

Opinion of the Scientific Panel on Biological Hazard of the European Food Safety Authority on the safety of a Thermo-Mechanical Process to Convert Category 2 and 3 Animal By-Products (ABPs) into Bio-Fuel¹

(Question N° EFSA-Q-2005-061)

Adopted on 13 July 2006

SUMMARY

The European Commission requested EFSA and its Scientific Panel on Biological Hazards to evaluate the safety of a specific Thermo-Mechanical process to convert Category 2 and 3 Animal By-Products (ABPs) into Bio-Fuel. After discussion with the Applicant it was agreed to limit the Category 2 material to manure and digestive tract contents only.

In the described process, heat and mechanical abrasion are combined to reduce ABPs into dry material (the Bio-Fuel) which can be subsequently incinerated to produce energy. The condensed water is kept for at least 1 hour at 70°C before being released into the sewer.

It was concluded that the Bio-Fuel production process considered by itself is only a drying process and is therefore not suitable to safe disposal of Category 2 and 3 ABPs. However, when the Bio-Fuel production and the subsequent incineration are considered as a combined process, this results in safe recycling into energy for Category 3 ABPs and manure and digestive tract contents.

KEY WORDS: Animal By-Products, Alternative Processes, Thermo-Mechanical Process, Bio-Fuel, Safety

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BACKGROUND

Legal background

Regulation (EC) No 1774/2002 of the European Parliament and of the Council, laying down health rules concerning animal by-products not intended for human consumption² was adopted on 3 October 2002. It divides animal by-products into three different Categories and requires them to be disposed of, recycled or used as follows:

Category 1 - animal by-products presenting a risk of contamination with BSE or scrapie agent, or with residues of prohibited substances (i.e. hormones used for growth promotion) or environmental contaminants (i.e. dioxins and PCBs) must be totally disposed of as waste by incineration, or co-incineration or landfill after undergoing appropriate heat treatment (Article 4).

Category 2 - animal by-products presenting a risk of contamination with other animal disease agents (i.e. animals which have died on the farm or were killed in the context of disease control measures on the farm) or at risk of residues of veterinary drugs may only be recycled for uses other than animal feed following appropriate heat treatment (Article 5).

Category 3 - parts of slaughtered animals that are not consumed by humans, can only be used in feed for farmed animals if they come from animals declared fit for human consumption following veterinary inspection (Article 6).

The Regulation also provides for the possibility to approve other means of disposal and other ways to use ABPs after consultation of the appropriate scientific committee (Articles 4(2)(e), 5(2)(g) and 6(2)(i)).

State of play

The Commission received a number of applications for approval of alternative methods for the safe disposal of ABPs from Member States and from industry. Seven of these applications were forwarded to the Scientific Steering Committee (SSC) requesting scientific evaluation. The SSC adopted the following opinions on this subject:

1. Opinion on six alternative methods for safe disposal of animal by-products (adopted by the SSC at its meeting of 10-11 April 2003); and
2. Final opinion and report on a treatment of animal waste by means of high temperature (150 °C, 3 hours) and high pressure alkaline hydrolysis (adopted by the SSC at its meeting of 10-11 April 2003).

For the five methods regarded as safe for ABPs of Categories 2 and 3, the SSC concluded that they would probably also have the capacity to safely dispose of ABPs of Category 1, but that there was not enough information or data supporting this claim.

Following this conclusion, the applicants of two of these processes forwarded new applications with additional information to the Commission, which were forwarded to the European Food Safety Authority (EFSA). The Panel on Biological Hazards of EFSA adopted

² OJ No L 273 of 10.10.2002, p. 1

an opinion on the “high pressure hydrolysis biogas” process on 26 November 2003 (question no EFSA-Q-2003-028), concluding that under certain conditions the process did not present an additional risk when disposing of ABPs of Category 1. Further, the Panel adopted an opinion on the “combustion of tallow in a thermal boiler” on 22 April 2004 and on the “biodiesel process” as a method of safe disposal of Category 1 material on 2 June 2004.

Description of the process

The company INETEC, based in the UK, has submitted a novel process and has asked the Commission to approve it as a safe means of disposal under Articles 5 (2) (g) and 6 (2) (i) of Regulation 1774/2002/EC, i.e. as far as Category 2 and 3 material are concerned. Details on the process and the studies carried out by this company, as well as further evidence, are contained in the comprehensive submission provided to the Commission.

TERMS OF REFERENCE

The Commission asked EFSA:

1. To assess the ability of the process submitted by INETEC to safely dispose of Category 2 and 3 animal by-products.
2. If the process is considered to present a risk, the Commission asks EFSA to advise on the risks of the use of that process and on possibilities for addressing them.

ASSESSMENT

1. Introduction

The original application received describes a Thermo-Mechanical process to convert Category 2 and 3 Animal By-Products (ABPs) into Bio-Fuel. After discussion with the Applicant it was agreed to limit the Category 2 material to manure and digestive tract contents only.

The process consists of four stages:

1. Loading: Waste is loaded directly into the Bio-Fuel converter using dolavs, a conveyor belt or a vacuum conveyor. The Bio-Fuel conversion is a batch process and the loading period is restricted to approximately 6 hours in the 20 hour operating cycle of the machine.
2. Bio-Fuel conversion by abrasive drying: This stage of the process lasts at least 12 hours. The temperature is raised to a process start temperature of around 70 °C, at which point water vaporization occurs. Abrasion at this temperature breaks down the structure of any paper or card packaging materials. The sustained abrasion and heat combination also breaks down much of the organic cell structure of the food waste itself. The process temperature will rise to a final value of at least 100 °C as water continues to vaporize. This combination of conditions is sufficient to completely break down the structure of the food-waste and to reduce moisture content to a final level of 10 to 15%. Water evaporated from the Bio-Fuel is continually extracted from the air space above the Bio-Fuel and is passed through a stainless steel condenser. Additional information provided by the Applicant showed that the water is subsequently kept for several hours at a minimum of 70°C in the storage tank. The condensate is of a

moderate strength and would be accepted for discharge into the sewer. On completion of this step the waste will appear as a dry powder/fibre mix.

3. Transfer of Bio-Fuel: At the end of the abrasive drying phase, Bio-Fuel will be discharged and automatically conveyed by a fully covered and electromechanically interlocked conveyor. The duration of the discharge phase is approximately 2 hours. The resulting Bio-Fuel will be exclusively co-incinerated on-site.
4. Energy conversion, use and recovery: Fuel from the silo will automatically be fed into the combustion system. Approximately 25 to 50% of the total energy output is used internally for Bio-Fuel preparation. The remaining 50 to 75% will be used to provide energy to the plant, as hot water, steam, space heating, refrigeration, etc. With regard to heat exchange, flue gas from the combustion chamber at around 850 °C will be fed directly into the Bio-Fuel converter. Heat that is not required by the converter will be diverted, via a heat exchanger, to provide energy to the plant. On exit the flue gas will be at 150 to 250 °C and will be exhausted to the atmosphere following cyclone separation. The quantity of ash after combustion is dependent upon the original feed material. The weight of ash is typically 2-4% of the original food waste by weight. The metal concentrations in the ash will be very low, due to the low level of metals in food waste.

2. Hazard identification

The application originally asks authorization for generic Category 2 and Category 3 ABPs materials and also considers the treatment of the possible packaging of these materials. After discussion with the Applicant it was agreed that the Category 2 material shall be limited only to manure and digestive tract contents.

Any hazard derived from those materials should be considered (EFSA, 2005). This includes pathogenic viruses, bacteria that could be present as vegetative cells, spores as well as parasites. Toxins produced by micro-organisms can also be present. In addition, biohazards carried over by packaging materials must also be considered.

3. Process

3.1. Process Parameters

The process parameters proposed by the Applicant are:

- a temperature of at least 80°C for 8 hours followed by a temperature of 100°C for at least 2 hours;
- a maximum particle size of 20 mm after the Bio-Fuel production;
- a Bio-Fuel water activity lower than 0.65;
- a temperature for the condensed water in the storage tank of at least 70°C kept for at least 1 hour.

The first three process parameters concern the Bio-Fuel itself which will be exclusively incinerated on site, and therefore have no impact on the safety of the process. In contrast, the fourth parameter concerns condensed water which will be released in the sewer without further treatment, and is therefore relevant to monitor the safety of the process.

3.2. Validation of the Process

The Applicant conducted several experiments to measure the temperature over time during the process. Temperature was measured continuously in one point of the processor and at intervals in several points of the material processed. Temperatures recorded from the processed material were always higher than temperatures recorded by the continuous monitoring. Particle size and water activity were also measured into the Bio-Fuel produced. The Applicant also provided data on the temperature of the condensed water evaporated from the drying process. These experiments were performed on equipment with a maximum capacity of 2 tons whereas the Applicant proposed equipments with capacities of up to 12 tonnes. It is considered that scaling up from 2 to 12 tons should not create additional problems provided that the process parameters are met. A full process validation was judged not to be necessary because the material is subsequently incinerated.

3.3. Agent Risk Reduction

The Applicant seeded a batch of raw material with bovine faeces intending to measure the number of *C. perfringens*, *Salmonella* and other Enterobacteriaceae in the faeces and in the Bio-Fuel. A reduction in the numbers of Enterobacteriaceae by at least 5-log₁₀ was demonstrated. However, *C. perfringens* and *Salmonella* were below the limit of detection in the bovine faeces and the Applicant could not demonstrate any reduction of this pathogen. In addition, relevant indicators for heat treatment, such as enterococci, were not measured. Therefore an experimental validation of the risk reduction, as defined in EFSA (2005) for Category 3 ABPs and for manure and digestive tract contents, was not provided for the Bio-Fuel production. However, subsequent incineration of the Bio-Fuel results in elimination of the hazards.

3.4. Risk Containment

Since the Bio-Fuel is co-incinerated on-site in a closed system, the biological hazards which could persist in the Bio-Fuel are contained adequately. However, biological hazards present in the ABPs could be transferred to the condensed water during the process. The storage of the condensed water for at least 1 hour at 70°C prevents accidental release of the pathogens relevant for Category 3 ABPs and manure and digestive tract contents (as described in the Reg. EC 1774/2002). However, 70°C is not high enough to inactivate the more heat resistant pathogens which could be present in Category 2 ABPs other than manure and digestive tract contents (*e.g.* bacterial spores and heat resistant viruses).

3.5. Identification of interdependent processes

The Bio-Fuel production and the co-incineration are regarded in this context as a single, combined, process. Should there be the intention, in the future, to separate the Bio-Fuel production from the incineration, it would have to undergo a complete validation with test organisms or indicators relevant for heat treatments (EFSA 2005) followed by a new assessment.

3.6. Intended end use of the products

The intended use of the product is to generate heat and energy. The resulting ash is deemed suitable to be disposed of in landfill. Following storage at 70°C for at least 1 hour the resulting condensed water can be discharged into the sewer.

4. Process monitoring

The Applicant proposed to continuously monitor time and temperature during the process, as well as the water activity and the particle size of the Bio-Fuel. In addition the Panel proposed that storage duration and temperatures during storage of the condensed water should be monitored. The incineration has to be performed in accordance with the Reg. 1774/2002.

CONCLUSIONS

5. Answer to terms of references as in the mandate

5.1. To assess the ability of the process submitted by INETEC to safely dispose of Category 2 and 3 animal by-products.

The Bio-Fuel production considered alone is only a drying process and is therefore not suitable for safe disposal of Category 2 and 3 ABPs.

However, when the Bio-Fuel production and the subsequent incineration are considered as a combined process, this results in safe recycling into energy for Category 3 ABPs and manure and digestive tract contents.

5.2. If the process is considered to present a risk, the Commission asks EFSA to advise on the risks of the use of that process and on possibilities for addressing them.

Processing Category 2 material other than manure and digestive tract contents could present a risk because it was not demonstrated that pathogens with high thermal resistance (*e.g.* heat resistant viruses and bacterial spores) could not be released via condensed water to the sewer. Therefore, processing of Category 2 ABPs should be restricted to material with lower risk such as manure and digestive tract contents as described in Reg. EC 1774/2002.

Placing on the market or landfilling the Bio-Fuel could present a risk because no adequate reduction of pathogens at this stage was demonstrated. Therefore, Bio-Fuel should be incinerated on site and not be placed on the market nor landfilled.

DOCUMENTS PROVIDED TO EFSA

- Letter (ref. D(2005)TG/khk/420298) from the European Commission, Health & Consumer Protection Directorate-Generale (DG Sanco) with a request for an opinion on the safety of a thermo-mechanical system to convert Category 2 and 3 Animal By-Products (ABPs) into Bio-Fuel.
- Documentation on the application, submitted by INETEC, for approval of the process as a safe means of disposal of ABPs as submitted to the European Commission (1 folder).

SCIENTIFIC PANEL MEMBERS

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REFERENCES

EFSA (2005). Opinion of the Scientific Panel on Biological Hazards on the safety vis-à-vis biological risks of biogas and compost treatment standards of animal by-products (ABP), adopted on 7 September 2005. *The EFSA Journal* (2005) 264, 1-21.