

Technical analysis of a back supply of heated rendering-plant fat to the disc drier

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ABSTRACT: The fulfilment of the subject of the Act No. 76/2002 Dig. on integrated prevention reduces energy consumption and increases hygienic safety of a thermal treatment of animal tissues at veterinary decontamination institutes. By making use of a back supply of heated rendering-plant fat to the continuous disc drier KDS 250 the so-called fritting effect is induced speeding up the evaporation of residual water and reducing the redrying time of the meat and bone paste. An analysis proved a reduced consumption of specific energy, whereby the demand for the best available technique (BAT) is met.

Keywords: Act on Integrated Prevention; best available techniques (BAT); veterinary decontamination institutes (VAÚ); meat and bone paste; meat and bone meal (MKM); rendering-plant fat; continuous disc drier

In 1996 the Directive 96/61/EU on Integrated Pollution Prevention and Control (IPPC) with effect from 1999 was approved in EU. The Directive was focused on a high standard of environmental protection. A high environmental efficiency of an enterprise can be attained by applying BAT – Best Available Technique and its most effective and efficient enforcement. This fact is anchored in the Directive 96/61/EU defining “the technique”, i.e. “the technology applied and the method of its proposal, implementation, operation maintenance and enterprise operation termination”. The best available technique (BAT) as the basis of an integrated prevention is a dynamic concept (MAREČEK 2002).

The requirements of the Directive 96/61/EU were incorporated into the Czech legal rules by the Act No. 76/2002 Dig., on Integrated Pollution Prevention and Control, Integrated Pollution Record and by the Amendments of some acts (Act on Integrated Prevention) which came into force and effect on 1 January 2003.

As far as the Department of Agriculture is concerned, the Act involves, among other things, “the equipment for a disposal or evaluation of animal bodies and animal wastes of the processing capacity exceeding 10 tons a day” (Head 6.5 of the Supplement 1 to the Act No. 76/02 Dig.).

In the Czech Republic the Act No. 76/02 Dig. relates to 9 veterinary decontamination institutes (VAÚ).

The fulfilment of the subject of the Act on Integrated Prevention also reduces energy consumption and increases hygienic safety of a thermal treatment of animal tissues at VAÚ (SLEZÁKOVÁ 2003).

The use of a back supply of heated rendering-plant fat to the continuous disc drier KDS 250, i.e. BAT, is based on inducing the so-called fritting effect resulting in a speeded-up evaporation of residual water and a reduc-

tion of the final drying time of thermally preprocessed meat and bone paste.

MATERIAL

Technological procedure

Major activity of VAÚ is to carry out veterinary decontaminations, i.e. collection, transport and harmless disposal of wastes of an animal origin (meat and bone meal wastes, bodies of perished animals – cadavers). The production line consists of the following technological equipment: energy source of steam generation, preparation room, engine room, pressing shop, fat storage room, production plant of meat and bone meal. The production line is connected to a condensation equipment, deodorization equipment and a sewage treatment plant. On 30 September 1996 the Central Contamination Commission of the Czech Republic unified the parameters of rendering-plant raw material at VAÚ with the regulations of the European Union (Commission Decision 96/449/EU). A mixture of the confiscations of animal origin is subject to the following obligatory process:

- a) a grinding to the particles of the max. size of 50 mm,
- b) thermal-pressure sterilizing at min. 133°C, at the pressure of min. 3 bar for min. 20 minutes,
- c) a drying of sterilized meat and bone paste by water evaporation in a drying room to the water content of 1–3%,
- d) a fat separation by pressing or extraction,
- e) a final processing of the products obtained: grinding, meat and bone meal (MKM) screening to the required grain size and removing rendering-plant fat from protein admixtures on a special centrifuge,

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f) storing and microbiological checks of the products obtained.

Main raw material processing is carried out in a closed room – the engine room where the raw material is thermally sterilized in a destruction equipment (autoclave). At VAÚ CZ two technological processing systems are applied: *a destruction (discontinuous)* and *a drying (continuous) system*. The original destruction system is advantageous for smaller processing capacities enabling a higher operational ability and a more sensible processing of various raw material sorts. It, however, requires a high proportion of manual work and an attendance. The continuous system is intended for a higher equipment efficiency making use of a higher stage of production automation.

In the destruction system the raw material is sterilized and dried in a single machine in a discontinuous way. To compensate the cycling process for the subsequent continuous fat separation a trough for meat and bone paste is used, to which individual autoclaves are discharged at specified time cycles.

In the drying (continuous) system the raw material is sterilized in a single machine (autoclave – preboiling tank) in a discontinuous way. The sterilized meat and bone paste is discharged by autoclave pressure into a large-capacity intermediate storage tank, where it is homogenized or possibly reheated. From the intermediate storage tank it is continuously dosed into a large-capacity continuous disc drier, from where the mixture of dried MKM and rendering-plant fat is discharged.

Methods applied

The paper was focused on carrying out a technical analysis of the suggested best available technique for VAÚ based on an operational appraisal in conjunction with the implementation of the EC Directive 96/61/EU.

The use of a back supply of heated rendering-plant fat to the disc drier KDS 250 was operationally verified at VAÚ CZ, where the so-called drying (continuous) system is applied. Technical parameters of the disc drier KDS 250 are listed in Table 1.

A technical analysis was carried out under exploitation conditions: from 100 kg of the raw material charged 33% of meat and bone paste was obtained providing 9–10% of rendering-plant fat and 23–24% of MKM on a press.

The efficiency of the continuous drier KDS 250 can be expressed as follows:

- a) on inlet side: 134 t of raw material charged within 24 hrs => efficiency 5.6 t/h,
- b) on outlet side: 44.2 t of meat and bone paste within 24 hrs => efficiency 1.8 t/h,
30.8–32.1 t of MKM and 12.1–13.4 t of rendering-plant fat within 24 hrs, i.e. specific efficiency – 1.25 t of MKM/h and 0.55 t of rendering-plant fat/h.

Inlet calculation parameters:

- drier efficiency – 5.6 t of raw material charged/h,
- specific weight of meat and bone paste – 740 kg/m³,
- specific weight of MKM – 650 kg/m³,
- specific weight of rendering-plant fat – 850 kg/m³,
- drier charging coefficient – 0.83.

RESULTS

By a technical analysis it was found that the greatest thermal effect of a back supply of rendering-plant fat to a drying equipment is obtained if the heated rendering-plant fat (of the temperature 100°C and in the quantity of about 1 m³/h) is sprayed into the drier in the place (point), where the dry-matter content in the meat and bone paste is 75% on average (70–80%), which is about a half up to two thirds of the drier working space. In this way the so-called fritting effect is induced speeding up the evaporation of residual water and reducing the re-drying time of the meat and bone paste.

The drying time without injecting heated rendering-plant fat was 10.3 hrs. When injecting rendering-plant fat, the drying time was reduced by 20–23% based on the character of the raw material processed, which is from the original 10.3 hrs to 8.2–7.9 hrs (see Fig. 1). In this way also the consumption of specific energy per ton of the produced raw material was reduced by about 20%.

For the curve illustrating the dependence of dry matter on the drying time without inducing a fritting effect the following correlation equation was defined:

$$y = 36.000 + 12.406 \cdot x, \text{ regression coefficient } r = 0.98783.$$

For the curve illustrating the dependence of dry matter on the drying time by inducing a fritting effect the following correlation equation was defined:

$$y_{fe} = 38.578 + 10.096 \cdot x, \text{ regression coefficient } r = 0.96846.$$

In either case the level of importance is 95%.

The change in the speed of the processed raw material displacement was implemented by a change in the number of outlet blades on the drier rotor discs.

Table 1. Technical parameters of the drier KDS 250

Drier	Rotor	Motor
Length 9.9 m	max. working overpressure 0.9 MPa	75 kW
Diameter 1.95 m	max. permissible wall working temperature 180°C	revolutions (speed) 1,450/min
Internal capacity 30 m ³	working substance-saturated steam	–
Efficiency 134 t of raw material charged/24 hrs	area 250 m ²	–
	8 rev./min	–

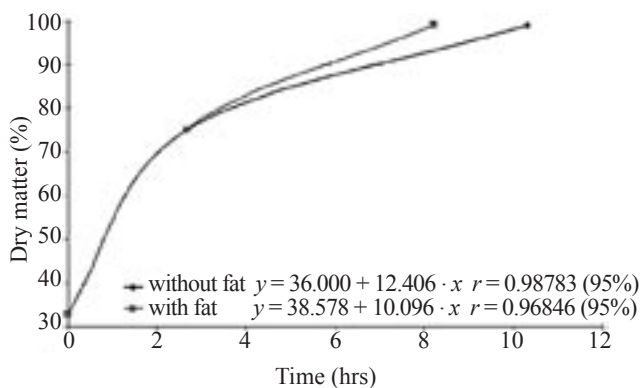


Fig. 1. Dependence of meat and bone paste dry matter on the drying time

CONCLUSIONS

The highest fritting effect is attained at the moment, when the heated rendering-plant fat (100 C in the quantity of about 1 m³/h) is injected into the drier in the place, where the dry-matter content in the meat and bone paste amounts to about 75% (70–80%), which is at about a 1/2 to 2/3 of the drier length.

The use of a back supply of rendering-plant fat to the continuous disc drier KDS 250 unambiguously proved the following facts based on an operational test:

- an increased line efficiency by 20%, which is an increase from 5.6 to 6.7 t/h of the raw material charged,
- the drying time was reduced from 10.3 to 8.2–7.9 hrs,
- a reduced specific energy consumption per 1 ton of the raw material produced by about 20%.

Another advantage of this technology is the fact that no overburning of the meat and bone paste takes place by reducing the drying time.

In conjunction with this advantage it is necessary to mention that the Czech Republic prohibited, since

1 November 2003, the use of MKM for feeding farm animals. This prohibition is temporary being in force by the end of 2005. It is presumed that the prohibited use of MKM for feeding ruminants as well as the prohibition of incorporating carcasses of dead animals with MKM for feeding purposes will be in force also following 2005. In accordance with the new now prepared bill (of Act) it will be, however, possible to use MKM for feeding monogastric farm animals. This sort of MKM will be able to be produced from slaughterhouse animal wastes intended for human nutrition (DUBEN 2004). The operationally verified BAT will again be of great importance due to its advantageous limited overburning of meat and bone paste.

A longer-term application of the back supply of heated rendering-plant fat reveals, in addition to the above mentioned advantages, also a reduced mechanical wear of the drier stirrer caused by reduced friction forces.

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Technická analýza procesu zpětného přívodu kafilerního tuku do diskové sušárny

ABSTRAKT: Věcné naplnění Zákona č. 76/2002 Sb. o integrované prevenci kromě jiného přispívá ke snižování energetické náročnosti a zvyšování hygienické bezpečnosti termického zpracování živočišných tkání ve veterinárních asanačních ústavech. Využitím zpětného přívodu zahřátého kafilerního tuku do kontinuální diskové sušárny KDS 250 se vyvolá tzv. fritovací efekt, který urychlí odpaření zbytkové vody a zkrátí dobu dosoušení masokostní pasty. Analýzou bylo prokázáno snížení spotřeby měrné energie; tím je plněn požadavek nejlepších dostupných technik (BAT).

Klíčová slova: Zákon o integrované prevenci; nejlepší dostupné techniky (BAT); veterinární asanační ústavy (VAÚ); masokostní pasta; masokostní moučka (MKM); kafilerní tuk; kontinuální disková sušárna

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