic environment and with condensation of produced vapors and gases.

The temperature of the mixture is raised to 158 C° in the first step, during 36 minutes then cooled to a temperature under 80 C° adding condensation liquid then the mixture is allowed to stand during 55 minutes. The supernatant fat is mechanically removed. 0.40 mass parts of sodium metasilicate solution of 1 mass % is added to inhibit deposition of contaminants.

The mixture is heated up again thereafter to 125 C°, the temperature is maintained during about 20 minutes then the mixture is cooled to a temperature under 50 C° and allowed to stay during 46 minutes. The supernatant fat is mechanically removed.

After the intensive heat-treatment 0.36 mass parts of a mixture of proportion 2 to 1 solution of thymol of 5 mass % and that of $MgCl_2$ of 10 mass % is added as stabilizer in order to reduce emission of ammonia and odor and to reach antiseptic effect.

The mixture is then continuously mixed and incubated at 39 C° in anaerobic environment during 48 hours.

The dry material content of the mixture is set to 37 mass % after the treatment.

The following raw materials are mixed together thereafter for compost making:

- 30 mass parts of heat-treated and aerobically stabilized meat industry waste material as described above,
- 25 mass parts of meat industry waste products i. e. maw and bowel content, feather, skin, meat industry products aimed to human consumption, solid residue matter of pet food originating from thermophilic system having pH 6.5 to 8.0 dry material content of 30 to 45 mass % and germ counts of f. coliform and f. Streptococcus less than 20 germs/g,
- 18 mass parts of meat industry sewage sludge of high fat content having 34 mass % fat content calculated to dry material,
- 27 mass parts of chopped and pre-treated branches, twigs, vine-branches and stalks of arboreous plants.

The pre-treatment is performed in such a way that the waste of branches, twigs, or vine-branches is inoculated with a mixture of proportion 1 to 1 of cultures of Peniophora gigantea of ATCC No. 32894 and Ceriporiopsis subvermisphora of ATCC No. 96608. Both cultures have efficient germ counts 10^9 germs/ml. The mixture is delivered in liquid carrier 1.5 months

The vegetable parts are chopped into particles of size of 3.5 cm before stacking.

The mixture of waste products composed according the above-described quantities is homogenized, the dry material content is set to 44 mass % and composted in open or closed stack composting system.

The width of stack is 3.1 m, the height is 1.6 m in open composting system.

The stacks are turned over every week.

After the thermophylic stage where x<50 C° the whole material of stack is sieved in such a way that the particles larger than 2.5 cm are separated.

Having removed the separated particles stacks are built up again and the composting continues.

The composting continues until the dynamic breathing intensity of at most 80 mg of O_2 per hour per kg of compost and V. ripening stage according to Dewar's self-heating test i. e. self-heating to 20 to 30 C° is reached.

The most important parameters of the compost end product and the results of the control experiment are shown in the Table 2.

Table 2

Characteristics	**Compost made according to invention**	**Compost of the control experiment**
PH	7.8	7.2
Total organic material mass % of dry material	12.56	10.28
Total nitrogen mass % of dry material	0.49	0.36
Total phosphorus mass % of dry material	0.29	0.23
Total potassium mass % of dry material	0.50	0.37
Mass per volume kg/m^3	571	580
Dynamic breathing intensity: mg O_2/kg of dry material/hour	38	65
Germ number of f. coliform	<1	18
Germ number of f. Streptococcus	<1	12
Salmonella species	negative	negative
Clostridium perfringens	negative	negative

The control experiment is performed in such a way that 30 mass parts of slaughterhouse waste i. e. skin, feather, maw and bowel content heat-treated at 180 C° under overpressure of 3 bars during 30 minutes 30 mass parts of cattle dung 30 mass parts of straw and 10 mass parts of soil containing clay of 25 mass % are mixed together then composted in open system in stacks of trapezoid cross-section.

Example 4

The components of the mixed waste product originating from slaughterhouses and meat packing plants and used in the process are as follows: 30 mass parts of maw and bowel content, 15 mass parts of feather, 15 mass parts of unhatched eggs, 20 mass parts of colostrum turned into waste, 10 mass parts of meat products aimed for human consumption turned into waste and blood of normally slaughtered ruminants.

The dry material content of the mixture is set to 23 mass %, the particle sizes of components are set to 3 cm by chopping and the mixture is homogenized.

The above-mentioned meat industry waste material undergoes a two-stage heat-treatment based on fat removing in such a way that pH of 100 mass parts of the above-mentioned meat industry waste is set to 6.7 with orthophosphoric acid of 0.8 mass %.

2 mass parts of mucilage of vegetable oil industry containing fine fiber stuff of pH 6.5, dry material content of 22 mass % and 0.55 mass parts of copper (II) sulfate of 11 mass % are added as anti foam additive to the mixture

The heat-treatment is performed in two stages in anaerobic environment and closed system with condensation of produced vapor and gases.

In the first stage the temperature of the mixture is raised to 158 C° during 36 minutes then the mixture is cooled to a temperature lower than 80 C° simultaneously adding condensation liquid.

The mixture is allowed to stand during 55 minutes and the supernatant fat is mechanically removed then 0.40 mass parts of sodium metasilicate solution of 1 mass % is added to the mixture to inhibit deposition of contaminants.

The mixture is then heated to 125 C° again the temperature is maintained during 20 minutes the mixture is then cooled to a temperature lower than 50 C° simultaneously adding condensation liquid.

The mixture is then allowed to stand during 46 minutes and the fat collecting on the surface is mechanically removed.

After the intensive heat-treatment 0.4 mass parts of mixture of proportion 2 to 1 of solution of thymol of 5 mass % and that of $MgCl_2$ of 10 mass % is added to the mixture as stabilizer.

The pH is set to a value between 7.2 and 8.4.

The mixture is then continuously mixed and incubated at 39 C° in anaerobic environment during 48 hours.

The dry material content of the mixture is set to 30 mass % after the treatment.

The mixture is lead to composting and mixed together with the following materials:

- 40 mass parts of heat-treated and aerobically stabilized meat industry waste product as described above,
- 30 mass parts of solid residual material of meat industry waste products such as maw and bowel content, feather, skin, meat industry products for human consumption, pet food originating from thermophylic system having pH 6.5 to 8.0, dry material content of 30 to 45 mass % germ numbers of f. coliform and f. Streptococcus less than 20 cells/g respectively,
- 2 mass parts of pre-treated parts of arboreous plants.

The above described mixture having dry material content of 18 mass % is pre-chopped with disintegrating mill to particle size less than 3 mm.

The prepared mixture is then lead into a wet milling machine (cavitation mill) and the milling continues during 20 minutes.

The collisions of particles among disintegrating elements result in a high homogenization and the particle size becomes less than 2 mm.

The mixture is composted in closed stack during 2 weeks until the dynamic breathing intensity of at most 80 mg of O_2 per hour per kg of compost and the V. ripening stage according Dewar's self-heating test i. e. self-heating to 20 to 30 C° is reached.

The most important characteristics of compost produced according to this example and those of the control experiment are shown in the Table 3.

Table 3

Characteristics	**Compost made according to invention**	**Compost of the control experiment**
pH.	7.6	7.2
Germ number of f. coliform	<1	18
Germ number of f. Streptococcus	<1	12
Salmonella species	negative	negative
Clostridium perfringens	negative	negative

The control experiment is performed using the mixture of following composition: 30 mass parts of waste product of slaughterhouse such as skin feather maw and bowel content treated at 180 C° under overpressure of 3 bars during 30 minutes, 30 mass parts of cattle dung, 30 mass parts of straw and 10 mass parts of soil containing 25 mass % of clay. The mixture is composted in stacks of trapezoid cross-section in open system.

CLAIMS

1. Process for treatment of meat industry waste products wherein the meat industry waste products are heat-treated, degreased then mixed with other waste materials and the mixture is composted characterized in that the pH of the meat industry waste material is set to 5.8 to 7.0 then 100 mass parts of waste material is optionally mixed with 15 to 35 mass parts of watery cattle or pig dung buffered to pH of 6.8 to 7.5 then optionally 0.2 to 0.7 mass parts of solution of 6 to 10 mass % of a mixture of carbacrole and thymol in ratio of 1 to 1 or 0.2 to 0.8 mass parts of of solution of 3 to 12 mass % of mixture of thymol and magnesium chloride in ratio of 2 to 1 is added to the mixture then 3 to 5 mass parts of mucilage of vegetable oil industry and 0.25 to 0.75 mass parts of copper (II) sulfate of solution of 10 to 15 mass % are added, the mixture is heat-treated thereafter in two stages at 130 to 160 C° and at 110 to 130 C° respectively, the supernatant fat is removed in both stages, then 0.2 to 0.7 mass parts of solution of 6 to 10 mass % of a mixture of carbacrole and thymol in ratio of 1 to 1 or 0.2 to 0.8 mass parts of solution of 3 to 12 mass % of a mixture of thymol and magnesium chloride in ratio of 2 to 1 is admixed and the mixture is incubated at pH of 7.2 to 8.4 and 35 to 43 C° in anaerobic environment,

30 to 40 mass parts of meat industry waste product treated in the above way and having dry material content of 10 to 40 mass %,

25 to 30 mass parts of residue material of dry material content of 25 to 45 mass % originating from biogas production from meat industry waste product,

10 to 20 mass parts of meat industry sewage sludge of dry material content of 15 to 30 mass % and fat content of at least 20 mass %,

2 to 35 mass parts of chopped branches, twigs vine-branches or stalks of arboreous plants – which were pre-treated with culture of microorganism Peniophora gigantea and/or that of Cerioporiopsis subvermisphora –

are mixed together and the mixture is then homogenized, the dry material content is set to 40 to 48 mass %,

the mixture is optionally pre-milled and undergoes wet grinding until the grain size less than 2 mm is reached and

the mixture is composted in open or closed stacks,

the compost –in a given case - is sieved after the thermophylic composting stage, the particles larger than 2 to 2.5 cm are separated and the fine grained material is further composted.

2. The process according to Claim 1 characterized in that fat cattle dung or pig one diluted with water in proportion of 1 to 1 is admixed to the mixture before the heat-treatment.

3. The process according to Claim 1 characterized in that lean cattle dung or pig one diluted with water in proportion of 1 to 3 is admixed to the mixture before the heat-treatment.

4. The process according to Claim 1 characterized in that 0.2 to 0.5 mass parts of trisodium monophosphate or sodium metasilicate solution are added to the mixture after the first stage of heat-treatment.

5. The process according to Claim 1 characterized in that the composting continues until the dynamic breathing intensity of at most 80 mg of O_2 per kg of compost per hour and Dewar's self-heating to 20 to 30 C° are reached.

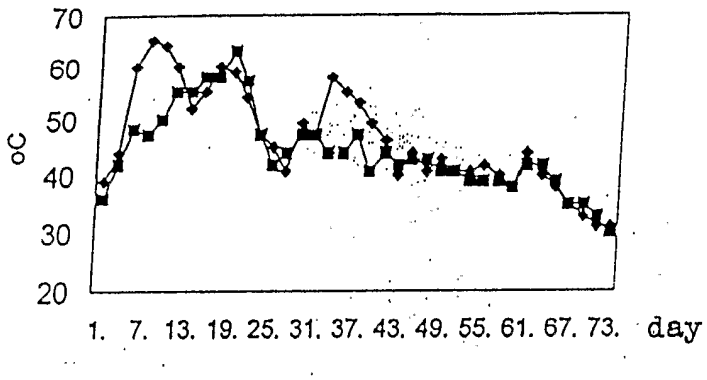


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No
PCT/HU2005/000054

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C05F1/00 C05F3/00 B09B3/00 C11B1/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C05F B09B C11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 200 085 A (RUDOLF ET AL) 6 April 1993 (1993-04-06) the whole document	1-5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search	Date of mailing of the international search report
20 October 2005	26/10/2005

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INTERNATIONAL SEARCH REPORT

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