USE OF STARCH BASED BINDERS IN COOKED MEAT EMULSIONS

G. Bonnefin and P.A. Baumgartner, Hawkesbury Agricultural College, Richmond, NSW, AUSTRALIA 2753.

INTRODUCTION

Smallgoods, particularly Australian luncheon chubs, enjoy wide popularity, and have done so for many years. These products are produced from the less expensive meats and make use of extenders and binders.

Common ingredients which are used in smallgoods manufacture include cereal flours, starches, soy proteins and gluten. These products are added to increase the water binding capacity, emulsifying capacity and the sliceability of the product. The use of extenders in smallgoods has been well documented (Pearson et al., 1965; Comer 1979; Rongey and Bratzler 1966; Lauck 1975).

The aim of this study was to determine the effects of seven starch based binders on the chemical and physical properties of an Australian cooked luncheon chub.

The seven binders were studied using a 32 factorial to determine the effect of cooking temperature and binder level on expressible moisture and compression force at the sample fracture point.

EXPERIMENTAL

Meat Preparation

The basic meat formulation was as detailed: fresh beef (63% cl), 70.0 kg; salt 2.34 kg; phosphate 0.30 kg; seasoning 0.564 kg; Prague Powder 2XNN, 0.15 kg; sodium erythorbate 0.12 kg; water/ice 43.0 kg. The products were manufactured at Presto Meat and Smallgoods, Greenacre, NSW, using standard commercial practices. The ingredients were preweighed and blended and added to the prepared meat in 250 litre Alpina silent cutter. Binders were added at 3%, 6% and 9% levels to the above formulation. Therefore, the quantity of binder at each level was 3.5 kg, 7.0 kg and 10.5 kg respectively.

The products were filled into 110 mm PVDC, centre seal casing, and clipped using a Poly Clip Super FCA clipper. Each batch of product was divided into three groups and then cooked to the specified temperature in water cooking vat and then chilled to 2-3°C.

INSTRON EXPERIMENTAL METHODS

The objective tests were carried out using an Instron Texture Testing Machine, Model 1140. The chart speed was set to 200 mm per minute, and the instrument was fitted with a 2512-206 head.

Compression

A 30 mm long section, with a diameter of 20 mm of product was compressed between flat surfaces to apply a force along the longitudinal product axis. A standard Instron compression attachment was used having a diameter of 25 mm. Compression was continued until the product fractured. From tests carried out, this occurred in most samples before 75% compression at which the Instron end stop was set.

Moisture Expression

Moisture expression was determined using the technique developed by Bonnefin (1988).

Binder Analysis

Binders were analysed according to AOAC, 1984, and the results presented in Table 1.

Binders

The following table illustrates the calculated starch level in the smallgoods at each level of addition, based upon the chemical analyses of the binder.

RESULTS AND ANALYSES

Compression

Figures 1, 2 and 3 summarise the results of the compression tests. Of the wheat starch based binders, Cerebind and Bindo have a degree of pregelation by nature of their production. From the results, the Cerebind treatment had a reduction in the compression force of the meat sample with increasing temperature at all levels of addition. However, with increasing levels, force increased up to a maximum at 70°C and at 75°C, fell away.

Bindo, the other wheat starch based heat treated binder, showed that at both the 6% and 9% levels, maximum compression was achieved at °C, with the 6% level being

Table 1

Binder	Protein %	Moisture %	Starch %
Bindo*	15.25	6.82	63.1
Cerebind**	15.02	10.86	63.9
Rice Starch	6.58	11.20	66.2
Wheat Starch	0.25	12.95	76.8
Tapioca Starch	0.07	12.70	59.1
Bull Meat Brand Binder***	1.52	12.10	59.4
Potato Starch	0.24	16.10	71.3

* Fielder Goodman Pty Ltd
** Lindgren Pty Ltd
*** Oppenheimer Australia Pty Ltd

Table 2

Binder Level %	3	6	9
	% Starch	% Starch	% Starch
Bindo	1.84	3.57	5.21
Cerebind	1.86	3.62	5.28
Rice Starch	1.93	3.75	5.47
Wheat Starch	2.24	4.35	6.34
Tapioca Starch	1.72	3.35	4.88
Bull Meat Brand Binder	1.73	3.36	4.90
Potato Starch	2.08	4.04	5.89

Fig 1

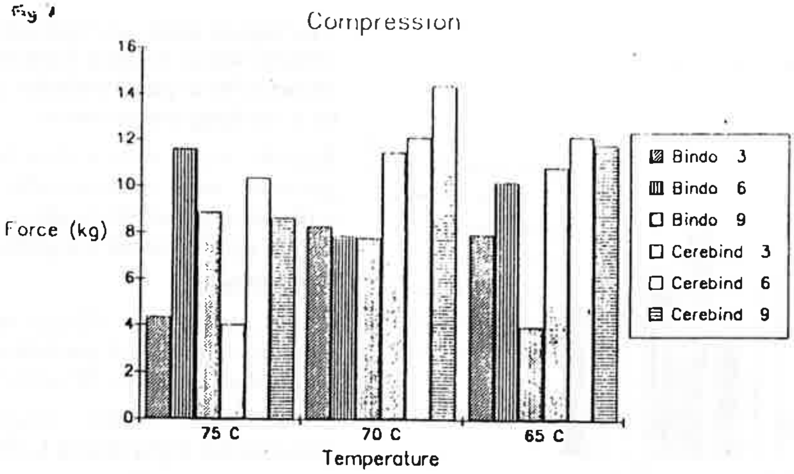


Fig 2

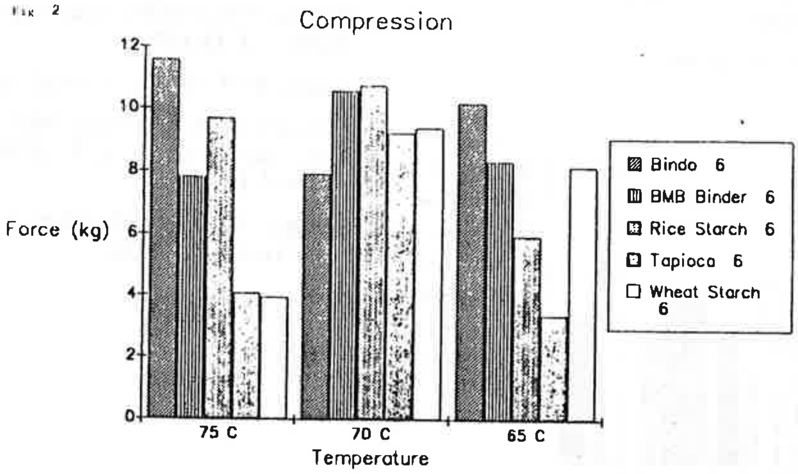
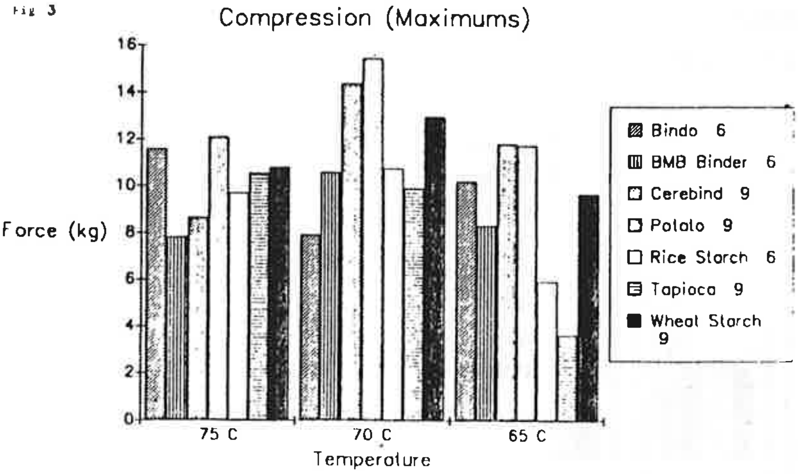


Fig 3



the higher. With the 3% level, due to inadequate starch level for the moisture level, texture deteriorated over 70°C as the starch granules disrupted completely.

At the 6% level Bull Meat Brand Binder, rice starch, tapioca starch and wheat starch all showed their highest compression force at 70°C. Bindo required 75°C. Potato starch and Cerebind showed no significant differences between temperature at this level.

In summary at both the 3% level and 6% level Cerebind, potato starch, tapioca starch, and cooking to 70°C, achieved the highest compression forces. The compression force also increased with increasing binder level. The exception to this is tapioca starch, which attained the highest compression force at the 9% level and 75°C treatment.

In comparing the similar products of Bindo and Cerebind, and their performance regarding compression force, it can be seen that Cerebind produced a greater compression force across all three levels of addition at 70°C than did Bindo. Also, Cerebind's compression was at a maximum at 70°C in all three levels, whereas Bindo's compression at the 6% and 9% levels, increased with temperature to 75°C.

Potato starch had a greater compression than tapioca, and increased with increasing level of addition. Potato's compression was also much higher than tapioca at all three addition levels at the 65°C temperature.

Similarities exist between the compression forces for both wheat starch and rice starch. Compression force was at a maximum at the 9% level at all temperatures for wheat starch, with the greatest force at 70°C. With rice starch, the maximum force occurred at the 70°C and 6% addition level.

Also the blend of starches used in Bull Meat Brand Binder gives the product its wide range of gelation temperatures, and also may be reducing the compression force. The wide gelation range is seen by the small variation in compression forces between all levels and temperatures.

Expressible Moisture

Generally the greater the level of binder added, the greater was the water holding capacity (Figures 4, 5 and 6). In this situation, all binders at the 3% level had the highest expressible moisture at 65°C.

All binders showed lowest expressible moisture figures at the 9% level and 75°C. This is illustrated in Figure 6.

The expressible moisture level decreased throughout all samples as the temperature of cooking increased. Figure 4 shows the most noticeable decrease occurred with 3% rice starch. Tapioca at the 3% level had the lowest reduction.

Figure 6 is at the 9% binder level, and it was this level where the lowest expressible moisture occurred.

CONCLUSION

The primary objective of this study was to compare the functional effects of various binders in a comminuted meat system. The greater the level of binder added, the better was the water holding properties of the product. Combined with cooking temperature we can see that 75°C provided the lowest expressible moisture levels.

Figure 4

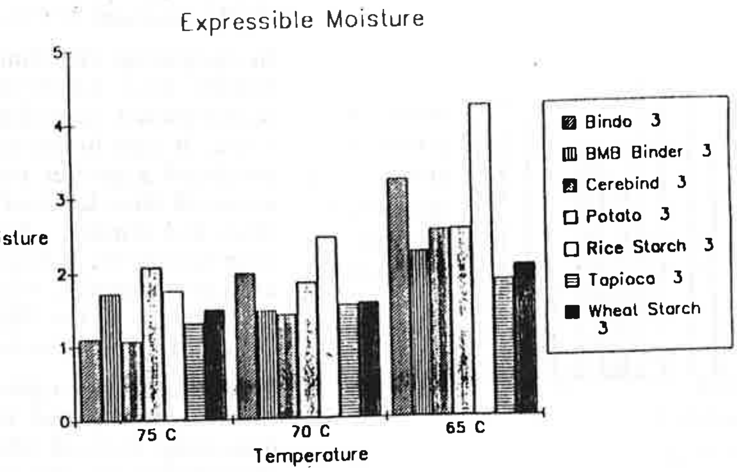


Figure 5

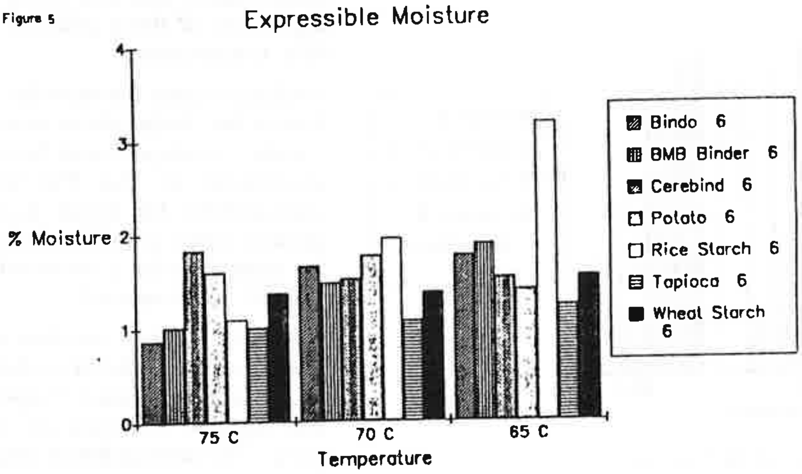
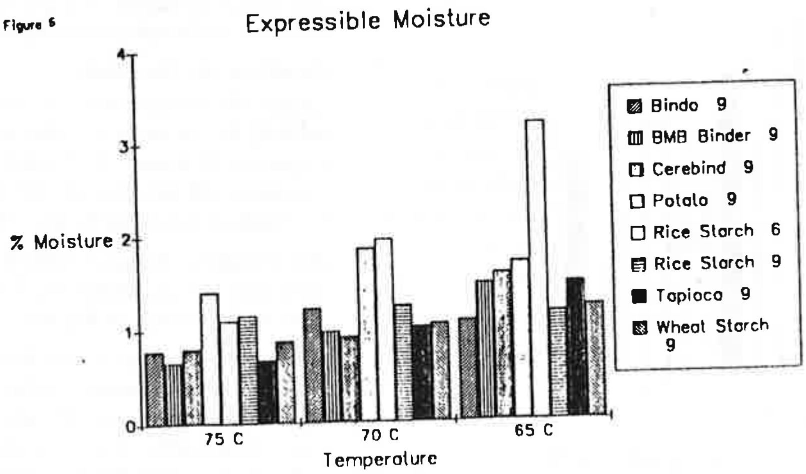


Figure 6



The highest levels of expressible moisture (lowest water holding capacity) were all shown to be at the 3% binder level and the 65°C cooking temperature.

Results have shown that binders, in general, have a favourable effect on reducing expressible moisture, but varying effects upon product compression.

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