SNAPSHOT

AUSTRALIAN MEAT PROCESSOR CORPORATION

Project title: Organic waste management at abattoirs

Project Report Reference: Project 2 in a portfolio of projects contained in 2016.1010

Date: June 2016

Project Description

Paunch waste currently has little value to the red meat processing (RMP) industry. This project aims to help understand the factors that have held back the implementation of paunch as a waste to energy stream and to start the process of turning this waste product into a valued commodity. This project investigated the drying rates, equilibrium moisture content and calorific value of paunch waste. These characteristics will enable optimum paunch drying conditions to be understood which will inform suitable dryer selection. The calorific value will also assist in evaluating the expected energy output of paunch for use as an energy source.

Project Content

A review on the current understanding of paunch characteristics relating to drying identified a lack of knowledge on the inherent properties of paunch such as drying rates and equilibrium moisture content. This lack of knowledge has held back the implementation of paunch reuse strategies.

A detailed methodology was developed to inform paunch characteristics. Drying rates based on temperatures of 35, 45, and 55°C and relative humidities of 40, 60, and 80% were determined (Figure 1) along with matching equilibrium moisture contents. Calorific values were found for both grass and grain type paunches in MJ/kg.

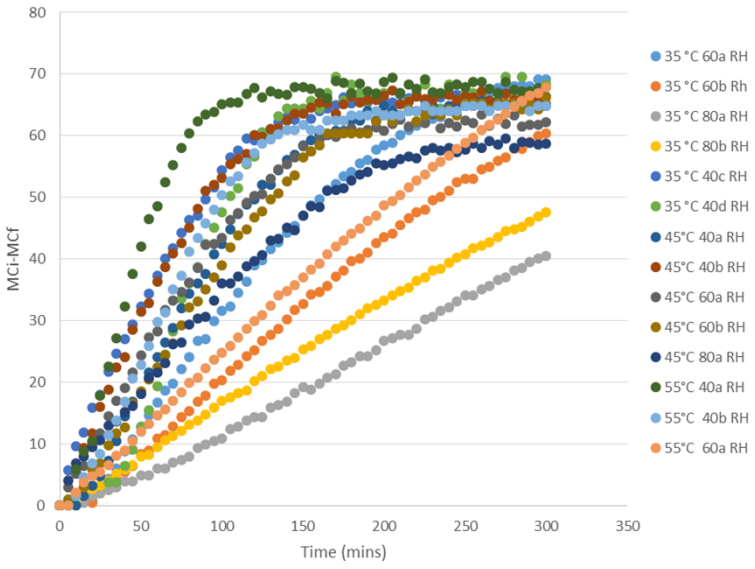

Figure 1: Graphical representation of all three temperatures (35, 45, 55°C) at varying humidity.

Project Outcome

The drying rates showed an expected drop in rate as humidity increased with paunch type, paunch variability, and humidity appearing to have a significant impact on drying time. Equilibrium moisture content ranged from approx. 7 to 13 % MC for humidities 40 to 80% in the temperature range of 35 to 55°C (Table 1). Equilibrium moisture content is the minimum moisture content achievable at certain climatic conditions.

Table 1: Averaged equilibrium moisture content values (% wet basis)

Averaged Equilibrium Moisture Content (% w.b)						
	Relative humidity					
Temperature °C	40%	Std dev	60%	Std dev	80%	Std dev
35	7.998	0.19	10.84	0.08	13.44	0.45
45	7.935	0.02	9.595	0.36	13.12	0.52
55	7.135	0.12	9.434	0.30		

Energy content was determined to be between 17.3 – 20.2 MJ/kg HHV (calorific value) for grass and grain type paunches. This energy content could significantly reduce the coal usage on sites with a coal fired boiler.

Further characteristics of paunch should be found and the field of knowledge increased into the behavior of paunch. A number of interesting paunch behaviors were identified in this report and further comparison of drying rates (for grass and grain type paunches), rates for different depths, and more equilibrium moisture contents would create a robust understanding of this material.

Solar dryer types need to be evaluated to determine the most effective design. A focus should possibly be on active dryers as opposed to passive dryers and tunnel type dryers over solar still designs. This is due to the ability to control increased humidity inside the dryer due to forced air over the sample as per an active dryer and better control over condensation inside a tunnel dryer as opposed to a modified solar still. Future work into the size of the dryer needed to handle the amount of paunch produced per week and the chamber design to increase the surface area of the product to be exposed to the drying air are also needed.

Benefit for Industry

Understanding that relative humidity is a controlling factor in the drying process of paunch will allow better decisions to be made in regard to selecting a suitable paunch dryer. The equilibrium moisture content and calorific value has led to easily calculated expected energy output and mix ratios for the RMP industry to use.

Example 1:

Equilibrium moisture content for 35°C air temperature at 40% relative humidity is 7.998%. Using the energy content of grain type paunches of 20.2 MJ/kg the LHV is 18.39 MJ/kg.

Assuming a medium sized abattoir produces 100 m^3 of paunch per week at 75% moisture content then 25 m^3 of paunch is produced per week bone dry, adding back 7.998% MC, equates to 1404 m3 per year (assuming 52 week operating period).

The coal value obtained from an abattoir in south east Queensland has a HHV of 28.69 MJ/kg at 3.3% MC with a LHV of 27.66 MJ/kg. The same medium sized abattoir uses approx. 2200 Tonne of coal per year.

Possible paunch energy = 1404 000 kg/year x 18.39 MJ/kg (LHV) = **25 819 560** MJ per year

Possible coal energy = 2200 000 kg/year x 27.66 MJ/kg (LHV) = **60 852 000** MJ per year

Example 2:

If the goal moisture content (G) is 9% for use in the boiler, mass of paunch (m_1) per week is 28 360 kg per week at a moisture content of 13.44%, coal moisture content (MC_2) is 3.3%.

$$m_2 = \frac{(28360\times9)-(28360\times13.44)}{3.3-9};$$

Mass of coal per week to be mixed with paunch = 22 090 kg to 28 360kg of paunch or a **1:1.3** mix for above moisture contents.

The above energy and mix ratio calculations show that paunch has the potential to be a significant waste to energy stream for the RMP industry to implement.

Contact Information

Australian Meat Processor Corporation Ltd
Suite 1, Level 5, 110 Walker Street
North Sydney NSW 2060
Phone: 02 8908 5500
Email: admin@ampc.com.au
Website: www.ampc.com.au